

UNIV. OF
TORONTO
LIBRARY

BINDING LIST MAR 15 192

VOLUME XVII, 1920

Containing the last number of the *Proceedings of the
Association*

INTERNATIONAL RESEARCH SOCIETY
OF THE
HUMANITIES



Digitized by the Internet Archive
in 2007 with funding from
Microsoft Corporation

P. Files
Psychological Bulletin *I*

EDITED BY

SHEPHERD I. FRANZ, GOVT. HOSP. FOR INSANE
SAMUEL W. FERNBERGER, CLARK UNIVERSITY (*Assistant Editor*)

HOWARD C. WARREN, PRINCETON UNIVERSITY (*Review*)

JOHN B. WATSON, NEW YORK (*J. of Exp. Psych.*)

JAMES R. ANGELL, 522 FIFTH AVENUE, NEW YORK (*Monographs*) AND
MADISON BENTLEY, UNIVERSITY OF ILLINOIS (*Index*)

WITH THE CO-OPERATION OF

B. T. BALDWIN, UNIVERSITY OF IOWA; E. B. HOLT, BRUNSWICK, ME.; W. S. HUNTER,
UNIVERSITY OF KANSAS; J. H. LEUBA, BRYN MAWR COLLEGE; MAX MEYER, UNI-
VERSITY OF MISSOURI; R. M. OGDEN, CORNELL UNIVERSITY; W. D. SCOTT, NORTH-
WESTERN UNIVERSITY; G. M. WHIPPLE, UNIVERSITY OF ILLINOIS; R. S. WOODWORTH,
COLUMBIA UNIVERSITY.

VOLUME XVII, 1920


Containing the Literature Section of the PSYCHOLOGICAL REVIEW
PUBLICATIONS

171247
15/5/22

PUBLISHED MONTHLY BY THE
PSYCHOLOGICAL REVIEW COMPANY
41 NORTH QUEEN ST., LANCASTER, PA.,
AND PRINCETON, N. J.

AGENTS: G. E. STECHERT & CO., LONDON (2 Star Yard, Carey St., W. C.); PARIS (16, rue de Condé)

Entered as second-class matter January 21, 1904, at the post-office at Lancaster, Pa., under the
Act of Congress of March 3, 1879



PRESS OF
THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

BF

1

P68

V.17

Cap. 2

CONTENTS OF VOLUME XVII

ORIGINAL CONTRIBUTIONS, REPORTS, GENERAL REVIEWS AND SUMMARIES, DISCUSSIONS

High Test Scores Attained by Subaverage Minds: S. C. KOHS.	1
General Standpoints: Mind and Body: W. T. MARVIN.....	6
Consciousness and the Unconscious: A. P. WEISS.....	10
Terminology: H. C. WARREN.	16
Apparatus: C. E. SEASHORE	16
Text-Books and General Treatises: H. S. LANGFELD	19
Report of the Secretary of the American Psychological Association: H. S. LANGFELD.....	33
Social Psychology: F. H. ALLPORT.....	85
The Psychology of Religion: G. A. COE.....	95
Crime and Social Psychology: A. L. KELLOGG.....	103
Cutaneous and Kinesthetic Senses: J. T. METCALF.....	117
Affective Phenomena—Descriptive and Theoretical: H. N. GARDINER.....	122
A Note on the Selectiveness of the Achromatic Response of the Eye to Wave-length and Its Change with Change of Light: C. E. FERREE & G. RAND.....	134
A Rejoinder to Drs. Ferree and Rand's Notes: L. T. TROLAND..	135
Communication: Psychological Terminology: H. C. WARREN.	143
The Physiology of Nerve and Muscle: E. B. HOLT.....	145
Some Recent Contributions to the Physiology of the Autonomic Nervous System: F. W. CARPENTER.....	161
Tropisms and Instinctive Activities: W. CRAIG.....	169
Sensory Physiology of Animals: K. S. LASHLEY.....	178
Habit Formation and Higher Mental Capacities in Animals: J. F. SHEPARD.....	187
Vision—General Phenomena: L. T. TROLAND.....	201
Hearing: R. M. OGDEN.....	228
Visual Space: M. C. WILLIAMS.....	241
Space Illusions: E. S. ROBINSON.....	243
Time Perception and Rhythm: P. F. SWINDLE.....	244
Graphic Functions: J. E. DOWNEY.....	250
Memory, Thought, and Logic: W. C. RUEDIGER.....	254

Memory and Learning: J. M. GLEASON.....	256
Attention and Interest: W. B. PILLSBURY.....	259
Values: H. T. MOORE.....	260
Statistics of the American Psychological Association in 1920: E. G. BORING.....	271
A Theory of Personality Based Mainly on Psychiatric Expe- rience: A. J. ROSANOFF.....	281
Heredity of Constitutional Mental Disorders: C. B. DAVEN- PORT.....	300
Introspection and General Methods: K. M. DALLENBACH....	313
Work, Fatigue and Inhibition: F. C. DOCKERAY.....	322
Reaction Time: V. A. C. HENMON.....	330
Esthetics: R. PINTNER.....	331
The Applications of Psychology to Industry: H. C. LINK....	335
Dreams: M. L. SMALL.....	346
Mental Tests: F. N. FREEMAN.....	353
Child Psychology: D. MITCHELL.....	363
Educational Psychology: C. T. GRAY.....	375
Correlation: J. B. MINER.....	388
The Psychology, Biology and Pedagogy of Genius: L. M. TERMAN & J. M. CHASE.....	397
Prostitution: F. MATEER.....	410
Visual Motor Functions: R. DODGE.....	418
Locomotor Functions: I. G. CAMPBELL.....	421
The Equivocal Position of the <i>Presentation</i> in the Psychology of James Ward: M. W. CALKINS.....	429

SPECIAL REVIEWS

Religious and Social Psychology (Berguer, Woodburne, Cook, Schleiter, Gilmore): J. H. LEUBA; (Kidd, Znaniecki): C. A. ELLWOOD; (Mackenzie): T. de LAGUNA; (Mercier): R. WOODRUFF.....	114
Cannon's Thirst: E. G. BORING.....	128
Goddard's Psychology, Normal and Subnormal: A. GESELL..	131
Ritter's Unity of Organism: W. S. HUNTER.....	198
Anrep's Pitch Discrimination: W. S. HUNTER.....	199
Lyon's Memory and the Learning Process: J. M. GLEASON..	264
Watson's Psychology, From the Standpoint of the Behaviorist: A. P. WEISS.....	266
Ziehen's Die Geisteskrankheiten des Kindesalters: A. J. Ro- SANOFF.....	310
Evan's The Problem of the Nervous Child: A. J. ROSANOFF..	312

MISCELLANEOUS

Books Received.....	31, 83, 115, 2378, 29, 350
Notes and News.....	31, 83, 116, 144, 200, 239, 279, 351, 435
Communications.....	433
Editorial Announcement.....	435

THE PSYCHOLOGICAL BULLETIN

HIGH TEST SCORES ATTAINED BY SUBAVERAGE MINDS

BY S. C. KOHS

Court of Domestic Relations, Portland, Oregon

Mushroom development in any branch of science leads to the growth and the perpetuation of fallacies of method and logic which time alone can correct. This is as true for the development of test-standardization technique as for any other similar field of research. At this time when mass tests are rapidly multiplying, and when their range of application is becoming more and more widely extended, it is necessary that we frequently reexamine the mathematical and statistical trellis work upon which such tests necessarily depend for sanction of reliability.

The present study is an attempt to formulate the mathematics of guessing, especially as it pertains to tests of the two-alternative type. What are the chances, for example, of obtaining a good record in a single group-test of fifty items, when the subject being examined lacks or does not utilize the intelligence or the information which he is supposed to possess, but proceeds, nevertheless, to mark his sheet, guessing as he continues through the items.

The prevalent opinion is thus expressed in a recent article by McCall.¹ In explaining a new type of test-method, illustrating by means of a test in United States Geography, he states:

"Let us consider first the reason for expressing a pupil's score as the number correct minus the number wrong. Imagine a pupil who is absolutely innocent of any knowledge of the physical features of the United States. Were such a pupil to take the above test and were he to mark every statement, he would according to the theory of chance mark ten statements correctly and ten incorrectly. The chances of his guessing right or wrong are fifty-fifty or one to one. His score on the above test would be:

$$\text{Score} = 10 - 10 = 0.$$

¹ McCall, W. A. A New Kind of School Examination. *J. of Educ. Research*, 1, 1920, 33-46.

In short the pupil's knowledge is zero and the method of computing his score gives him zero. Suppose instead that he knows ten statements and guesses at the other ten. Of the ten guessed at, he would, according to chance, get five correct and five wrong. That is, even though his real knowledge is ten he will show fifteen correct ($10 + 5$) and five incorrect. The method of computing his score brings out his real knowledge.

$$\text{Score} = 15 - 5 = 10.$$

A pupil who marks every statement correctly makes a perfect score, viz:

$$\text{Score} = 20 - 0 = 20."$$

The implied assumption is that "chance" will take care of the "guesser," since in the long run, and with perhaps few and unimportant exceptions, he who guesses will accidentally obtain as many answers right as wrong.

In order to bring the conditions of this study more clearly before the reader, we will assume, by way of illustration that:

(1) We are dealing with a test of 50 items, each of which the subject is required to examine and mark "plus or minus," or "true or false," or "same or opposite," or "correct or incorrect," and so on (two-alternative type);

(2) In recording the score we subtract the number wrong from the number right (unweighted);¹

(3) The subject has inferred that the test has been arranged so that there are approximately as many items of one alternative as of another, and proceeds to mark his test sheet accordingly; and

(4) The subject exercises no further judgment but places his marks indiscriminately and is guided purely by chance.

The question which immediately arises and which bears fundamentally on the validity of a test-score obtained by this method is: What are the chances that a subject proceeding as above indicated, will obtain a score of 100 per cent., of 80 per cent., of 50 per cent., of 25 per cent., of 5 per cent. of 0 per cent.? And in addition, assuming that one is examining a group of 300 individuals, among whom 36 utilize this chance, indiscriminate procedure, what proportion of these 36 may be expected to receive a score of 100 per cent., what proportion, 50 per cent., what 10 per cent., and so on?

In the present article we shall content ourselves merely with an analysis of theoretical expectation. At a later time empirical results will be presented together with some additional considerations upon which these preceding findings may throw some light, as well as some general conclusions regarding the validity of this method for measuring intelligence or the results of teaching.

¹ See excellent article on this subject by THURSTONE, L. L. A Scoring Method for Mental Tests. *PSYCHOL. BULL.*, 16, 1919, 235-240.

Theoretical Expectation

If we were to toss fifty unbiased pennies the chance of any combination of heads or tails falling upon the table could be determined by means of the formula:

$$p_{n, Q-n} = \frac{Q!}{n!(Q-n)!2^Q},$$

where p = the probability expressed as a decimal, $p_{n, Q-n}$ equals the probability of the occurrence of a certain set of possibilities n and $Q-n$, Q equals the total number of chances, n equals the number of events of one kind, $Q-n$ the number of events of the other kind, only two kinds of events being possible. This formula is really a short expression of the one generally used to find the $(r+1)$ term of any binomial expansion. The results presented in Table I were obtained by means of the binomial expansion:

$$(a+b)^n = a^n + \frac{n}{1} a^{n-1}b + \frac{n(n-1)}{1 \cdot 2} a^{n-2}b^2 + \dots + b^n,$$

in which a and b are each $\frac{1}{2}$ and n equals 50.

TABLE I
THE PROBABILITY OF OBTAINING DIFFERENT SCORES BY CHANCE

(1) No. Right (or) (No. Wrong)	(2) No. Wrong (or) (No. Right)	(3) Score in Per Cent.	(4) Chance of Obtaining Score in Column 3—1 Out of:	(5) Probability (p)
50	0	100	1 125 899 906 842 624.	.000 000 000 000 000 889
49	1	96	22 517 998 136 852.	.000 000 000 000 044 4
48	2	92	919 101 964 769.	.000 000 000 001 09
47	3	88	57 443 872 794.	.000 000 000 017 4
46	4	84	4 888 840 238.	.000 000 000 205
45	5	80	531 395 678.	.000 000 001 88
44	6	76	70 852 757.	.000 000 014 1
43	7	72	11 272 030.	.000 000 088 7
42	8	68	2 097 122.	.000 000 477
41	9	64	449 383.	.000 002 23
40	10	60	109 606.	.000 009 12
39	11	56	30 142.	.000 033 2
38	12	52	9 274.	.000 108
37	13	48	3 173.	.000 315
36	14	44	1 200.	.000 833
35	15	40	500.	.002 00
34	16	36	229.	.004 37
33	17	32	114.	.008 77
32	18	28	62.	.016
31	19	24	37.	.027
30	20	20	24.	.042
29	21	16	17.	.059
28	22	12	13.	.077
27	23	8	10.	.100
26	24	4	9.	.111
25	25	0	9.	.111

These figures are presented graphically in the following chart. It is assumed that 1,000 individuals have guessed. No factors have influenced their reactions except pure chance. The frequencies of the various scores are presented.

The 1,000 reactions, above mentioned, are presented in tabular form in Table II:

TABLE II
FREQUENCY OF SCORES FOR 1,000 GUESSERS

(1) Plus Scores	(2) Number of Persons Obtaining	(3) Minus Scores	(4) Number of Persons Obtaining
52	.1	52	.1
48	.3	48	.3
44	.8	44	.8
40	2.	40	2.
36	4.	36	4.
32	8.	32	8.
28	16.	28	16.
24	27.	24	27.
20	42.	20	42.
16	59.	16	59.
12	77.	12	77.
8	100.	8	100.
4	111.	4	111.

Zero Score, obtained by only 111 persons out of 1,000.

Minus and Zero Scores, obtained by over 50 per cent. of total.

The above tables and graph lead to the conclusion that *if a person guesses in a two-alternative test of 50 items, then according to the law of chance he would obtain half right and half wrong, or a zero score only once in every 10 chances approximately.* Four times in ten, he would obtain some positive score, and approximately four times in ten, some negative score.

It is also clear from Table I that the chances of obtaining a plus 100 per cent. score is only one in over one million billions! *A score of 4 per cent. (disregarding sign) is practically twice as frequent as a score of 0 per cent.* A score of 16 per cent. (disregarding sign) is as frequent as a score of 0 per cent. On the whole, all scores from about 60 per cent. and over are very rarely obtained by an indiscriminate procedure. Scores between 45 per cent. and 60 per cent. although not rare do not occur very frequently. But scores between 0 per cent. and 30 per cent. are quite frequent.

Let us assume a situation mentioned in the early portion of this discussion. If one is examining a group of 300 individuals, among whom 36 are guessing, what distribution of scores may be expected.

Table III answers this question and is deduced from the figures of Table I.

TABLE III
PROBABLE DISTRIBUTION OF SCORES OF 36 GUESSERS

(1) Score	(2) Frequency	(3) Score	(4) Frequency
Plus 28 per cent.	1	Minus 28 per cent.	1
" 24 "	1	" 24 "	1
" 20 "	2	" 20 "	2
" 16 "	2	" 16 "	2
" 12 "	3	" 12 "	3
" 8 "	3	" 8 "	3
" 4 "	4	" 4 "	4

Zero Score—4

Positive Scores: 16 (45 per cent.)

Negative and Zero Scores: 20 (55 per cent.)

Positive Scores Above 16 per cent.: 4 (11 per cent.)

Positive Scores Above 28 per cent.: Practically 0 per cent.

In conclusion it may be said that although our "intuition" in the past regarding the operation of the laws of chance in tests of the two-alternative type was, in the main, correct, nevertheless we have been inclined to exaggerate the frequency of zero scores, and to underestimate or overlook the frequency with which significant, positive scores might occur. Further generalizations shall be left for the later empirical study. The applications will then be more evident.

GENERAL REVIEWS AND SUMMARIES

GENERAL STANDPOINTS: MIND AND BODY

BY WALTER T. MARVIN

Rutgers College

During the past year two textbooks in psychology have appeared in both of which the authors have endeavored to present their subject matter consistently and rigorously based upon one general psychological principle. On the one hand Watson (11) has written a behavioristic psychology. On the other hand Warren (8) has given us a book that formulates the subject matter strictly from the point of view of the double-aspect theory. Watson makes his standpoint quite clear in the preface to his book. Behavior psychology is purely an American product and is not to be confused with the so-called objectivism of European objectivists such as Beer, Bethe, von Uexküll, Nuel, Bechterew, and others, who are orthodox parallelists. "The present volume does some violence to the traditional classification of psychological topics and to their conventional treatment. For example, the reader will find no discussion of consciousness and no reference to such terms as sensation, perception, attention, will, image and the like. These terms are in good repute, but I have found that I can get along without them both in carrying out investigations and in presenting psychology as a system to my students. I frankly do not know what they mean, nor do I believe that any one else can use them consistently." With similar consistency Warren keeps before the reader the double aspect he believes each psychological fact exhibits, the physiological or objective, and the mental or subjective. Doing so forces him to offer many tentative neurological hypotheses.

The most prominent book dealing explicitly with the logically fundamental problems of psychology, which has appeared during the past two years, is that of Strong (6). It presents a thorough-going panpsychism. What appears to us as physical is in itself psychical. "Mind has been evolved out of mind-stuff"; and this mind-stuff is feeling, or sentience. In the words of Drake (4) "while the whole book is headed toward an answer to the question

how consciousness could come to arise out of a non-conscious world, the bulk of it is taken up with answering the preliminary question, *What is consciousness?* The answer is: Consciousness is not a stuff or substance, but a function, a relation. The substance of the mind—indeed, of everything that exists—is feeling, sentience, mind-stuff. But the bare existence of this stuff does not in the least imply consciousness. It is only when a bit of sentience causes the organism to react that we speak of the organism as conscious. The organism uses the mental state not as its own state, a bit of its own existence, but as if it were the outer object itself.” Consciousness is this use of a psychic state as a symbol, as the vehicle of an intention directed toward another object than itself. Drake proceeds to give a summary of what he regards as the most significant points of Strong’s book and to record his own conviction of the truth of panpsychism. Turner (7) also gives an analysis of the book which he criticizes unfavorably. Finally, Washburn (9) gives a keen analysis of one important aspect of Strong’s doctrine. Can the continuous and richly qualitative world of human experience be deduced from the discrete, or atomistic and purely quantitative world of physical science? Does Strong succeed, once having admitted this dualism, in reaching a monism, panpsychic or otherwise? In reply to these questions Washburn points out that we can account for the seeming simplicity, or continuity of a world that is really complex and discrete, but that we cannot deduce quality from quantity. The former is “probably just a matter of the size of the reacting organism.” To be aware of an atom we should have to respond to atoms individually; and we have every reason to believe that no organism could exist small enough so to react. The reactions of the clumsy organisms with which we are familiar, overlap; and thus the spatial and temporal intervals of the real physical world become the continuous world of sensation. However, when it comes to getting quality from quantity no such method is available. “Simplicity and complexity are motor terms;” and no movement is ever qualitative. Moreover, it helps us not at all to call qualities illusory. Illusion they may be, “but there they are; reds, greens, low tones, high tones, odors; a color refusing to reveal itself to direct experience as made up of odors or even of other colors; no ultimate identity between them anywhere.” “The nearest that we can come to any derivation of quality from the non-qualitative is to ask how else, except under the guise of qualitative differences, an organism could represent to itself the

essence of those molecular patterns whose true differences, those of spatial arrangement, it is unable because of the size and clumsiness of its movements, to perceive. A molecule of sugar and a molecule of fat differ in the pattern, in three dimensions, and the number of their atoms. It is impossible by means of any reacting mechanism we possess, to respond to these patterns and numbers as such. Yet it is important, we may suppose, that the organism should distinguish them: if not as patterns, then how else but by transforming them into qualities? Yes; but on the atomic conception of the universe, there is no such resource at its disposal: qualitative differences are something quite foreign. *They cannot be fitted into a universe of atoms, even a universe of mind-stuff atoms.*"

Besides these three books and articles called forth by the last there have appeared several articles bearing on the foundations of psychology and especially concerned with behaviorism. In a reply to a review, by de Laguna, of *The Animal Mind*, Washburn (10) urges in defense of dualism that introspection has the added advantage over behaviorism of directly observing to what I react in a way the outsider cannot. De Laguna (3) replies, this answer is beside the issue. "How introspection, which is by definition a sort of observation unverifiable by others, can yet possess scientific value, the only solution I know is that offered by behaviorism, *viz.*, that introspection has such a value only in so far as the introspective observations of the subject are treated as *responses*, and not as statements of observed facts." Introspection is a peculiar type of response that, it is admitted, needs analysis and that thus far has not been adequately discussed by the behaviorist.

Weiss (12) finds the origin of dualism in the traditional psychology in the tendency of man to react toward a perplexing and dimpling situation as toward another person. Hence has arisen the "hidden-man" to be found in primitive animism and in all its descendants. As more careful study and analysis control our reactions the "hiddenman" gradually disappears. Thus in psychology the personal soul, or spirit, became the ego, or self, and this in turn has become the mind, or consciousness. This survival of the "hidden-man" in psychology has been especially tenacious due to the fact that human behavior is determined by neural processes and we have no sense organs to observe in ourselves these processes. Hence psychology to overcome this limitation in the study of human behavior has personified neural function. In another article Weiss (13) formulates the relation between physiological psychology

and behavior psychology. The two differ in assumptions, methods, and subject-matter. The assumptions of the former are based upon a dualistic system, of the latter upon a monistic system. The method of the former is that of "introspection supplemented by an analysis of the neural factors correlated with given mental patterns," whereas the method of the latter is "that of a statistical, genetic, and mechanical analysis of those movements that form the basis of human interaction." The subject-matter of the former is mind "as revealed by introspection and as correlated with neural function." Whereas the subject-matter of the latter is "human action and conduct regarded solely as a mechanical function of the environment and the reaction system." Bawden (1) finds the origin of what he calls psychologism, or the hypostasizing of consciousness in the same tendencies that at an earlier stage resulted in animism. Like every other science, art, or other enterprise psychology has had its guiding fictions. These fictions have tended to become realities. The consciousness of recent psychology is such an hallucinatory entity. In time we are aroused from our dogmatic slumber and look again at the facts as they are. To-day behaviorism is thus arousing the psychologist; and he is finding that consciousness is but a name for that group of behavior traits in which the stimulus has receded and the response is postponed. "It is the socially important articulomotor group of incipient and delayed responses that furnishes the clue to the nature of consciousness since these exhibit, in its clearest form, the arrested act or attitude in its function as superinducing still other act-inducing attitudes." Finally, Kantor (5) attempts "to define the function of critical evaluation as it applies in psychology and to point out the consequences of its correct use in that discipline." So doing leads him to a destructive criticism of behaviorism.

In the field of psychical research one book dealing with principles has recently appeared. Boirac (2) believes that psychical research has genuinely reached the scientific stage, that it is a science and that it has results to offer to the world. Moreover, he believes that it is sufficiently advanced in its development to call for a study of its methods and apparatus. In his book he offers us such a study.

REFERENCES

1. BAWDEN, H. H. Psychology and Scientific Method. *J. of Phil., Psychol., &c.*, 1919, 16, 603-609.
2. BOIRAC, E. *L'avenir des sciences psychiques*. Paris: Alcan, 1917. Pp. 301.

3. DE LAGUNA, G. A. Dualism and Animal Psychology. *J. of Phil., Psychol., &c.*, 1919, 16, 296-300.
4. DRAKE, D. Panpsychism Again. *J. of Phil., Psychol., &c.*, 1919, 16, 433-439.
5. KANTOR, J. R. Psychology as a Science of Critical Evaluation. *Psychol. Rev.*, 1919, 26, 1-15.
6. STRONG, C. A. *The Origin of Consciousness*. London: Macmillan, 1918. Pp. viii + 330.
7. TURNER, J. E. Dr. Strong's Panpsychic Theory of Consciousness and Perception. *J. of Phil., Psychol., &c.*, 1919, 16, 428-433.
8. WARREN, H. C. *Human Psychology*. Boston: Houghton Mifflin, 1919. Pp. xx + 460.
9. WASHBURN, M. F. Dr. Strong and Qualitative Differences. *Phil. Rev.*, 1919, 28, 613-617.
10. WASHBURN, M. F. Dualism and Animal Psychology. *J. of Phil., Psychol., &c.*, 1919, 16, 41-44.
11. WATSON, J. B. *Psychology from the Standpoint of a Behaviorist*. Philadelphia: Lippincott, 1919. Pp. xiv + 429.
12. WEISS, A. P. The Mind and the Man-within. *Psychol. Rev.*, 1919, 26, 327-333.
13. WEISS, A. P. The Relation between Physiological Psychology and Behavior Psychology. *J. of Phil., Psychol., &c.*, 1919, 16, 626-634.

CONSCIOUSNESS AND THE UNCONSCIOUS

BY A. P. WEISS

Ohio State University

During the past year the conceptions underlying the terms conscious, unconscious and their derivatives, seemed to approach three general categories: (1) Consciousness regarded as a special form of behavior. (2) Consciousness as a unique and irreducible datum of experience that is only described by a special (mental) class of attributes. (3) Consciousness as a dynamic factor, modifying human behavior and influencing human welfare. Such terms as preconscious, coconscious, unconscious, subconscious, are used either to represent transition stages between the three categories indicated, or as different aspects of them. No pronounced tendency is discernable that the confusion in the use of the terms is growing less, although the greater interest that is manifested may be regarded as an indication that greater uniformity may eventually result.

Bawden (3, 4), Weiss (91) attempt to trace the evolution of consciousness from its earliest behavior manifestations. Bosanquet (5), Feingold (22), Harvard (29), have articles in which the general nature of consciousness is analyzed. Laird (36), Larguier (37),

discuss introspection and the origin of the idea of mind. Marshall (45) believes that the "outthereness" quality of outer-world objects is a mental quality and when this quality is abstracted from our total experience, the state called consciousness remains. Mulford (50) undertakes to describe the unconscious. Reyburn (55) scrutinizes the nature of mental processes, and Thurstone (81) regards the anticipatory aspect of consciousness as developing out of the fact that every psychosis is an unfinished act in the process of being defined into overt response. Wieman (94) defines mentality as that process by which the physical organism is adjusted for some preparatory overt action upon the environment. Turner (82), Washburn (90), Drake (17), discuss Dr. Strong's (75) panpsychism. Ward (86, 87) makes a critical and careful analysis of sense-knowledge.

Broad (6) and Burroughs (8) take up the topic of design in nature. Elkus (20) discusses Warren's (88) conceptions of purpose and believes that the older danger of anthropomorphism is likely to be displaced by *physicomorphism*. Of the papers on method, Sellars (67), Richardson (56, 57), Merrill (46), Broad (7), represent the epistemological or philosophic point of view, while the standpoint of biology is represented by Jennings (33) in a discussion of the relation between determinism and human conduct in which he maintains that experimental determinism does not imply that conscious states have no (experimental) effect on action, or that everything would have happened in just the same way without consciousness. It only implies that if what now occurs were different, the earlier conditions would have been different, though what now occurs need not be predictable from nor existent in those earlier conditions.

From the systematic point of view a number of interesting articles have appeared. Hencke (30) reduces the vitalistic concept to an instinctive and emotional basis. Calkins (10) analyzes Spaulding's (73) "relations and subsistent entities" while Moore, Johnson, Hicks, Smith, Ward, have a symposium (76) on "Are the Matériaux of Sense, Affections of the Mind?" DeLaguna (16) comments on the dualistic implications in Washburn's (89) textbook. Macintosh (42), Weiss (92), Turner (83), discuss those aspects of consciousness that are fundamental to methodological development. Calkins (9) outlines the personalistic conception of nature as a detailed cosmology that is regarded as not involving the difficulties to be found in animism, phenomenalism, and in de-

terminism. The reviewer believes that this is one of the clearest and best descriptions of the principles underlying her own system of self-psychology.

Dunlap (19) accounts for Fite's (24) attack on the methods of experimental psychology by calling attention to the fact that, for many philosophers, psychology is still identified with spiritualism and the many other mystic thrillers that absorb the attention, instead of being identified with the less spectacular developments in education, business and medicine. When practical applications of conscious phenomena are considered Schroeder (65) criticizes the psychoanalytic methods of Prince (53) as applied to the authorship of the book of Mormon. An anonymous writer (2) gives an excellent account of agoraphobia symptoms. Abramowski (1) reports an ingenious set of experiments on perception and recall and shows the relations between his results and the findings in pathological cases. Thalheimer (79) regards the concept of purpose as primarily of heuristic value, while Sinnett (70), and Schiller (64) feel that purpose has definite existential properties.

L. J. Russell (61), Marshall (44), Weiss (91), make an attempt to isolate the fundamental facts from which the concept of consciousness is derived. Sheldon (68) calls attention to the principle of asymmetry as a factor in the concept of reality.

Sociological implications are given attention by Cohen (13) and Follett (25). Hall (28) and McClure (43) indicate the probable future relation between psychology and governmental functions. Richardson (58), Rogers (59), Teggart (78), Thorburn (80), Urban (84), and Knowlson (35) write on the more general sociological aspects as revealed in community life, personal responsibility and reform. Loomis (40) defends naturalism and Sonneberg (72) describes the biologist's religion.

The medical aspects of consciousness are treated by Dearborn (15) who describes some functions of consciousness, and by Dryfoos (18) in the elements of psychoanalysis. Emerson (21) treats of the subconscious in its relation to other phases of consciousness. Fischer (23), Löwy (41), Morselli (49), Wells (93), refer primarily to the pathological aspects of consciousness. Cory (14) gives an interesting account of the non-literary activities of the author known as Patience Worth. Geley (26) develops the conception of a super-psychology and a super-physiology as fundamental to the so-called supernatural psychical phenomena. Gregory (27) speculates on the possibility of an independent existence of mind.

The year has been very fruitful in the recognition which philosophers have given the topic of consciousness. Calkins (11), Hicks (32), Laski (38), Spaulding (73, 74), discuss various aspects of naturalism. Carr (12), Mursell (51), Pratt (52), Radhakrishnan (54), treat of realism and perception. Devoting their attention to logic we have, Broad (7), Morgan (48), B. Russell (60), L. J. Russell (62), Schiller (63), Shelton (69), Tawney (77). Second (66) shows the relation between imagination and scientific thinking, and Lloyd (39) gives the function of philosophy in reconstruction.

REFERENCES

1. ABRAMOWSKI, E. *Le subconscient normal*. Paris: Alcan, 1914. Pp. 442.
2. ANON. Confessions of an Agoraphobic Victim. *Amer. J. of Psychol.*, 1919, 30, 295-299.
3. BAWDEN, H. H. The Evolution of Behavior. *Psychol. Rev.*, 1919, 26, 247-276.
4. BAWDEN, H. H. Psychology and Scientific Method. *J. of Phil., Psychol., &c.*, 1919, 16, 603-609.
5. BOSANQUET, B. Appearance and Reality, and the Solution of Problems. *Phil. Rev.*, 1919, 28, 290-295.
6. BROAD, C. D. The Notion of a General Will. *Mind*, 1919, 28, 502-503.
7. BROAD, C. D. On the Relation between Induction and Probability. *Mind*, 1918, 27, 389-404.
8. BURROUGHS, J. Is Nature without Design? *North Amer. Rev.*, 1919, 209, 659-671.
9. CALKINS, M. W. The Personalistic Conception of Nature. *Phil. Rev.*, 1919, 28, 115-146.
10. CALKINS, M. W. Spaulding's Relations and Subsistent Entities. *J. of Phil., Psychol., &c.*, 1919, 16, 635-640.
11. CALKINS, M. W. The New Rationalism and Objective Rationalism (Discussion). *Phil. Rev.*, 1919, 28, 598-605.
12. CARR, H. W. What Does Bergson Mean by Pure Perception? *Mind*, 1918, 27, 472-474.
13. COHEN, M. R. Communal Ghosts and Other Perils in Social Philosophy. *J. of Phil., Psychol., &c.*, 1918, 15, 673-688.
14. CORY, C. B. Patience Worth. *Psychol. Rev.*, 1919, 26, 397-407.
15. DEARBORN, G. V. N. Some Functions of Consciousness. *Med. Record*, 1918, June 15. Pp. 13.
16. DE LAGUNA, G. A. "Dualism and Animal Psychology" (Discussion). *J. of Phil., Psychol., &c.*, 1918, 15, 617-622.
17. DRAKE, D. Panpsychism Again. *J. of Phil., Psychol., &c.*, 1919, 16, 433-438.
18. DRYFOOS, A. D. The Elements of Psychoanalysis. *N. Y. Med. J.*, 1916, 103, 595-596.
19. DUNLAP, K. "Scientific Prepossession" and Anti-scientific Animus. *J. of Phil., Psychol., &c.*, 1919, 16, 156-161.
20. ELKUS, S. A. Purpose as a Conscious Concept. *J. of Phil., Psychol., &c.*, 1919, 16, 290-296.
21. EMERSON, L. E. The Subconscious in Its Relation to the Conscious, and Unconscious. *Psychoanal. Rev.*, 1919, 6, 59-64.

22. FEINGOLD, G. A. The Present Status of the Unconscious. *Monist*, 1917, 27, 205-232.
23. FISCHER, O. Raphael Scherman und das Problem der Gedankenuebertragung. *Wien. klin. Woch.*, 1918, 31, 684-685.
24. FITE, W. The Human Soul and the Scientific Prepossession. *Atlantic Mo.*, 1918, 796-804.
25. FOLLETT, M. F. Community is a Process. *Phil. Rev.*, 1919, 28, 576-588.
26. GELEY, G. *De l'inconscient au conscient*. Paris: Alcan, 1919. Pp. 346.
27. GREGORY, J. C. Mind, Body, Theism and Immortality. *Phil. Rev.*, 1919, 28, 164-175.
28. HALL, G. S. The View-point of the Psychologist as to the Courses of Study which Will Meet the Future Demands of a Democracy. *Ped. Sem.*, 1919, 26, 90-99.
29. HARVARD, J. What Does Bergson Mean by Pure Perception? *Mind*, 1919, 28, 463-470.
30. HENKE, F. G. A Note on the Psychology of Vitalism. *Amer. J. of Psychol.*, 1919, 30, 406-414.
31. HICKS, G. D. Symposium: See reference 76.
32. HICKS, G. D. The Basis of Critical Realism. *Proc. Aristot. Soc.*, 1916-1917, 17, 300-359.
33. JENNINGS, H. S. Experimental Determinism and Human Conduct. *J. of Phil., Psychol., &c.*, 1919, 16, 180-183.
34. JOHNSON, W. E. Symposium: See reference 76.
35. KNOWLSON, T. S. *Originality; A Popular Study of the Creative Mind*. Philadelphia: Lippincott, 1918. Pp. 304.
36. LAIRD, J. Introspection. *Mind*, 1919, 28, 385-406.
37. LARGUIER DES BANCELS, J. Sur les origines de la notion d'ame. *Arch. de Psychol.*, 1918, 17, 58-66.
38. LASKI, H. J. The Pluralistic State. *Phil. Rev.*, 1919, 28, 562-575.
39. LLOYD, A. H. The Function of Philosophy in Reconstruction. *J. of Phil., Psychol., &c.*, 1919, 16, 505-518.
40. LOOMIS, R. S. A Defense of Naturalism. *Int. J. of Ethics*, 1919, 29, 188-201.
41. LÖWY, MAX. Bemerkungen zur Lehre von der Hypnose und zur Pulsbeeinflussung in derselben. *Wien. klin. Woch.*, 1918, 31, 712-713.
42. MACINTOSH, D. C. A Sketch of the Philosophy of Religion with Illustrations of Critical Monism. *Mind*, 1919, 28, 129-161.
43. MCCLURE, M. T. Liberty and Reform. *J. of Phil., Psychol., &c.*, 1919, 16, 589-596.
44. MARSHALL, H. R. Other Men's Minds. *J. of Phil., Psychol., &c.*, 1918, 15, 627-631.
45. MARSHALL, H. R. Of Outer-world Objects. *J. of Phil., Psychol., &c.*, 1919, 16, 46-50.
46. MERRILL, A. A. Prediction and Spontaneity. *J. of Phil., Psychol., &c.*, 1919, 16, 161-162.
47. MOORE, G. E. Symposium: See reference 76.
48. MORGAN, C. L. Fact and Truth. *Proc. Aristot. Soc.*, 1916-1917, 17, 195-215.
49. MORSELLI, M. *Sulla origine subconsciente delle cosi dette personalita spiritiche*. (Extract from *Luce a Ombra*, 1917.)
50. MULFORD, H. J. What is "The Unconscious"? *Amer. J. of Psychol.*, 1919, 30, 253-259.

51. MURSELL, J. L. The Critical Philosophy and the Theory of Types. *J. of Phil., Psychol., &c.*, 1919, 16, 347-351.
52. PRATT, J. B. Realism and Perception. *J. of Phil., Psychol., &c.*, 1919, 16, 596-603.
53. PRINCE, W. F. Authorship of the Book of Mormon. *Amer. J. of Psychol.*, 1917, 28, 373-389.
54. RADHAKRISHNAN, S. Bergson and Absolute Idealism. *Mind*, 1919, 28, 275-296.
55. REYBURN, H. A. Mental Process. *Mind*, 1919, 28, 19-40.
56. RICHARDSON, C. A. Scientific Method in Philosophy and the Foundations of Pluralism. *Phil. Rev.*, 1918, 27, 227-273.
57. RICHARDSON, C. A. On Certain Criticisms of Pluralism. *Mind*, 1919, 28, 54-65.
58. RICHARDSON, C. A. The Notion of a Deterministic System. *Phil. Rev.*, 1919, 28, 47-66.
59. ROGERS, A. K. The Place of Pleasure in Ethical Theory. *Phil. Rev.*, 1919, 28, 27-46.
60. RUSSELL, B. Professor Dewey's "Essays in Experimental Logic." *J. of Phil., Psychol., &c.*, 1919, 16, 5-26.
61. RUSSELL, L. J., C. A. Strong: The Origin of Consciousness; An Attempt to Conceive the Mind as a Product of Evolution. *Mind*, 1919, 28, 471-480.
62. RUSSELL, L. J. The Basis of Bosanquet's Logic. *Mind*, 1918, 27, 432-464.
63. SCHILLER, F. C. S. What Formal Logic is About. *Mind*, 1918, 27, 422-431.
64. SCHILLER, F. C. S. Methodological Teleology. *J. of Phil., Psychol., &c.*, 1919, 16, 548-553.
65. SCHROEDER, T. Authorship of the Book of Mormon. *Amer. J. of Psychol.*, 1919, 30, 66-72.
66. SEGOND, J. L'imagination pure et la pensée scientifique. *Rev. Phil.*, 1919, 88, 297-321.
67. SELLARS, R. W. The Epistemology of Evolutionary Naturalism. *Mind*, 1919, 28, 407-426.
68. SHELDON, W. H. The Asymmetry of Reality. *J. of Phil., Psychol., &c.*, 1919, 16, 645-658.
69. SHELTON, H. S. Logic and Formalism. *Mind*, 1918, 27, 464-471.
70. SINNETT, A. P. Imprisoned in the Five Senses. *Nineteenth Century*, 1919, 85, 499-511.
71. SMITH, J. A. Symposium: See reference 76.
72. SONNEBERG, W. A Biologist's Religion. *Monist*, 1918, 28, 567-585.
73. SPAULDING, E. G. *The New Rationalism*. New York: Holt, 1918.
74. SPAULDING, E. G. The New Rationalism. (A Rejoinder.) *Phil. Rev.*, 1919, 28, 606-612.
75. STRONG, C. A. *The Origin of Consciousness*. New York: Macmillan, 1918.
76. SYMPOSIUM: Are the Materials of Sense, Affections of the Mind? *Proc. Aristot. Soc.*, 1916-1917, 17, 418-458.
77. TAWNEY, G. A. Logic as the Science of the Pure Concept. *J. of Phil., Psychol., &c.*, 1919, 16, 169-180.
78. TEGGART, F. J. The Approach to the Study of Man. *J. of Phil., Psychol., &c.*, 1919, 16, 151-156.
79. THALHEIMER, A. Purpose. *J. of Phil., Psychol., &c.*, 1919, 16, 541-548.
80. THORBURN, W. M. The Rights and Wrongs of a Person. *Mind*, 1918, 27, 405-421.

81. THURSTONE, L. L. The Anticipatory Aspect of Consciousness. *J. of Phil., Psychol., &c.*, 1919, 16, 561-568.
82. TURNER, J. E. Dr. Strong's Panpsychic Theory of Consciousness and Perception. *J. of Phil., Psychol., &c.*, 1919, 16, 428-433.
83. TURNER, J. E. Vitalism and Mechanism. *Sci. Prog.*, 1918, 12, 305-311.
84. URBAN, W. M. The Nature of the Community. *Phil. Rev.*, 1919, 28, 547-561.
85. WARD, J. Symposium: See reference 76.
86. WARD, J. Sense-knowledge. (I) *Mind*, 1919, 28, 257-274.
87. WARD, J. Sense-knowledge. (II) *Mind*, 1919, 28, 447-462.
88. WARREN, H. C. A Study of Purpose. *J. of Phil., Psychol., &c.*, 1916, 16, 5-72.
89. WASHBURN, M. F. *The Animal Mind*. (Second, revised edition.) New York: Macmillan, 1917.
90. WASHBURN, M. F. Dr. Strong and Qualitative Differences (Discussion). *Phil. Rev.*, 1919, 28, 613-617.
91. WEISS, A. P. The Mind and the Man-Within. *Psychol. Rev.*, 1919, 26, 327-334.
92. WEISS, A. P. The Relation Between Physiological and Behavior Psychology. *J. of Phil., Psychol., &c.*, 1919, 16, 626-635.
93. WELLS, F. L. Mental Regression: Its Conception and Types. *Psychiat. Bull.*, Oct., 1918.
94. WIEMAN, H. N. The Nature of Mentality. *Psychol. Rev.*, 1919, 26, 230-246.

TERMINOLOGY

BY HOWARD C. WARREN

Princeton University

The committee appointed by the American Psychological Association to consider questions of psychological terminology in a preliminary report (3) deals with fundamental terms, such as *psychology*, *mind*, *consciousness*, *experience*, and *self*. The list contains twenty-eight terms. In most cases alternative definitions are given, often quite divergent; the aim is to include all meanings used today by recognized psychological authorities.

Solomon (2) urges that at least the most important and most frequently used terms in psychopathology "should stand for some definite, clearly expressed, specifically outlined concepts." Many such terms are used repeatedly by various writers without giving a clear concept of what they signify. He instances the vague use of such terms as *dementia præcox*, *neurasthenia*, *hysteria*, *psychosis*, *consciousness*, *the unconscious*, and *subconsciousness*. The writer specifies several familiar Freudian terms as standing in need of more precise definition.

The term *factor*, as Frost points out (1) has two distinct uses in genetic discussions. It may mean a definite property or charac-

teristic of the germ plasm, or an actual (probably material) unit of genetic segregation. Frost calls attention to the need of clearly distinguishing these two uses, especially in their bearing on the related terms *germ*, *determiner*, and *unit character*.

REFERENCES

1. FROST, H. B. The Different Meanings of the Term "Factor" as Affecting Clearness in Genetic Discussion. *Amer. Natural.*, 1917, 51, 244-250.
2. SOLOMON, M. Need for Stricter Definition of Terms in Psychopathology. *J. of Abnorm. Psychol.*, 1917, 12, 195-199.
3. WARREN, H. C. ET AL. Definitions and Delimitations of Psychological Terms. *PSYCHOL. BULL.*, 1918, 15, 89-95.

APPARATUS

BY C. E. SEASHORE

University of Iowa

Dunlap (4) records experimental results showing the unreliability of the 1/5 second stop watch for association tests. The chief objection is that there is a tendency in the experimenter to reduce variations in the records by setting up a reaction habit of a relatively constant period. The reviewer wishes herewith to correct an error in the classification of Klopsteg's (1) chronoscope in last year's review of apparatus. Through the courtesy of the manufacturers the writer has had the privilege of testing the device. This chronoscope consists of a galvanometer and fall apparatus with a switch for electrical control, together with the necessary batteries. The time reading is taken in terms of the throw of the galvanometer. The operation of the instrument is silent; the indicator returns to zero automatically. The reading may be thrown on a large scale before an audience. It is perhaps the most accurate means which we now have for ready measurement of very short time intervals; such as, less than 0.01 sec.; but for ordinary reaction time other devices are more convenient. A clock of precision in which the principal feature is the employment of a "slave" clock to do a great part of the work, leaving the master pendulum no function except that of controlling the other, is described by Bartram (1). The paper contains a mathematical discussion of the best working conditions and of the possible magnitude of errors which might arise from various causes.

Burt (2) has described a pneumograph which automatically

records the instant inspiration and expiration respectively begin and incorporates the time record in the breathing record. Nutting (7) has designed an instrument which takes the place of the Marten's comparison photometer for use as a brightness photometer, illuminometer, and reflectometer. The instrument is simple and comparatively inexpensive and avoids the use of the polarization principle. The density is controlled by means of a precision iris diaphragm.

A monochord (5) device for the testing of the upper limits of tones is attracting attention among otologists. By stroking the wire with a turpentine brush longitudinal vibrations of high frequency are set up. The instrument is calibrated to 25,000 v.d. The lower range of pitch is provided for by the usual manner of producing transverse vibrations by bowing. While the instrument is very ingenious and simple, it is only of rough qualitative value, because in the higher regions the tones can not be made sufficiently intense; a person who falls out at 17,000 v.d. with this instrument may hear as high as 25,000 v.d. when a louder tone is produced in the telephone receiver.

A pitch range audiometer (3, 8) has been devised for the measuring of acuity of hearing quickly and accurately for all pitches within the principal functional tonal range with a pure tone. The instrument is built on the principle of induction. The pitch is determined by the speed of revolution of a toothed wheel, and is measured by an electrical tachometer. The intensity is varied by a series of resistance shunts and the tone is delivered through a telephone receiver. It covers a range from 15 vibrations up to 8,000 vibrations. The test can be made in a fraction of the time that it could be made with tuning forks and gives vastly more details.

REFERENCES

1. BARTRAM, C. O. A Clock of Precision. *Proc. Phys. Soc. London*, 1917, 29, 120-149.
2. BURTT, H. E. A Pneumograph for Inspiration-expiration Ratios. *PSYCHOL. BULL.*, 1918, 15, 325-328.
3. DEAN, L. W., & BUNCH, C. C. The Pitch Range Audiometer. *Laryngoscope*, Aug., 1919.
4. DUNLAP, K. The Stopwatch and Association Test. *Psychobiol.*, 1917, 1, 171-175.
5. GOLDSTEIN, M. A. The Monochord. *Laryngoscope*, 23, 216-221.
6. KLOPSTEG, P. E. A New Chronoscope and Fall Apparatus. *J. of Exp. Psychol.* 1917, 2, 253-263.
7. NUTTING, P. G. A New Type of Comparison Photometer. *J. of Opt. Soc.*, 1917, 1, 83-86.
8. SEASHORE, C. E. The Pitch Range Audiometer. *Jour.-Lancet*, Oct., 1919.

TEXT-BOOKS AND GENERAL TREATISES

BY HERBERT SIDNEY LANGFELD

Harvard University

Three interesting text-books of psychology have appeared this year. They differ considerably from one another and from the traditional text-book to which we have grown accustomed during the past years.

Hunter's *General Psychology* (4) is the broadest in scope but the least intensive in treatment of special topics. His plan has been to give the student a general idea of mind in all its manifestations. The originality of the book consists principally in the number of fields described and the arrangement of the material. The behavior viewpoint is prominent but not dominant. Introspective data are given but inasmuch as psychological observation does not necessarily mean a "looking within" the student is advised to consider introspection as synonymous with observation as practised in the other sciences.

Part I starts with a brief survey of animal psychology with special references to methods of experimentation. There follow descriptions of mental tests and mention of the application of psychology to business, law, etc. The facts of abnormal psychology which are particularly interesting to psychologists, such as paranoia, multiple personality, and psycho-analysis form the next chapter. Part I ends with a brief account of the self and its social aspects, social institutions and racial psychology. This material is presented in the first part of the book in order to interest the student in concrete problems and to counteract the idea that normal human psychology is all-important in the study of the mind. The author states, however, that one may begin with Part II and if it is a short course, the chapters of Part I may be used as collateral reading.

Part II begins with Attention, which is described as "the clearness into and out of which objects move." Under the subjective conditions of attention are included instincts, habits and the laws of association. The student is then given an adequate account of the nervous system, and reflex and instinctive action. The chapter on Emotion which includes a description of the important work of Sherrington and Cannon, McDougall's analysis of the emotions and Lipps' theory of empathy precedes the chapter on the Affective

processes. The psychology of the senses, including Weber's Law and visual space is covered in two chapters. The last chapters are concerned with imagination, memory and thought. Hunter has avoided any lengthy discussions and has been successful in selecting important facts and presenting them with equal emphasis. In the short space at his command, however, he has been able to do little more than stimulate the student to further study.

The most original text-book which has appeared in years and one which most strongly reflects the opinions and personality of the author is Watson's *Psychology from the Standpoint of a Behaviorist* (15). The title is a very honest one. It is an outline of the manner in which one of the behaviorists desires to see psychology developed. Perhaps the term outline may be misleading in that a great many facts of importance are given in some detail. The results are, in many instances, admitted to be tentative and as suggestions for future work. Indeed, there are so many hints for further experimentation and such concrete and practical descriptions of methods which lay entire stress upon objective control that the book will undoubtedly be more useful to research students than to members of an elementary course. As Watson has well described the features which first impress the reader we may quote from his preface; "The present volume does some violence to the traditional classification of psychological topics and to their conventional treatment. For example, the reader will find no discussion of consciousness and no reference to such terms as sensation, perception, attention, will, image and the like. These terms are in good repute, but I have found that I can get along without them both in carrying out investigations and in presenting psychology as a system to my students. I frankly do not know what they mean, nor do I believe that anyone else can use them consistently. I have retained such terms as thinking and memory, but I have carefully redefined them in conformity with behavioristic psychology."

The author has, indeed, been very successful in avoiding these terms, but at times it was necessary to make a considerable circumlocution in order to do so. The "Psychology" is, of course, in terms of stimulus and response. Although no introspection is used the spoken word is admitted as a response of the human organism.

It is impossible to give here more than a few of the outstanding features of the book. It should be said at the outset that most of the

facts to be found in the traditional text-books are to be found here, but in unexpected settings and original terms. Four methods for obtaining psychological data are described: "1. Observations with and without instrumental control. 2. The conditioned reflex method." 3. The verbal report method. 4. Methods of Testing.

Under the title of "The Receptors and Their Stimuli" are given many of the facts of sensations. Instead of speaking of the sensation of red from wave lengths between 760 and 647 mm., to take an example, we learn that the subject when stimulated by these wave lengths replies "I see red." There are excellent cuts of the sense organs, in fact throughout the book there are numerous well-chosen illustrations of the human anatomy. Space perception and visual hallucination are included in this chapter. Before describing the responses of the organism we are given the essential facts of the nervous system and the muscles and glands. Under the latter are included the liver, kidney, thyroid, etc. The first hereditary motor response to be described is the emotional. Results are given of experiments which the author made upon the reaction of babies to various objects such as pigeons, rabbits, rats, etc. In the first months no fear was shown toward these animals. The reader will find a considerable amount of original data in the investigations by the author, especially upon children, in almost all of the succeeding chapters. As a suggestion for a practical study of the emotions a class experiment is described in which individuals are rated according to various characteristics of their emotional life.

In the chapter upon instincts there is a detailed description of investigations upon nursing, grasping reflex, defense movement, crawling, etc.

Habits are classified as explicit bodily habits and explicit and implicit language habits. We find that it took a hundred and fifty trials for a child to learn through experience to avoid grasping at a flame. The learning curve and retention are treated under the subject of bodily habits. There is a genetic treatment of language which follows a detailed description, with illustrations, of the vocal apparatus. In regard to thought the author states that it may be explicit or implicit.

The material generally found in a chapter on memory is here found in the chapter dealing with language. In the chapter upon "The Organism at Work" Watson states that the psychology of fatigue is in such a helpless position that the concept of fatigue had

better be dropped. It is simply necessary to state that results are obtained under such and such conditions.

Dr. Arai's experiments upon the work curve are given at some length. A considerable part of the chapter is concerned with the effect of drugs and abnormal conditions upon work. The psychology of habit is continued in the chapter on "Personality and its Disturbances." Various methods of studying personality behavioristically are here included. There is very much more on instincts, habits, and learning in general than is ordinarily found in a text-book, so that even those who desire a fuller and more conventional treatment of sensory psychology may find it an advantage to use this as a supplementary text. The book is written with a great deal of vigor and holds the interest of the reader. It might be added that Watson takes occasion to mention the deficiencies of the air medical service, especially in the employment of unscientific otologists, obstetricians and gynecologists, instead of psychopathologists and psychologists.

Warren's *Human Psychology* (14) will appeal to those instructors who have not taken an extreme position in regard to psychological methods, for mind is described structurally, functionally and behavioristically. The aim of the author seems to be to give the student a brief and straightforward account of all the important facts and problems with which a student of experimental psychology should be acquainted before starting independent reading and research. The book therefore covers a very wide range of subjects. As in the case of the other books summarized, there is much originality shown in the classification and arrangement of the material. Another feature of the book is the close coördination throughout the text, of the psychological and the physiological facts. In fact, the nervous mechanism is very strongly emphasized. After a short chapter, descriptive of the organism as a whole, there are several chapters upon the physiology of the nervous system, with special emphasis upon the nervous arc and factors of stimulation and response. The two chapters upon behavior cover reflexes, instincts, and intelligent action. Under the last heading we find a detailed account of the learning process. A short chapter deals with some of the important factors of consciousness. The psychology of the senses is covered in two chapters. Experience is divided into sensation and ideas. There is a general description and comparison of these two elements of consciousness. Perception, imagery, feelings and conations are included under the

heading "Primary Mental States." We find a general description of perception and special treatment of space, illusion, time, rhythm, discrimination-threshold, etc.

Distinction is made between memory images and images of the imagination. There is also a psychological explanation of general images. Special attention is also given to the various attributes of feeling.

Secondary mental states include the emotions, voluntary action and thought as expressed in language. There is a very elaborate classification of emotions and a list of the sentiments together with their origin. The various types of central control and volition as well as the nature and factors of the will are briefly sketched. The student is informed of the controversy over imageless thought and is given a psychological explanation of meaning and value. A description of the laws of the association of ideas leads to a few pages upon dreams and rational thinking.

A chapter is devoted to a description of the general set of the organism, producing attitudes which are termed interest, desire, attention, etc. After showing what is meant by character and classifying the temperaments, the author shows how these various phases make up the general character or self. There is a useful summary of the contents of the book and several pages of special conclusion. Four problems are discussed in the appendix, namely the mind and body relation, including the question of thought transference, mechanism and purpose, neural activity and theories of color vision. At the end of each chapter there are references to chapters of standard text-books which may be used as collateral reading. There are also several practical exercises, directions for performing which are given at the end of the book. There are excellent illustrations, especially of the essentials of the human anatomy. (The recent text-books in psychology make it unnecessary to use a separate physiology in general courses.) The book seems best suited for advanced courses. It should be used in elementary courses only if the students are above sophomore grade.

Pillsbury has made a number of important changes in a new edition of his *Essentials of Psychology* (10). The various topics have been brought up to date, wherever it has been deemed necessary. The greatest number of changes have been made in the chapters on "Memory and Imagination" and on "The Emotions," ten pages having been added to the former. In the latter chapter the latest facts, such as the results of Cannon's work, are now in-

cluded. A new chapter entitled "The Types of Mind" which deals briefly with the nature and method of intelligence tests, has been added. Many of the paragraph headings have been altered and new ones added. There are several new cuts. The exercises and references at the end of each chapter have been thoroughly revised and there is now in addition a list of questions. The author has also improved his style throughout the book.

Fröbes (2) considers that his text-book is a supplement to a general outline and to research in special fields. He states that his book differs from the general run of text-books in that it is midway between a condensed outline and a reference book intended for specialists. His aim has been to give to psychologists a book somewhat similar to that which medical men have in Tigerstedt's *Physiologie*.

The book is ponderous both in size and style. Only the first volume has as yet appeared and its six hundred odd pages brings one only to the end of the chapter on the laws of association.

One might describe the book as a composite photograph of the writings of the better-known psychologists such as Wundt, Müller, Stumpf, Fechner, Titchener, Witasek, etc. Very few references are beyond 1914 and many of them date from the early days of experimental psychology. The treatment is very conservative and there is absence of any definite point of view or critical analysis. The modern tendencies in experimental psychology have not been recognized and few references have been made to the work done in America. There is no attempt at originality, the various subjects being explained with quotations or paraphrases from various authors. For example, under the differential threshold for pitch one is given results from Preyer, Witasek, Brentano and Stumpf within the space of ten lines.

The first third of the book deals with the sensations. The second third with auditory perception and space, and movement. In the last third of the book there is a brief treatment of thought, perception and comparison. Following this there is a relatively extensive description of psychological methods including the principles of correlation, and finally a statement of the laws of association. The book is a presentation of experimental results rather than methods or theories. It may be helpful to the student in starting a problem or writing a seminar paper, especially if he has not a complete bibliography or good library facilities.

Kaplow's *Psychologie generale* (5) is a system of psychology

which, as the sub-title suggests, is based upon a study of dreams. The author's desire is to be empirical. He has therefore developed a system of psychology from about five hundred observations upon himself which he has made during the course of five years. He has refrained from using the observation of others on account of their unreliability. One suspects that the author's generalizations are, to some extent, determined by his training in the philosophical psychology of the last century. One is reminded, in places, of Lipps, although he has not even Lipps' tolerance for modern experimental facts. It is impossible, in this place, to review the book in detail. An idea of it may be obtained from the fact that the author presupposes three egos. There is the central ego which is "adynamique." It uses no energy except, perhaps, the vital energy which only disappears at death. There is also the automatic ego and a third ego which is a combination of the two. Much use is made of the concept of the focus of the mind, which is not to be confused with attention, and the explicit function which probably corresponds to Wundt's apperceptive mass.

Goddard's *Psychology of the Normal and Subnormal* (3) is not only for students in normal schools and colleges, but also for parents and for the general reader who is interested in teaching, in social problems, vocational guidance, etc. The various subjects are treated under the threefold aspect of physiology, normal, and abnormal psychology. Extensive descriptions are given of the neural basis for the various forms of mental activity. These activities are then described as they appear in the normal individual. Thus far the book resembles the usual text-book. The reader, however, is led beyond this into the normal field. In fact the impression one receives is that of an abnormal rather than normal psychology. The facts of the two fields, however, are brought closely together so that they supplement each other. There are numerous illustrations and a summary is given at the end of each chapter.

The first chapters are concerned chiefly with the nervous system and its development. Memory and attention and the association of ideas, are shown to be inherent properties of the nervous mechanism. The higher mental processes are then described. Considerable attention is given to the problems of emotional life, and to will, action and habit. The author has presented a view of emotions which he believes has not before appeared in a textbook. In the appendix he has printed Mosso's article on

"The Mechanism of the Emotions." A short second part of the book describes some of the possibilities of applying the principles of the first part to practical problems of life especially to the training of the feeble-minded. The book is written in simple, and so far as possible, non-technical language. The facts are frequently illustrated by experiences which will be readily understood by the general reader. As a textbook it is probably best adapted to a course in abnormal or in comparative psychology.

Bridges in *An Outline of Abnormal Psychology* (1) lists and classifies the abnormal manifestations of the various fields of psychology. He also describes very briefly the theories and explanations of these manifestations. Part I follows the division of the ordinary human textbook, namely sensation, perception, memory, etc. Part II lists the symptom complexes of insanity and Part III those of the border-line diseases. There are lists of references at the end of each chapter. The author desires the book "to serve as a guide for students of abnormal psychology in the absence of a comprehensive text-book." It seems to the reviewer that the book will be useful to students of abnormal psychology, even though they may have access to text-books on the subject, for it will be of considerable aid to them in systematizing and remembering the many necessary facts of the subject.¹

Starch's *Educational Psychology* (13) may be used as a text-book, as well as a reference book for those working in the field of educational psychology. The author's chief aim has been to present the most important experimental data in the field of education. He has not dealt to any extent with theory, since he desires his book to be as practical as possible. He has also devoted less space to a discussion of instincts, fatigue and imagery than has usually been done. The first part of the book is concerned with the native equipment of the human organism. The range of variation in the capacities of pupils is shown. There is also a treatment of the correlation of various capacities. This leads to a discussion of results relative to sex differences. In the part upon the inheritance of mental traits there is first a description of the work upon defectives and then of the resemblance of brothers and sisters and twins. This part ends with a description of intelligence tests.

Part II gives considerable data upon the learning curve and the transfer of training. The third part is concerned with the

¹ A critical review of this book by S. I. Franz appeared in the BULLETIN, June, 1919.

methods of measuring the ability in learning special school subjects. The author considers this part unique for a text-book. Considerable data are presented which will assist in teaching these subjects. A large part of the book consists of tables and graphs.

Lipmann's *Psychologie für Lehrer* (6) is similar in treatment to his psychology for lawyers. It is interesting in style and subject matter. He has been able, in a short space, to present some of the most essential facts clearly and concisely. It is especially interesting to note the change which has taken place regarding the German ideas on educational methods. When on the subject of "Authority" Lipmann states that the teacher should make very little use of his authority in his relation to the pupil. He should not insist upon his statements being accepted uncritically, but should prove, so far as possible, the assertions he makes. Further the student should be told that true religious values and ideals are a matter of faith rather than knowledge and should be distinguished from so-called dogmas which masquerade under the guise of religion. Attention is particularly directed to the reliability of statements made by children, to memory, fantasy, and play, feeling, will and character, including questions of morality. There is no attempt to treat these subjects more than superficially, but the book will undoubtedly prove suggestive to teachers, especially in Germany.

Although Link's *Employment Psychology* (7) is essentially for those who desire to enter the field of industrial psychology, and for the business man who wishes to know the practical value of psychology in the selection of employees and in putting the right man in the right place, the book will make a good text for part of a course in applied psychology. Link is very conservative in his estimate of the value of the various psychological tests he describes. The book will probably win the confidence of the business man. It should also put the student in the proper attitude toward applied work. The reader is shown how the tests are devised, how their practicability is determined, and finally the manner in which they are applied, the results obtained, the calculations made and the deductions drawn. Many actual experiments in selecting the personnel for different businesses are described in detail. Not only are successful methods given but also some which were negative in result. By this means the student is warned of the danger of too much optimism and advised of the necessity for great patience. A number of tests for the selection of employees are briefly described. Part of the book is devoted to trade tests. Another part deals

with the method of comparing men according to impression, output, etc. The last part of the book contains general remarks upon employment methods. An appendix gives a more detailed account of some of the tests and methods of computing results. The book, though serious in tone, has an easy interesting style.

Seashore believes that it is possible, through scientifically determined tests, to decide whether one possesses sufficient musical ability to warrant fitting oneself for a musical career. In his book, *The Psychology of Musical Talent* (12), he has described tests for determining the presence of the essential features in musical ability, such as the sense of pitch, of intensity, of timbre, of consonance, etc. Experiments which have been carried on in Seashore's laboratory are described. There are also illustrations and descriptions of instruments invented by the author. There are included short explanations of the concepts necessary to an understanding of the psychology of music. The book will be of value to teachers of music, and instructors will find it useful in courses of general and applied psychology.

Peterson and David's *The Psychology of Handling Men in the Army* (9) will be of value not only to officers but to students of military psychology and may also serve as collateral reading for a course in applied psychology. The subjects treated are competition, play, team-play, leadership, the principles of learning, habit, discipline, and loyalty. Most of the chapters are divided into three parts. The first part is written by Lieut. David in a somewhat popular style, setting forth the practical aspects of the subject. Peterson explains the underlying psychological principles in the second part. The third part shows the immediate application of the facts and also contains quotations relative to the subject from competent army officers.

Part I of Marshall's *Mind and Conduct* (8) is entitled "The Correlation of Mind and Conduct." The first question discussed is the nature and limits of the correspondence of consciousness and behavior and the place of the subconscious. In behavior we find instinctive action opposed to adaptive action. In consciousness there is the opposition of instinctive feelings and reason. Habits are termed pseudo-instincts. If instinctive action is slowed down it shows the characteristics of adaptive action. On the conscious side, as action becomes more automatic instinctive feelings take the place of thought, and then, in turn disappear. The action thus becomes entirely unconscious.

Marshall describes the empirical self which is a "similacrum of the non-presentable self" or conceptual self which is described as an "undifferentiated mass of psychic elements." It is from the ego of self-consciousness that we learn the general nature of the self.

The second part deals with "Some Implications of the Correlation." The chief characteristic of self is the creativeness, evidence for which is to be found in the existence of ideals which are not part of the real world. In discussing freedom and responsibility the author states that we never do anything which, at the time of action, seems to us irrational. We are responsible for our acts in that we are the author of them. In this sense responsibility has ethical significance.

In the third part Marshall discusses the rôle of pleasure, happiness, intuition and reason in conduct.

Ritter in his two volumes upon *The Unity of the Organism* (II) has given much information upon the structure of the cells, cell theories, the relation of the organism to the cells, neural integration and nerve action. He discusses the connection between the physical and psychical and closes with a theory of consciousness. His specific information is drawn from the works of others. As he himself states in the preface, he is a complete stranger in the fields treated, namely the chemistry of the organism, heredity, human consciousness and the nature of knowledge. The book is highly speculative and philosophical. Owing to lack of definition in the style, it makes rather difficult reading.

REFERENCES

1. BRIDGES, J. W. *An Outline of Abnormal Psychology*. Columbus: R. G. Adams & Co., 1919. Pp. 126.
2. FRÖBES, J. *Lehrbuch der Experimentellen Psychologie*. Frieberg, i/Br.: Herdersche Verlagshandlung, 1917. Pp. xxvi + 605.
3. GODDARD, H. H. *Psychology of the Normal and Subnormal*. New York: Dodd, Mead, 1919. Pp. xvii + 349.
4. HUNTER, W. S. *General Psychology*. Chicago: University of Chicago Press, 1919. Pp. xiii + 351.
5. KAPLOUN, A. *Psychologie Generale*. Lausanne: Librairie Payot & Cie., 1919. Pp. 205.
6. LIPMANN, O. *Psychologie für Lehrer*. Leipzig: Barth, 1920. Pp. vi + 196.
7. LINK, H. C. *Employment Psychology*. New York: Macmillan, 1919. Pp. xii + 440.
8. MARSHALL, H. R. *Mind and Conduct*. New York: Scribner, 1919. Pp. viii + 236.
9. PETERSON, J., & DAVID, Q. J. *The Psychology of Handling Men in the Army*. Minneapolis: Perrine Book Co., 1919. Pp. iii + 146.

10. PILLSBURY, W. B. *Essentials of Psychology*. (Revised Edition.) New York: Macmillan, 1920. Pp. xiii + 428.
11. RITTER, W. E. *The Unity of the Organism*. Boston: Richard Badger, 1919. 2 vols. Pp. xxix + 398; xv + 408.
12. SEASHORE, C. E. *The Psychology of Musical Talent*. Boston: Silver, Burdett, 1919. Pp. xvi + 288.
13. STARCH, D. *Educational Psychology*. New York: Macmillan, 1919. Pp. viii + 473.
14. WARREN, H. C. *Human Psychology*. Boston: Houghton, Mifflin, 1919. Pp. xx + 460.
15. WATSON, J. B. *Psychology from the Standpoint of a Behaviorist*. Philadelphia: Lippincott, 1919. Pp. xi + 429.

BOOKS RECEIVED

- McDOUGALL, W. *An Introduction to Social Psychology*. (Fourth edition with a new preface and a third supplementary chapter.) London: Methuen, 1919. Pp. xxiv + 459. 7/6.
- ZIEHEN, Th. *Lehrbuch der Logik*. Bonn: Marcus & Webers, 1920. Pp. viii + 866. M. 47.50.
- TRIDON, A. *Psychoanalysis. Its History, Theory and Practice*. New York: Huebsch, 1919. Pp. 272. \$2.00.
- HOFFMANS, J. *La Philosophie et les Philosophes*. Bruxelles: Van Oest & Cie, 1920. Pp. xvii + 395.
- STÖRRING, G. *Die Frage der Wahrheit der christlichen Religion*. Leipzig: Engelmann, 1920. Pp. 70. M. 2.
- PELLETIER, A.-M. *L'Individualisme*. Paris, Giard & Brière, 1920. Pp. 118.
- WOODBURNE, A. S. *The Relation between Religion and Science: A Biological Approach*. Chicago: Univ. of Chicago, 1920. Pp. 103.
- HEMSTREET, W. *The Ether and the Soul*. Brooklyn: W. Hemstreet, 1920. Pp. 41.
- HAGGERTY, M. E. *Intelligence Examination. Delta 2, for Grades 3-9*. Yonkers-on-Hudson: World Book Co., 1920. \$0.75.
- HAINES, T. H. *Mississippi Mental Deficiency Survey 1919*. Miss. Mental Hygiene Commission.
- HAINES, T. H. *The Mental Deficiency Survey of Kentucky, 1917. Bulletin of the National Association for the Study and Education of Exceptional Children*. Vol. I, No. 2.
- MOEHLMAN, A. *A Survey of Teachers' Salaries in Detroit*. Detroit Educational Bulletin, No. 1, 1920.

NOTES AND NEWS

THE following items have been taken from the press:

A COURSE of lectures on "Psychology and Health" was given by Professor G. M. Stratton, of the University of California, in San Francisco, during the months of January and February.

DR. SCHACHNE ISAACS, formerly instructor in psychology at the University of Cincinnati, has been awarded a fellowship in psychology by the Society for American Fellowships in French Universities.

THE New School for Social Research offers three fellowships in social research for the academic year 1920-1921. Each fellowship carries a stipend of \$2,000, and successful candidates required to be in residence during the period of their tenure. Further information may be obtained from Mr. Horace M. Kallen, 465 West 23d Street, New York.

THE PSYCHOLOGICAL BULLETIN

PROCEEDINGS OF THE TWENTY-EIGHTH ANNUAL
MEETING OF THE AMERICAN PSYCHOLOGICAL
ASSOCIATION, CAMBRIDGE, MASSACHUSETTS
DECEMBER 29, 30, 31, 1919

REPORT OF THE RETIRING SECRETARY, H. S. LANGFELD, HARVARD
UNIVERSITY

The American Psychological Association held its twenty-eighth annual meeting at Harvard University on Monday, Tuesday and Wednesday, December 29, 30 and 31. The sessions were in the rooms of Emerson Hall and were attended by a very large number. One hundred and fourteen names were registered while many more participated in the various meetings. Fifty-seven papers were read. An analysis reveals among the papers six on theoretical problems, sixteen on experimental work, nine on intelligence tests, seven on clinical psychology, two on animal psychology, six on educational psychology, two on social psychology, six on applied psychology and three on matters of general interest to psychologists and anthropologists.

The Monday morning session was devoted entirely to General Psychology. In the afternoon there was a session upon Experimental Psychology, which was paralleled with one on Intelligence Tests. In the evening there was a reception at the home of the Secretary.

Tuesday morning there was a joint meeting of the American Association of Clinical Psychologists and at the same time a session for Experimental Psychology. In the afternoon there was a joint session with the American Anthropological Association. J. R. Angell, chairman of the National Research Council, was to have described the aims of this organization. As he was ill, his paper

was read by the President, W. D. Scott. W. V. Bingham read a paper upon the *Aims and Problems of the Division of Anthropology and Psychology*, and Clark Wissler described the manner in which the anthropologists and psychologists should coöperate. The annual business meeting was held at four o'clock in Emerson Hall. The banquet was given at the Harvard Union and was followed by a smoker. The retiring President, Walter Dill Scott, read his presidential address after the dinner.

On Wednesday morning there were parallel sessions, one on Educational and Comparative Psychology, and the other on Social and Applied Psychology. In the afternoon some of the members visited the McLean Hospital, the Psychopathic Hospital, the Nutrition Laboratory and the Judge Baker Foundation.

The Apparatus Exhibition was held in the Psychological Laboratory. Apart from the exhibit of the C. H. Stoelting Company of Chicago, the following were exhibited by members of the Association: Pictures of Psychologists by E. A. Kirkpatrick, Fitchburg State Normal School; Group Tests by W. V. Bingham, Carnegie Institute of Technology; Test Blanks and Charts by S. L. Pressey, University of Indiana; Reed I. Q. Slide Rule and Kohs Age-Finding Card by S. C. Kohs, Reed College; Tunable Bars for Pitch Discrimination by P. Young, University of Minnesota; Filters and Wedges by Prentice Reeves, Eastman Kodak Company; New Maze Apparatus by W. R. Miles, Carnegie Nutrition Laboratory; Motor Coördination Tests by F. A. C. Perrin, University of Texas; Class-Room Tachistoscope, Continuous Choice Apparatus, Apparatus for Paired Comparison of Transmission Colors, Self-Registering Tambour, Automatic Apparatus for Constant Stimuli Experiments, Device for Varying Brightness Independent of Color, by the Harvard Psychological Laboratory.

TRANSACTIONS AT THE ANNUAL BUSINESS MEETING.

The Annual Business Meeting was held on December 29, in Emerson Hall.

It was voted that the minutes of the previous meeting be accepted as printed.

The following items of business, reported by the Council, were then acted upon:

1. The Secretary reported the deaths of the following members of the Association during the past year: Edward Cowles, August Hoch, and John Wallace Baird.

2. The Treasurer's report as printed below was read and accepted. The following budget, prepared by the Council, was also read and adopted:

ESTIMATE OF RESOURCES

On deposit.....	\$128.10	
Dues (approximate).....	775.00	
Interest (approximate).....	50.00	
Sale of Monographs.....	?	
Withdrawal from principal funds.....	50.00	<u>\$1003.10</u>

ESTIMATE OF EXPENDITURES

Printing and supplies.....	\$325.00	
Postage.....	125.00	
Reprints.....	100.00	
Abstracts.....	50.00	
Incidentals of meeting.....	50.00	
Apparatus Exhibition.....	25.00	
Election committee.....	70.00	
Secretary's stipend.....	250.00	
Other committees.....	?	<u>995.00</u>

3. It was voted to authorize the Secretary to withdraw \$50 from the principal funds of the Association.

4. The members of the Program Committee for the ensuing year were announced as follows: Messrs. Fernberger, Langfeld and the Secretary.

5. It was voted to hold the next annual meeting in affiliation with A. A. A. S., at Chicago, December 28, 29, 30, 1920.

6. It was voted to appoint W. D. Scott as representative on the Council of the A. A. A. S. for 1920.

7. It was voted to appoint Harvey Carr as local member of the Executive Committee.

8. It was voted to authorize the Secretary to withdraw an amount not to exceed \$150 from the principal funds of the Association, to defray the expenses of the Committee on the Academic Status of Psychology.

9. It was voted that the Council nominate double the number of candidates for vacancies on the Committee on Anthropology and Psychology of the National Research Council and that these names be included on the ballot for officers.

10. It was voted that the two candidates recommended by the Council—Messrs. Warren and Watson—should be nominated to serve on the Division of Anthropology and Psychology of the National Research Council from July 1, 1920.

11. The Secretary reported the following nominations for membership in the Association and was instructed to cast the ballot of the Association for their election: Floyd Henry Allport, Ph.D., Instructor in Psychology, Harvard University; Thomas William Brockbank, Ph.D., Instructor in Psychology, The Catholic University of America; Mabel Ennsworth Goudge-Crane, Ph.D., Assistant Professor of Psychology, Ohio State University; John Edgar Coover, Ph.D., Assistant Professor of Psychology, Stanford, Jr., University; Thomas Russell Garth, Ph.D., Adjunct Professor in Psychology, University of Texas; Arnold L. Gesell, Ph.D., M.D., Professor of Education, Yale University, Josephine Mixer Gleason, Ph.D., Instructor in Psychology, Vassar College; Charles Hughes Griffiths, A.M., Ph.D., Instructor in Psychology, University of Michigan; Samuel B. Heckman, Ph.D., Assistant Professor of Education, College of the City of New York; Clark L. Hull, Ph.D., Instructor in Psychology, University of Wisconsin; Schacne Isaacs, A.B., A.M., Assistant Psychologist, Medical Research Laboratory, Air Service, U. S. Army; Jacob Robert Kantor, Ph.D., Instructor in Psychology, University of Chicago; Paul Kruse, Ph.D., Assistant Professor of Educational Psychology, Cornell University; Conrad Lund Kjerstad, Ph.D., Instructor in Psychology, State Normal School, Valley City, N. D.; John Norbert Melville, Special Secretary, Public Charities Association of Philadelphia; Katherine Murdock, Ph.D., Lecturer on Psychology, School of Philanthropy, New York City; Franklin Cressey Paschal, Ph.D., Assistant Professor of Psychology, University of Arizona; Edward Stevens Robinson, A.B., A.M., Instructor in Psychology, Yale University; Agnes Low Rogers, Ph.D., Professor of Education, Goucher College; Curt Rosenow, Ph.D., Psychologist, Juvenile Psychopathic Institute, Chicago; Georgiana Ida Strickland, Ph.D., Assistant in Psychology, Barnard College; Augustus Trettien, Ph.D., Professor of Psychology, Toledo University; Rutledge Thornton Wiltbank, Ph.D., Assistant Professor of Psychology, University of Chicago; Joseph Usury Yarbrough, M.A., Instructor in Psychology, University of Texas; Herman H. Young, Ph.D., Director, Child Direction Department, Child's Service Bureau, Youngstown, Ohio; Paul Thomas Young, Ph.D., Instructor in Psychology, University of Minnesota; Marvin J. Van Wagenan, A.M., Ph.D., Assistant Professor of Educational Psychology, University of Minnesota.

12. It was voted to elect Edwin G. Boring as Secretary of the Association for three years from January 1st, 1920.

13. It was voted to amend the Constitution, raising the annual dues from \$1 to \$2.

14. It was voted to deposit one copy of the Proceedings of the Association from 1892 to 1917 in Robbins Library at Harvard University, one copy in the Congressional Library, and one copy in the keeping of the Secretary.

The Chairman then called for the reports of Committees. Mr. Dodge, representing Mr. Yerkes, chairman of the Committee on Election of Officers, reported the results of the ballot of the Association to be as follows; for President, Professor Shepherd Ivory Franz, of the Government Hospital for the Insane; for members of the Council, elected for three years to succeed Messrs. Bingham and Hollingworth, Messrs. Langfeld and Yoakum.

Mr. Woodworth had nothing to report concerning the work of the Committee on Standardization of Mental Measurements and Tests. It was voted that the Committee be discharged.

Mr. Baldwin distributed a printed report on the Academic Status of Psychology which it was voted to accept. It was also voted that the Committee be discharged.

Mr. W. F. Dearborn made a brief report for the Committee on Teaching Experiments. It was voted that the report be received and the Committee discharged.

Mr. Warren reported progress for the Committee on Terminology. It was voted that the Committee be continued.

Mr. Geissler made a brief report for the Committee on Publications in Applied Psychology. It was voted that the report be received and the Committee be discharged.

Mr. Baldwin made a report for the Committee which had been called to confer with a committee from the American Association of Clinical Psychologists. It was moved to adopt the report which recommended the establishment of a section for Clinical Psychology of the Association.

The Secretary introduced the report of the Committee on Qualifications for Psychological Examiners and other Psychological Experts. After much discussion it was voted that the Committee be discharged and that a Committee of five members be appointed to consider methods of procedure for certifying Consulting Psychologists. It was also voted that the Council provide for mimeographing the full report of Mr. Haggerty's Committee, to be distributed among the members. It was further voted that the Committee be instructed to take cognizance of legislative attempts

to give legal status to psychologists and that it provisionally adopt the Wisconsin standard.

It was voted to authorize the President to appoint a committee of two members to coöperate with the Division of Anthropology and and Psychology for the purpose of arranging for an Abstract Journal in Psychology of international character.

New Business: Mr. Ogden moved to express the thanks of the members to the Secretary and to Harvard University for the kind hospitality shown. The motion was carried by a rising vote.

The meeting then adjourned.

REPORT OF THE TREASURER FOR THE YEAR 1919

DR.

To balance from the previous year.....	\$1808.56
Dues received from members.....	386.25
Interest from July 1, 1918, to July 1, 1919.....	59.53
Sale of Monographs, Nos. 51 and 53, year ending December 31, 1918.....	4.32
	<u>\$2258.66</u>

CR.

By Printing and Supplies.....	\$ 212.53
Postage.....	46.52
Expressage.....	6.77
Reprints of proceedings.....	26.38
Reprints of Nat'l Research Council report.....	44.61
Incidental Expenses 1918 meeting.....	44.20
Secretary's stipend.....	250.00
Exchange on cheques.....	1.40
Council's expense to extra meeting.....	6.55
Expense, election committee.....	65.38
Dues undeposited.....	3.00
	<u>\$707.34</u>
Balance in Fifth Avenue Bank.....	\$ 118.71
Balance in Union Dime Savings Bank.....	1432.61
	<u>\$1551.32</u>
	<u>\$2258.66</u>

CAMBRIDGE, MASSACHUSETTS,
December 27, 1919

HERBERT S. LANGFELD,
Treasurer
Audited by the Council.

TITLES AND ABSTRACTS OF PAPERS

Changes in some of our Conceptions and Practises of Personnel.
(Presidential Address.) WALTER DILL SCOTT, Northwestern University.

GENERAL AND EXPERIMENTAL PSYCHOLOGY

On the Use of the Gaussian Law in Mental Measurement. E. G. BORING, Clark University.

The normal law of error is frequently, either explicitly or implicitly, assumed in the statistics of mental measurement. Any form of distribution depends, however, upon the scale of units against which it is plotted; and, unfortunately, the assumption of the normal law is usually made without a critical examination into the nature of the unit of measurement. If the normal law is the law of chance, then it is evident that two mutually dependent variables, for which the relationship is not simply linear, can not have the same form of chance distribution; if the distribution for one is normal, then the distribution for the other can not possibly be normal.

It appears that the extensive use of the normal law in mental measurement comes as a result of an uncritical application of the generalities of games of chance to the psychophysical organism. Logically we may not assume the normal law except, as is the case for games of chance, in a definite knowledge of the nature of the unit. Almost always in mental measurement, however, we have no unit but simply a scale of rank-orders in which our data are placed. Moreover, because of the dependence of the form of distribution upon the unit, we can not, in the present state of psychological information, hope to arrive at a general conclusion that the Gaussian function applies to any entire class of mental data.

Relaxation. G. V. N. DEARBORN, Sargent Normal School.

Numerous experiments show that serviceable "relaxation" is best brought about by lowering the tension of the attention; *directly*, by "making the mind a blank" (lapsus), and *indirectly*, by assuming an unexciting euphoric tone, a kind of hygienic Nirvana.

Demonstration of hemobarograms. Deliberate general relaxation seems to show two types of reagents. One type, a small minority, does lower the brachial arteriotension by muscular relaxation; the other type does not, but raises it or throws it into unusual variation, or both. Both classes usually exhibit an initial effort-rise. The neural class-difference is unknown, but probably it is not largely a matter of direct voluntary control, for a professional expert in this respect (Neudorf) showed on relaxation a blood-pressure rise. Restful relaxation, then, has to be mentally coaxed and seldom can be physically driven. It seems not improper to suppose that the nerves directly inhibitory to the contraction of voluntary muscle (Nicolaides, Dontas, Wooley, Froelich), are stimulated from the upper cortex cerebri, in some way related to a change in the conscious kinesthesia, as an indescribable sagging sensation in the musculature. This may or may not be part of a hurlyless and worryless euphoria acting through the autonomic and the vagus.

Are There Any Instincts? K. DUNLAP, Johns Hopkins University.

In general psychology the term "an instinct" is used in a rather loose way to indicate various combinations of unlearned activities which it is useful to consider together. What one psychologist designates as a *reflex*, another may classify as an *instinct*. Some restrict the term to unconscious activities; some to non-volitional activities; some exclude neither consciousness nor volition. Usually the term is applied without restriction both to activities considered as a group from the physiological point of view, and to activities teleologically grouped. This looseness is perhaps not detrimental, from the point of view of general psychology: but is productive of confusion in social psychology.

In social psychology (taking MacDougal as an illustration) the tendency is to classify "instincts" *teleologically*, ignoring the physiological groupings. Thus, the "reproductive instinct" includes any and all activities of a certain grade which are concerned with the propagation of the species: the "pugnacious instinct" includes all those activities which contribute to or eventuate in combat. This procedure is by no means harmless, as it substitutes definitely the teleological for the psychological point of view. The practical result is that the social psychologist stacks his cards in giving his list of "instincts," and his further analyses are productive only of the conclusions he assumes at the start. Given a different list of "instincts," a different social psychology results.

There are endless possible classifications of "instincts" to which no objection can be made if it is understood that they are constructed for purposes of convenience only. One may perfectly well assume that there is a "moral instinct," if it be admitted that there are results in the world which can be classified as "moral." If one does not wish to consider these results in a group by themselves, then there is, for him, no "moral instinct."

The activities included under several different "instincts" may be identical. Certain "instincts" may include all the activities of the animal. Some "instincts" are merely modifications or expression of others. This is not an objection for teleological classification, but indicates that the classification is not psychological.

It is suggested that we cease to speak of "instincts," since these do not occur in a psychological sense: and that we use the term "*instinctive activities*," restricting it to the meaning it now has in contrast with "instincts."

A Behavioristic Interpretation of Concepts. R. C. GIVLER, Tufts College.

Concepts are written or spoken words which point to classes or to the relations between objects, and whose *meaning* is the motor attitude, attunement, or set which the sight or the sound of the word arouses in us.

We distinguish between the origin and development of concepts and their everyday use, but lay special emphasis upon the latter. Particularly is it to be noted that the same concept (word) may have practically the same meaning whether it be in the focus or the fringe of the "thought." This is because the function of all concepts is an instrumental function, *i.e.*, the attitudes they stimulate are all neuro-muscular-tension attitudes which normally eventuate in some overt action. The neuro-muscular mechanism involved in the building up of these attitudes, while still wanting in some of its details, is nevertheless predicatable in the main from what we know of the mechanics of nerve and muscle.

Certain implications of this theory in pedagogy, ethics, logic, and religion are obvious. The service which all concepts properly render is, from the biological point of view, the building up of motor attitudes (potential energy) which can go over into overt action (kinetic energy, or work.) The relative value of concepts may also be criticized on these grounds.

The Conditioned Reflex and the Freudian Wish. G. HUMPHREY, Harvard University.

The process of building up the wish as Freud understood the term is a complicated one, *e.g.*, to the desire for food, once satisfied by food alone, must be added numerous frillings in the case of the epicure. Why are these accessories necessary? Because, they have become "associated" with food. In other words, the wish I have for a meal consists of the hunger drive put into operation by the mechanism of the conditioned reflex, simultaneity, as Aristotle observed, being the essential factor in this substitution of one stimulus for another. Restated in terms of the conditioned reflex, the wish becomes then a course of action for which the organism is set (Holt) by means of a system of conditioned reflexes. Such a system requires a very complex nexus of stimuli. If some of these are missing, some of the reflexes will be excited and others left unexcited. A stress is set up, and it is then that we say that we have a wish in the non-Freudian sense of the term. This partial excitation is at the bottom of most of the pathological cases, and it explains many instances of "conflict." In "conflict" the hindrance to complete excitation is internal, consisting of previously acquired inhibitory reflexes. The discomfort comes not from the opposition of the two reflexes but from the fact that one of them is partially excited. There is no evidence that mere inhibition causes discomfort, but there is evidence that stress is caused by partial excitation of a system, and indeed the word "tantalize" expresses exactly this pure partial excitation. Whenever we have inhibition causing a conflict, there is always partial excitation. Introspection gives the cause of the unpleasant feeling as the fact of the inhibition, but this is only "rationalization." The stress is internal to one of the systems, not external to both.

Thus systems of interconnected conditioned reflexes are set up, the reaction to the combined stimuli of which constitutes the Freudian wish. The constituent reflexes come to condition each other as well as the joint reaction, and so, when some of them are excited and others not, the whole mass is thrown into a condition of stress. Hence the wish as the ordinary man understands it, which is a mild form of conflict.

The Tonal Manifold; with a Note on the Attribute of Brightness. R. M. OGDEN, Cornell University.

The paper describes a graphic representation of the tonal series

as it varies from the lowest to the highest audible tones. Each tone is pictured as having a certain volumic spread on the base line of the chart, thence rising to a peak which indicates its pitch-brightness. The height of the peak above the base line is measured by Wien's curve of inherent intensity, which denotes relative sensitivity for different degrees of vibrational frequency.

Within the musical range of tones volume decreases regularly with increase of vibrational frequency, while the variation of inherent intensity indicates our ability to discriminate pitch-brightness with approximately equal increments of vibration.

With the lowest tones the volumic spread is exaggerated and the pitch-salients are displaced from the center of the mass to indicate the fact that low tones sound higher than they should. With the highest tones, on the contrary, the volumic spread is progressively less than it should be and the pitch-salients are displaced in the opposite direction, indicating the tendency to judge high tones as flat and finally as lacking true tonal value.

The possibility of brightness as an independent variable is also discussed and further investigation of the transition from tone to vocable, by adding vibrational components which vary but slightly in frequency, is advocated. The indications are that the characteristic of a vocable rests upon a compound of closely graded components whose resultant sound, within limits, need not vary in pitch, intensity, or volume, but would manifestly vary in brightness, since the saliency of the pitch would be reduced or rounded off by the combined effect of closely graded vibrational frequencies.

Plethysmographic Studies of Physical and Mental Work. J. E. ANDERSON, Yale University.

Circulatory reactions in the arm were studied during periods of physical and mental work by means of a Lehmann arm plethysmograph connected with a piston recorder.

1. With subjects introspectively in good physical condition a one-minute test period of physical work (with the foot ergograph) was accompanied by a vaso-dilatation in 74 per cent. of the cases: with subjects in poor condition such a dilatation occurred in 47 per cent. of the cases.

2. The effect of a long fatiguing period of physical work was shown in an increased tendency to vaso-constriction in subsequent one-minute test periods. Similarly the later periods of mental work (during an hour of experimentation upon mental work) exhibited an increased tendency toward vaso-constriction.

3. A high percentage (approximately 75 per cent.) of all the records taken during mental work showed vaso-dilatations. There was some variation in the percentage of dilatations corresponding to each type of work. On one group of subjects the results were as follows: simple counting 65 per cent., reading 73 per cent., translating 75 per cent., continuous addition 77 per cent., memorizing poetry 80 per cent. and physical work 83 per cent.

4. Other results suggest a relationship between the difficulty of the mental work and the consistency of circulatory reaction during a five-minute period of work, *i.e.*, the persistence of a vaso-dilatation or a vaso-constriction without change throughout the period. Reading a newspaper article was accompanied by such a persistence of reaction in 11 per cent. of the cases, continuous addition in 40 per cent. and memorizing poetry in 60 per cent.

5. If the first period of work (physical or mental) is productive of a decided volume change (either a vaso-dilatation or a vaso-constriction) it is likely that all subsequent periods on the same day will show the same volume change.

6. The character of the volume change tends to be constant for any given individual: some subjects consistently gave vaso-dilatations, others consistently gave vaso-constrictions and still others equal percentages of vaso-dilatations and vaso-constrictions.

7. No correlation appeared between feeling tone and the direction of the volume change, *i.e.*, the percentages of vaso-dilatations for pleasant, unpleasant, and indifferent mental work are the same.

The Momentary Character of Ordinary Visual Stimuli. P. W. COBB,
Medical Research Laboratory.

Measurements of the visual threshold, made under conditions devised to represent extreme types of distribution of light met in practice, have not shown changes in visual sensitivity at all comparable with the changes expected from the testimony of those who have had to use the eyes under the practical lighting systems so typified. In the measurements the writer has in mind, the threshold was measured as the least difference in brightness between the two halves of a field, with an exposure-time of three seconds.

It would appear that the defect in the method consisted in the fact that in the ordinary use of the eyes stimulation is momentary and never prolonged. Aside from experimental situations such as just mentioned the eyes are only by way of exception

ever fixated or stationary in any state of attentiveness to visual stimuli. Researches upon the eye-movements executed in reading, for example, have shown that the fixational pauses are momentary. Further, in ordinary use, the stimulus is never of such diminutive spatial or photometric magnitude as is adequate for leisurely observation.

For the experimentalist the situation is helped by looking upon the retina as a physico-chemical reactor, undergoing continual change in the course of ordinary activity; and tending, under constant stimulation, toward a corresponding end-state at a rate greater the greater the remoteness of that end-state. Such an end-state is theoretically never reached, and is practically not even approximated. The result of threshold measurements made with prolonged fixation is an appraisal of sensitivity with respect to the end-state, while the result of threshold measurements made with momentary stimulation may be expected to be a measure of the lability of the retina under the conditions involved. This latter would seem to be a better representative of the sensitivity of the retina as a practical consideration.

Speculatively, undue fatigue of the eyes under a bad distribution of light might be explained by the hypothesis that the wonted fixational pauses of the individual have become relatively inadequate owing to a slowing of the retinal response and that the efforts at readjustment of the rhythm are irritating and fatiguing. There is a parallel in the effort required to adjust one's locomotor movements to a step much different in length or frequency from his own.

Intra-serial Expectation in the Method of Constant Stimuli. S. W. FERNBERGER, Clark University.

The present experiment was devised to discover if the order of the presentation of the series of stimuli in the method of constant stimuli has any effect upon the formation of the judgments. One might expect any of three possible results: 1, no effect; 2, physiological expectation, which would be bound up with the absolute impression of the stimuli, or 3, psychological expectation, bound up with the tendency of observers to reverse a preceding judgment.

We employed lifted weights as our stimuli with the usual three categories of judgment. We so arranged our experiment that two complete series of stimuli were mixed, and so the judgments for these two series were taken under similar conditions. In the first

series, our central stimuli (96 and 100 grams) immediately followed our heaviest stimuli (104 grams). In the second series, our central stimuli (96 and 100 grams) immediately followed our lightest stimuli (88 grams).

We found a marked and invariable psychological expectation—evident in a strong tendency toward reversal of the former judgment—for all of our four subjects. There was a marked tendency to judge the critical stimuli (96 and 100 grams) lighter when they immediately followed the 104 gram weights; and to judge them heavier when they immediately followed the 88 gram weights. This is evidenced by a rise in the point of subjective equality for the first series and a lowering of that point for the second series. The difference between these two points of subjective equality was, on the average for all of our subjects, about 2.5 grams—this value being well beyond the probable error. There was little difference in the size of the intervals of uncertainty for the two series—the average difference being well within the probable error. Progressive practice did not seem to have any marked effect on this factor of intra-serial expectation but, if anything, seemed slightly to increase its influence.

An Acuity Lantern and the Use of the Illumination Scale for the Detection of Small Errors in Refraction and Their Correction.
C. E. FERREE & G. RAND, Bryn Mawr College.

This apparatus was devised in response to a request by the Eye Division of the U. S. Naval Hospital for a means of making a quick and accurate test of acuity at low illuminations. Experience has shown, roughly speaking, that only 25–30 per cent. of the men on the battle-ships have a sufficiently keen acuity of vision at low illuminations to qualify for all branches of the look-out and signal service work. The apparatus provides for a wide range of illumination in just noticeably different steps (beginning at 0.07 meter-candle or lower), with no change in the color value of the light and with a specification at each step of the intensity of light falling on the test-object.

The apparatus has the following laboratory and clinic uses. (1) Photopic acuity may be tested under the conditions of a constant and uniform illumination of known intensity. In case the test-object is a line or chart of letters, provision is made that each letter receives equal amounts of light. (2) Scotopic or twilight vision may be tested—also the amount and rate of scotopic adaptation.

A precise and feasible means is thus afforded for testing the light sense insofar as it affects the power to see clearly. (3) The light sense may be tested directly in terms of the amount of light required to arouse just noticeable sensation. And (4) by making it possible to determine with great exactness the minimum illumination at which the test-object can just be discriminated, the apparatus provides a very sensitive means for detecting small errors in refraction and in their correction.

Insofar as the test-object is concerned, clearness of seeing depends upon the value of the visual angle subtended and the intensity of the illumination. It follows from this that either the illumination scale or the visual angle scale may be used for the detection of errors in refraction, *i.e.*, in the diagnostic procedure either the illumination may be held constant and the visual angle varied or the converse. Since the visual angle scale sustains a 1:1 relation to the acuity scale while acuity changes slowly with change of illumination, the illumination scale possesses the greater sensitivity for the detection of small errors in refraction—also greater ease and feasibility of contrivance and manipulation. Used in this way the illumination scale serves in effect as an amplified scale and has an advantage in sensitivity in proportion to the amplification. In clinic practice it has already been shown to be of great value in determining the exact amount and placement of the correction of astigmatisms.

The Influence of Expectation on Supraliminal Discrimination. L. R. GEISSLER, Clark University.

Several years ago the writer published results of experiments measuring the influence of expectation on the accuracy of sound-localization. In the present report the work was extended to judgments of supra-liminal differences of sound intensities and of visual extents. The difference limen for a soft and a loud standard sound intensity and for a short and a long standard visual extent (of 15 and 30 cm.) was determined for each observer in preliminary trials which served also the purpose of familiarizing him with the standards. In the main series twelve variable stimuli of each kind were used, three of which were smaller than the low standard, four greater than the low, but smaller than the high standard, three greater than the high standard, and two were equal to the standards. Each standard was compared equally often with each of the variables under the following three conditions: (a) Either standard was

given and the observer instructed to expect a variable similar to it in intensity or extent; (b) the standard was not actually given but merely announced and the observer instructed to expect a variable like it, as vividly as possible; (c) the variables were given without previous mention of a standard and the observer instructed to compare their intensity or length with his memory images of either of the two standards. The judgments were expressed on the basis of prearranged scales.

In order to control in an objective or behavioristic way the expectant attitude, a "conditioned habit" (analogous to a "conditioned reflex") was set up during the sound-experiments by the use of the involuntary arm-tremors recorded by the Titchener automograph. In the visual experiments the behavioristic control was attempted by placing the hands during the expectation-period at distances apart equal to either standard expected.

The influence of expectation manifests itself in general thus: the intensity or extent of a variable stimulus is the more over- or underestimated, the more it differs from the previously expected standard; the tendencies to err are always in the direction of the expected standard and thus lead to a decrease of the interval between the two stimuli compared. The error tendency is larger when the standards to be expected are also previously given in perception than when they are merely imaginably anticipated. The probable explanation of these phenomena lies presumably in the definite muscular set involved in the expectant attitude, which interferes with the proper neuro-muscular readiness to receive the new stimulus.

Psychological Effects of Deprivation of Oxygen as Indicated by a New Substitution-Test. H. M. JOHNSON & F. C. PASCHAL, Air Service Medical Research Laboratory.

The following work was begun with two purposes in view: (1) To indicate, independently of the experimenter's personal judgment, the extent and rate of deterioration of behavior under a diminishing supply of oxygen; and (2) to ascertain whether the higher processes tend to deteriorate before, after or simultaneously with, the simpler processes. The experiment failed of the first objective but contributed somewhat toward the attainment of the second.

Thirty highly selected subjects were successfully used, all but three being aviators whose training had been completed and who

were awaiting discharge at the port of debarkation. A considerable number had been engaged in combat service in the A. E. F.

Deprivation of oxygen was accomplished by the use of the Henderson rebreathing apparatus as originally constructed, or as modified by Rogers. In the latter form, the apparatus permitted control, within reasonable limits, of the rate of diminution of the oxygen supply.

The work assigned the subject was the transliteration of a number of sets of nonsense material into different ciphers. The sets of material and also the sets of ciphers were developed with a view to uniform distribution of difficulty and the results showed that the attempt was successful. The effects of practice was stabilized by the transliteration of three to six sets, before deprivation of oxygen began. The measure of performance is the number of letters correctly enciphered per unit of time. The subject is so informed.

While large individual differences appear, there is a definite tendency toward a steady improvement from practice until a moderate degree of diminution of oxygen has been reached. At this stage a definite loss of speed or accuracy, or of both, is usually evident; but it may be followed by a marked increase in effort, which compensates partially or entirely for the impairment so far sustained. As deprivation proceeds still farther, compensation ceases to be adequate, and eventually integrated responses fail. The results of this experiment are by no means conclusive, but they suggest that responses tend to deteriorate in the order of the degree of coördination which they involve.

The Physical Measurement and Specification of Color. L. A. JONES & P. REEVES, Eastman Kodak Company.

The paper deals with the physical methods by which those properties of radiant energy which determine the resulting color are measured and specified.

The first method, analytical in nature, specifies the quality of radiation by giving the relative intensity at each wavelength throughout the visible spectrum. The results are plotted graphically and give a spectrophotometric curve. This method gives the exact physical composition of the radiation in question but provides no direct specification of the subjective factors.

In a second method, which is synthetic, the specification is made directly in terms of the three subjective factors, viz., hue, saturation and intensity. Such measurements are made by means

of a colorimeter, the action of which is based upon the fact that any color can be matched by a mixture in proper proportions of monochromatic light with white light. The hue factor is specified in terms of the "wave-length of the dominant hue," and the saturation factor in terms of "per cent. white." Intensity is measured by means of some suitable photometer which may or may not be an integral part of the colorimeter. In case of reflecting surfaces, the intensity factor is specified in terms of reflecting power, transmitting media by the total transmission and in the case of emitting sources by the intensity of the source.

A third method, partly analytical and partly synthetical, specifies a color by giving the relative intensities of some arbitrary red, green and blue which when mixed together match the unknown. Types of colorimeters and color comparators are discussed.

The paper aims to present a general outline of the subject and to emphasize the importance of a precise measurement of the various factors necessary for a complete specification of color.

A Pursuit Pendulum. W. R. MILES, Carnegie Nutrition Laboratory.

From psychological data collected on aviation candidates at the Nutrition Laboratory in 1917, it was learned that the accuracy of ocular pursuit movements in following a swinging pendulum correlated fairly well (+ .40) with the subsequent progress of the men in learning to fly. The Dodge photographic technique for recording such ocular movements appeared to certain government advisors as too complex for adoption at aviation fields. To meet this objection a very simple apparatus has been arranged which gives an immediate and quantitative score for the accuracy of the eye-hand pursuit coordination.

In this device a pendulum carrying a reservoir is arranged to swing over a sink or table, a small stream of water flowing from the lower extremity as the pendulum swings. The individual under test, seated before the sink, attempts to collect the water in a cup of limited diameter. A separate cup is used for each double swing of the pendulum and the volume of liquid collected in each cup is measured. A double swing in this particular apparatus requires 2 seconds, and 50 c.c. of liquid are expelled. The release is by the fall of a small hammer visible to the subject. The device is its own chronometer and has no electrical features. Other more complicated apparatus of a similar nature are suggested.

As a performance test the catching of the liquid challenges the interest of most subjects. Results are presented for a group of 18 adults who made 20 catches per day on 35 days. On the first day individual averages range in performance from 16 to 57 per cent. with a total average of 30 per cent. On the last day performance ranges from 62 to 90 per cent. with a total average of 75 per cent.

The Comparative Influence of Majority and Expert Opinion. H. T. MOORE, Dartmouth College.

The writer describes a group experiment in social psychology the purpose of which was to measure the influence of majority and expert opinion on affective responses. This influence was measured in terms of reversals of judgment made in agreement with the majority and with the expert. Paired comparisons dealing with linguistic, ethical and musical judgments supplied the first data. The material used was 18 pairs of instances of bad English speech, 18 pairs of ethical situations, and 18 pairs of resolutions of the dominant seventh chord, played on an organ.

At a second trial the same paired comparisons were repeated, preceded in each case by the announcement of the majority preference. A third trial was conducted similarly, this time with the announcement of expert opinion regarding each pair. Comparison of the records of the three trials showed what per cent. of chances to reverse judgment in agreement with majority or expert opinion had been accepted by each individual in the three fields of language, morals, and music.

As a check experiment another group was given the same series of comparisons on two separate occasions, and without any special influence during the second trial. This made it possible to estimate the chance factor in the reversals of the above judgments.

The results indicate that the probability of reversing judgment in matters of speech agreeable to majority opinion is 5.3 times mere chance; whereas the tendency toward reversal in agreement with the expert in this field is 4.1 times chance. Moral reversals under majority influence are 4.7 times chance; similar reversals of musical preference are only 1.9 times chance. In these last two fields majority and expert influence are almost equally effective.

Some Notes on Early Imaginative Behavior of Children. G. C. MYERS, Camp Upton.

Samples from elaborate notes on the writer's two children were

given in reference to their imaginative behavior with emphasis upon the influence of definite early experiences, and of stories read to them as early as the sixteenth month.

Analysis of these notes seem to emphasize the following: (1) That nothing can happen in the child's experience without affecting in some way his subsequent behavior. (2) That children symbolize and dramatize naturally (without being taught); (3) That symbolism is the fundamental means of childhood play and hence of childhood joy; (4) That probably the most pronounced kind of joy in childhood is the joy in awareness of creation; (5) That fairy tales and other imaginative stories, devoid of fear appeals, are indispensable to a normal happy childhood; (6) That the imaginative behavior of children reveal often their strongest wishes, as well as their most subtle motives; (7) That to appreciate any child so as best to guide his conduct, the parent, nurse, and teacher, must have a clear, detailed and comprehensive conception of the way that child's imagination works.

A Comparison of Motor Tests With Estimates of Character, Mental Test Scores, and University Grades. F. A. C. PERRIN, University of Texas.

The investigation reported in this paper had for its object the analysis of motor ability. The data upon which the analysis is based include; (1) the scores of three complex motor tests—the Bogardus Fatigue test, card sorting, and a coördination test; (2) systematic observations of the subjects during the testing; (3) the scores of fourteen tests of elementary motor functions, such as rhythm, balancing, motor memory, inhibition, aiming; (4) estimates of certain traits of character observed during the testing; furnished, however, by judges who were not witnesses of the test performances; (5) mental test scores; (6) university grades. An intensive study was made of a group of 51 adult subjects.

Among the conclusions formed may be mentioned the following: (1) Motor ability is not general, but definitely specialized. The scores of the different tests fail to show correlations; in fact, the largest coefficient of correlation obtained was negative. (2) A complex motor performance is not to be explained primarily in terms of a number of specific motor functions. While it is true that the Bogardus test involves accuracy, rhythm, and speed, the correlations between ability in this performance and in these functions are too small to justify such an assumption. (3) In addition

to these specific motor functions, a few others may be described, such as degree of ambidexterity, fine coördinations as contrasted with gross adjustments. But these cannot be established as general explanatory principles. (4) The type of intelligence measured by mental tests and by university grades fails to correlate in any significant way with any of the motor tests. But at the same time, factors best described as intelligence factors contribute primarily to superior ability in complex motor tests. These tasks must be regarded as learning reactions; and, although the intelligence elements function in these reactions, they do so largely in an unconscious manner. (5) The assumption that there are general traits of character which can be used as explanatory principles in the analysis of motor ability is justified only in part. *Poise* seems to be fairly general, and operative in motor achievement as well as in social adjustment. *Determination* is a variable and unpredictable trait. (6) Emotional factors are difficult to evaluate, but in general their effects are secondary. Blood pressure records fail to indicate emotional disturbances. Inferiority complexes not only appear during the attempts of the subjects to master difficult motor tasks, but seem to function in a variety of ways.

The Psychology of Belief. A. A. ROBACK, Harvard University.

The purpose of this experiment was (a) to discover the psychological factors inducing the attitude of belief, and (b) to study the effect of repetition on this attitude.

Passages from the most diverse authors covering the scholastic discourses of St. Anselm, the picturesque dogmatism of St. Thomas Aquinas, the visionary doctrines of Swedenborg, the paradoxical utterances of Nietzsche, the tenets of Christian Science, the political issues of the day, etc.—were presented anonymously for short periods to seven subjects and their introspection recorded in regard to their attitude of belief, its antecedents and sensori-motor concomitants. The schematic scale of belief judgments consisted of (a) *absurd*, (b) *credible*, (c) *acceptable*, (d) *convincing*. The demand for another class on the part of the subjects necessitated the inclusion of non-acceptability as the content of an attitude intermediate between those calling forth respectively the judgments of credibility and absurdity.

The results showed that belief depends on the *congruity of the imagery induced by the passages with the memory images of a similar situation actually experienced*. The rational element in belief has

apparently been much overestimated in the literature judging from the fact that the judgments in the vast majority of cases were induced by imagery and emotional sets. At times an absurd or non-acceptable idea couched in quaint language would be judged credible by way of compromise. The logical attitude giving way to the aesthetic appreciation of a passage is one of the most interesting results in this connection. In many cases the judgment was given before the idea of the passage was justly grasped.

Familiarity is an asset in bringing on the attitude of belief. Repetition serves to modify the original attitude in the opposite direction. Convincing passages become less so, while absurd passages take on a credible aspect. This paradoxical change is due to the shifting view-point of the subject, who interprets a literal passage figuratively and a figurative passage literally as his tendency to ward off monotony increases.

On the psychophysical side, acceptance is characterized by a tingling in the chest and feeling of well-being; rejection, on the other hand, is marked by tenseness, contraction in the throat and chest, checking of respiration and sometimes kinaesthesia in opposite directions.

Three Experiments in Retroactive Inhibition. E. S. ROBINSON, Yale University.

1. In the first experiment the test material consisted of series of four-place numbers, eight numbers to the series. The interpolated material was of five kinds: (*A*) series of four-place numbers similar to the test series, (*B*) series of consonants, (*C*) passages of descriptive poetry, (*D*) multiplication problems, (*E*) passages of simple narrative prose. (*A*), (*B*) and (*C*) were memorized; (*D*) and (*E*) were not. Recall of the test material took place immediately after the interpolated period which was constant in length however filled.

In terms of amount, accuracy and time of recall there is a decided inhibition for condition (*A*), *i.e.*, where interpolation and test activities are very similar. There is no such decisive evidence for inhibition for any of the other conditions.

2. In the second experiment the test material consisted of series of three-place numbers displayed four, six, eight, ten or twelve times. Memorizing the test material was followed by a constant interpolated period which was filled with the memorizing of a second series of numbers (always displayed eight times) or with reading, with no attempt to memorize, in a daily newspaper.

Curves were plotted showing amount, accuracy and time of recall for various degrees of learning where (1) memorizing numbers and (2) newspaper reading were interpolated. These curves show that memorizing a similar material causes retroactive inhibition as compared with reading dissimilar material. This inhibition is present for all the degrees of learning examined and is on the whole constant in absolute amount. There is some evidence, however, that, measured in absolute terms, there is less inhibition for series presented eight times than for those presented four or twelve times.

3. In the third experiment the test material consisted of three place numbers displayed eight times. The interpolated material consisted of similar series also displayed eight times. The period between memorizing the first series and its recall was twenty minutes in length. The interpolated memorizing, which took five minutes, was placed in the first, second, third or fourth five minutes following the test memorizing.

There is a pronounced inhibition caused by the interpolated memorizing and the amount of this inhibition is practically constant for all temporal positions of the interpolated memorizing. There is a slight possibility, however, of less inhibition where the interpolated memorizing occupies one of the mid periods.

Wave-Phase in the Open-Ear Localization of Sound. C. E. SEASHORE,
University of Iowa.

1. Demonstration of the localization of sound by wave phase in open-air conduction.

2. Some laws of the movement of this phantom sound with reference to synchronism, distance, pitch, intensity, timbre, and direction of the two courses.

3. The empirical curve of intensity in a series of standing waves.

4. Wave phase localization interpreted in terms of intensity.

An Entoptic Phenomenon Demonstrating the Optic Impulse. L. T. TROLAND, Harvard University.

When a spot of light of appropriate area is thrown upon the retina in the general region of the yellow spot, bands of luminosity can often be seen which connect the stimulus spot with the vicinity of the blind spot. A study of the course of these bands for different shapes and locations of the stimulus spot, in comparison with the histology of the nerve fiber layer of the retina indicates that they

are due to secondary stimulation of retinal fibers by the impulses passing along other adjacent fibers. The present paper will give the results of observations on the phenomenon with fifteen spectral colors distributed at intervals of $20\text{ }\mu\mu$ over the spectrum. Measurements of the threshold of the phenomenon with respect to intensity indicate that this is in the neighborhood of one photon, and that there is a distinct minimum in the middle of the spectrum, the curve for the effect corresponding roughly with a reciprocal of the visibility curve. The laws of adaptation and the color effects of the phenomenon will also be reported upon, and theoretical implications of the results will be developed.

The Competitive Factor in Reactions to Choice. A. P. WEISS, Ohio State University.

A short telephone buzz was the stimulus for pressing a key with the index finger of the right hand; a flash of light the stimulus for pressing another key with the second finger; for both sound and light, both keys were depressed. When the reactions exceeded 300 sigma, a flash of red light indicated to the subject that his reactions were "slow." The stimuli were presented in variable order and at variable intervals. The reactions were automatically recorded and this record indicated both speed and accuracy. The competitive factor was introduced by having each subject score his own record and also check over the scores of each of the other subjects. This scoring activity was observed and analyzed.

The experimental situation was thus made up of two factors: (1) the sound light stimuli that released the finger movements; (2) the stimuli from handling the records that released the scoring movements. Only the effects of the second, the competitive situation will be considered.

At first the handling of the records was accompanied by: energetic verbal reactions to the various scores; actual finger movements demonstrating, "How to make a good score," or "How to beat the machine"; verbal resolves to excel on the next series; prolonged discussion of the records. These reactions, which represent the competitive situation, may be regarded as *excess* movements that accompany the actual scoring activity of counting and checking. These *excess* movements retard the development of speed and accuracy in scoring, but prolong the finger reactions and increase the tonicity of those muscles that accommodate the subject better for the sound and light stimuli. As the energetic

verbal discussion and prolonged finger reactions disappeared, speed and accuracy for scoring improved, but the speed and accuracy for the finger reactions approached a level. The effect of competition in this experiment may therefore be regarded as manifesting itself in two ways; (1) by prolonging the time during which the subject reacts, both overtly and incipiently, to the stimuli that release the finger reactions; (2) by keeping the tonicity of a specific group of muscles, (finger-eye-ear accommodation) at a higher level. In other words, the competitive situation is the equivalent of additional practice.

INTELLIGENCE TESTS

Some Group Tests. W. V. BINGHAM, Carnegie Institute of Technology.

A spiral omnibus intelligence test blank is shown which the Bureau of Personnel Research has prepared by combining in a single time-limit test the various parts of Army Alpha. Like other omnibus tests it differs from other forms of group intelligence test in demanding more rapid and repeated readjustments of mental set. It is a "*spiral omnibus*" test because of the progressively increasing difficulty of the unit task as each form of task recurs. It is convenient to administer, requiring no oral directions by the examiner. Its relative reliability as compared with Army Alpha or the Thurstone cycle-omnibus test has not yet been adequately measured.

Current editions of Thurstone's tests are exhibited, including the *cycle-omnibus* intelligence test for use with college students and high school seniors, a set of engineering ability tests, and two general clerical tests. The engineering ability tests have been used this year with ten thousand entering students in forty-seven engineering colleges. The cycle-omnibus intelligence test has been given to 24,000 entering students. It is the plan to check the performance in these tests against achievement in the college course as shown by student marks and instructor's estimates.

These test blanks are not for general circulation, but educational authorities who may be contemplating the use of mental test methods may obtain samples by correspondence with L. L. Thurstone, Carnegie Institute of Technology, Pittsburgh. It is particularly desired to obtain additional norms of seniors in Manual Training and Technical High Schools.

Intelligence Tests at Brown University. S. S. COLVIN, Brown University.

During the academic year 1918-19, two sets of psychological tests were given to all first-year men. One set, designated the Brown University Tests, was given early in the year and later the Alpha Army Tests were given. The Brown University Tests, and to a less degree the Army Tests, proved of diagnostic and of prognostic value. By means of these tests it was found possible to judge with considerable accuracy in regard to a student's mental capacity and his probable success in college work. The Brown Tests, in particular, gave a very fair indication of the student's probable scholastic attainment, the correlation (Pearson) between the results of this test and standing in college for the first two terms being .60.

At the opening of the present year, the Thorndike Comprehensive Tests were given to about 300 first-year men, and later, the Brown University Tests were given to these same students. The Thorndike Tests, as well as the Brown Tests, gave distribution conforming with great exactness to the normal frequency curve, clearly indicating that the abilities tested were satisfactorily measured. There was a close agreement between the results of the Thorndike Tests and the Brown University Tests, indicating that the two measure approximately the same kind of abilities.

The results so far obtained give reason to believe that these tests are of considerable value in determining the ability of men to do college work, and in advising them in regard to the problems connected with their study and their plans for future careers.

The Average Mental Age of Adults. E. A. DOLL, Princeton University.

The median letter-grade of army recruits proved to be low C. The Stanford Binet mental age equivalent of low C is thirteen years. Hence the median mental age of unselected adult males is thirteen years. The median mental age of negro and foreign-born recruits is found to be only ten years. One thousand adult male state prisoners examined with Alpha register a median mental age equivalent to thirteen years (allowance being made for nationality and color). Five hundred typical public school children examined with Alpha show no increase in median scores by age after thirteen years. Five hundred delinquent boys show no increase in median Alpha score after year thirteen. Six hundred

reformatory inmates, young men between sixteen and thirty, register a median equivalent mental age of thirteen years in Alpha. In the army group, in the state prison group, in the state reformatory group, and in the public school and juvenile delinquent groups after thirteen years of age, there is no significant correlation between increase of Alpha score and increase of age.

These facts induce the hypothesis that the average mental age level of native white adults is approximately thirteen years. No attempt is made to determine the life age limit of mental age growth of individuals. It is necessary to make a distinction between mental age level and total intellect. It is improbable that mental development as a whole is complete at thirteen years, either for individuals or on the average. Emotional development, maturity, skill, acquisitions, aptitudes, and the like probably continue to develop indefinitely.

Clinical psychology is obliged to revise its differentiating mental age standards. It is doubtful if sixteen years should be used as the upper life age limit in calculating intelligence quotients. The upper mental age limit of feeble-mindedness is not coincident with the lower mental age limit of normality.

Allowance must be made for nationality and color in employing mental age for mental diagnosis. Hence the contention that "all who test below mental age twelve or I. Q. 70 are feeble-minded" is seen as a fallacy both logical and experimental. Recent experiences and new data indicate a necessity for extending the concept of a borderline zone of feeble-mindedness to cover a range from mental age seven to mental age thirteen. The application of mental age as a differentiating criterion of mental defect and mental subnormality is specifically limited in the clinical mental diagnosis of persons over ten years of age.

Measurement of Intelligence in Schools for the Blind. S. P. HAYES,
Mount Holyoke College.

It has been found possible to use the Binet tests in measuring the intelligence of the blind, only minor changes in the tests being necessitated by the lack of vision. About 1,000 pupils with varying deficiencies in vision have now been tested. The curve of distribution of intelligence quotients takes the normal form, though the per cent. of low-grade pupils is much too high.

A modification of the Pressey group point scale has also been used in three schools for the blind and the results show a similar

distribution to that obtained by the Binet test, and a high correlation with the Binet scores and with estimates of ability by the teachers.

Plans have been made for a mental survey of eight schools for the blind in the east this winter, in which extended tests of attainment in school subjects will be given along with tests of intelligence.

Three-Dimension Models for Symbolizing Abilities J. B. MINER,
Carnegie Institute of Technology.

A method for representing individual differences in abilities is suggested. It permits of symbolizing the proportional combination of tested abilities to be found in a complex ability. The model for representing an ability, say salesmanship, as distributed among different individuals within society is to be distinguished from the model representing that ability within one individual. The purpose is to supplement the usual representation of the relations of abilities through frequency surfaces, correlation tables or surfaces. It utilizes a third dimension for relations not now taken care of which are measurable in terms of multiple regression equations, etc. By models and diagrams some possibilities of this method are shown in order to stimulate further thought in this field.

The Evaluation of School Attainment in Terms of Mental Ability.
R. PINTNER, Ohio State University.

So far little has been done to coördinate mental and educational tests, and use them for a more accurate diagnosis of the school child. A mental test alone is not sufficient to place a child accurately. We need a measure of his school attainment, and the norms for school work should be based upon age as well as grade. Concretely the problem is: given a child of a certain age and a known mentality, what ought to be his attainment in the ordinary school subjects. The writer has devised two survey tests, one mental and the other educational, to be used together for this purpose.

The standardization is based only upon the children who have taken both tests, and is an age standardization. So far over 1,500 cases have been tested. Because the difference between two percentiles varies greatly in amount at different parts of a distribution, all percentiles have been converted into a so-called index which is equivalent to the sigma value of the percentage rating.

These indices range from zero to one hundred, and have been chosen instead of the sigma values themselves in order to make the procedure simpler for general use in the schools.

Differences between indices are now comparable at any part of the distribution and it is these differences that are significant. In a survey of a school system the median indices, mental and educational, serve as a measure for the school. If the difference between these two indices is small, then the school is accomplishing what can be legitimately demanded of it, and this regardless of the fact that the indices themselves may be high or low. A high mental along with a high educational index indicates children of good mentality accomplishing school work worthy of their capacity. A low mental with a low educational index indicates children of poor mental caliber accomplishing what is suited to their ability. A difference between the indices of more than ten points would seem to denote abnormal conditions. A high negative difference (educational minus mental) indicates good mentality accomplishing poor work and raises the question of the efficiency of the teachers, methods and administration. A high positive difference indicates that the school is accomplishing better results than are ordinarily obtained with children of its mental caliber.

In the same way we may analyse and compare different classes in the same school and also different children in the same class. A better understanding of the educational needs of the child can be made by this combined educational and mental measurement than by a mental test alone. It shows up at once the children of good mentality who are doing school work below their capacity, even although it may be excellent work for the grade they happen to be in. These measurements bring into prominent relief the fallacy of expecting children of different mental ability to do the same educational work, and at the same time suggest where and how a better adjustment is to be made.

Some Recent Work in Mental Tests for College Students. L. L. THURSTONE, Carnegie Institute of Technology.

The Society for the Promotion of Engineering Education is conducting a coöperative investigation of intelligence tests and other objective tests as possible criteria of admission. Six tests have been given to about ten thousand freshmen in forty-seven coöperating colleges. The Pennsylvania State Educational Association is also trying our intelligence examination in thirty-

seven coöperating colleges and normal schools within the state of Pennsylvania. Several other large colleges are giving these intelligence examinations to their entire freshman classes.

At Carnegie Institute we have experimented with about fifty different intelligence tests during the last five years in order to ascertain the diagnostic value of each test as determined by student scholarship and pooled faculty opinion. Some of our mental test work is labeled *service* and the rest of it is labeled *research*. For several reasons we find it essential to keep these two objectives quite distinct. Mental test service at the Carnegie Institute was first in the form of advice to the faculty committees on scholarship of delinquent students. Later it developed that we could be of service in advising the deans about the admission of mature students to professional and vocational courses who did not happen to satisfy the regular entrance requirements. We have been fortunate in that the students so admitted have been retained with good scholastic standing and this in turn has increased the confidence in intelligence examinations on the part of the faculties and administrative officials of the institute. The next step toward official recognition was made when we were requested to give an intelligence examination to every day student of the institute. Now that the results have been further verified it has been decided by the committee on admissions that every student who takes any entrance examination either in June or September in Pittsburgh or in any other locality will also be required to take an intelligence examination. This intelligence examination is prepared by the division of psychology and is so arranged that it can be sent to the high-school principal who conducts the other entrance examinations. This does not apply to the applicants who enter by certificate and who do not take any entrance examinations. It applies only to those who are required to take some entrance examinations in which case a compulsory intelligence test is added. The intelligence test that we use for the purpose just outlined is our Psychological Examination, Test IV, which is a sixteen-page pamphlet in the cycle-omnibus form.

Ability in Mental Tests in Relation to Reading Ability. L. W. WEBB, Northwestern University.

This study is an endeavor to discover the significance one's reading ability has in relation to one's general intelligence such as is employed when taking a group intelligence test.

The subjects in this study were ninety students in one of the writer's classes in psychology. Men and women were in about equal proportion in the group. The Alpha Test was first given to the class; about two weeks later two tests devised by Thurstone, called A and B were used; these were given on succeeding days. A week later the Monroe Silent Reading Test for High-School Students was used; the time was $3\frac{1}{2}$ minutes instead of the usual 5. This test has a score for both rate and comprehension.

The correlation values by the Pearson method were computed for rate of reading and the three tests; this was also done for the combined score of A and B. The values were worked out for comprehension. The correlation between rate and comprehension in reading is .85. This indicates that for our purpose rapidity of comprehension is the more important consideration. For rate of reading the values range from .47 to .59 while the same values for comprehension range from .48 to .69.

We believe that we are justified in making the following conclusion from the above data. Rapidity of comprehension in reading is one of the large factors in determining the grade one makes in a pencil and paper group intelligence test. The fairly high positive correlation values existing in this relation and the consistency with which they occur support this conclusion.

One or two additional suggestions are made. The premium on rapidity of comprehension in our intelligence tests may be one of the significant causes of low correlations so often reported between intelligence tests and scholarship grades. This needs further study. A difficult reading test might be of value in intelligence testing. Our schools should do a better task in teaching rapidity of comprehension in reading, recognizing that this ability is probably limited by the student's intellectual capacity.

Superior I. Q. in Mental Breakdown. F. L. WELLS, McLean Hospital.

Median I. Q. (adult) in 102 consecutive Stanford scale examinations of McLean Hospital patients is 88. This is entirely compatible with normal self-maintenance. I. Q. over 100 is frequent, and as high as 119 has been observed in adults conspicuously incapable of self-maintenance. Only in the organic psychoses does the breakdown regularly involve the ideational capacities with which the intelligence scales are concerned. Normal and superior "intelligence" is very generally associated with grave judgment and

conduct disorder. Above a necessary minimum, the value of intelligence for general adaptation depends greatly upon the support of other factors in the personality, somewhat as a boxer's technical skill must be supported by courage and physique. Intelligence scales measure essentially ability to deal with *ideas*, as distinct from ability to deal with *things*, or with other *persons*. Psychotic breakdowns are essentially failures of adjustment to the social environment. The present experience emphasizes the minor rôle of "intelligence" (ideational capacity) in mental balance, and supports the conception of education as a discipline of character rather than of knowledge.

A Study of the Intelligence of 250 Delinquent Girls. E. L. Woods, Wisconsin State Department of Public Instruction.

This paper presents the results of a study of 250 delinquent girls in the Wisconsin Industrial School for Girls, by means of group and of individual tests.

Certain facts of training, of heredity and of home and social conditions were also ascertained in an attempt to see what, if any, correlation there might be between: (1) test results and amount of schooling; (2) test results and normal versus abnormal home conditions.

The group tests used were the recently devised Virginia tests Alpha 1. These have been used on several thousand school children in typical cities of the United States and age and grade norms established. The individuals showing marked variation from the average of the group were also tested with the Binet scale.

The charts will show: 1. A comparison by school grades between the delinquent group and an unselected group of school children in group test achievement; 2. A comparison by ages between the delinquent group and the unselected group in group test achievement; 3. The relation between amount of school training and accomplishment on the group tests both for the delinquent and for the unselected group; 4. The relation of group test achievement to mental maturity as rated by standard individual tests; 5. Correlations between various tests in the Alpha 1 group (as, for example, the Devens literacy, the unfinished pictures, and the like) and mental maturity.

The paper draws certain conclusions with regard to the usefulness of group tests both in institutions for delinquents and in school groups.

ABNORMAL PSYCHOLOGY

Variations in Mental Equipment not indicated by an Intelligence Ratio. A. F. BRONNER, Judge Baker Foundation.

Earlier psychology tended to emphasize the multiplicity of mental processes, their differentiation from each other and their functioning in simple and complex combinations. Psychologists, it would seem, should be the last to endorse the thesis that by the study of merely a few mental processes or of a few complex activities on the basis of brief group testing or in terms of a numerical rating of "general ability" practical adjustments, educational, vocational, and social, can be satisfactorily made.

Group testing has very specific values; it has also distinct limitations; many of the individual's most important reactions are lost altogether. But also an "intelligence" quotient or coefficient is, in a sense, group testing; if used only in quantitative terms it is a statement of an individual's "ability" as a group-rating. It enables comparative studies of groups and investigation of the make-up of any one group. However, it does not afford opportunity for knowing or stating the variabilities of any one individual in the group. It represents no analytical interpretation, no adequate study of the individual himself.

The function of clinical psychology is largely that of individual diagnosis, inevitably involving the problems of individual adjustments. The solution of these problems cannot be revealed by a numerical figure, or by a general statement of an individual's rating in a group even in terms of his variation from a central tendency that may have been established for his age, sex and social group. Solutions involve intensive and accurate study of abilities and disabilities as they are related to the problem at hand.

Extremely varied special problems are presented to the clinical psychologist; these require special study by means of special tests, unless we hold the brief that there is such a high correlation between all mental abilities that the findings on any test or set of tests are therefore valid for all mental processes.

The criterion of the value of a test is not its correlation with an I. Q. or some other test or system of tests. The criterion is the reliability of the test itself and its practical value as diagnostic of abilities required in practical accomplishment.

The analysis and interpretation of test findings is the second great requirement of the clinical psychologist. Illustrative problems and findings are included.

Hemi-Hypertrophy in Relation to Mental Defect. A. GESELL,
Yale University.

Hemi-hypertrophy is a rare but a significant anomaly of development. It is a congenital abnormality which consists in a unilateral overgrowth of one half of the body.

The paper includes: a description of a moron exhibiting this abnormality, studied by the author in 1914 and in 1919, a review of the medical literature and an analysis of the cases to discover the relation of hemi-hypertrophy to mental deficiency, a discussion of possible relations to twinning, physiological age, cranial asymmetry, cerebral sclerosis, and hypertrophic amentia, and the clinical significance of physical asymmetry.

The Psychology of Functional Neuroses. H. L. HOLLINGWORTH,
Columbia University.

The psychoneurotic picture is essentially that of a redintegrative reaction,—a portion of an original stimulus or situation redintegrates the total response previously given to the original situation. The redintegrative reaction, however, is common also to normal perception, to infantile thinking and to primitive magic, and the psychoneurotic make-up must be distinguished from these conditions. The distinction is to be made on the basis of *sagacity*, which along with *learning*, constitute intelligence. Sagacity consists in the ability to single out the significant detail, instead of reacting to any chance item. Redintegration may take place on a cortical level, in which case it constitutes ordinary understanding, thought, or perception of meaning, and is a normal process. Or it may take place on a postural level, in which case the picture of conversion hysteria results. Or it may take place on the autonomic level, thus giving rise to the anxiety neurosis. If cortical redintegration takes place, the postural and autonomic responses may be determined by the total pattern and are not redintegrative. Cortical immaturity or weakness would mean greater redintegrative predisposition on the other two levels. Since the postural level is more closely connected with the cortical level than is the autonomic, intellectual inferiority would predispose one more definitely toward conversion hysteria than toward the anxiety type. Measurement of psychoneurotic soldiers shows that not only are they in general intellectually inferior, but also that the conversion forms represent a lower intelligence level than do the anxiety forms. A measurement of the influence of motivation is also presented.

Most of the "mechanisms" of psychoanalysis are reducible to the concept of redintegrative response, as are also various other notions of hysteria.

The Psychological Detection of Syphilis. F. MATEER, Bureau of Juvenile Research.

This is merely a brief attempt to demonstrate the possibilities of present-day clinical psychology when the accepted methods are used for the analysis of qualitative and functional indications instead of serving merely the discovery of a mental level. In the Bureau the ascertainment of mental age is merely a preliminary, although a necessary, step in the diagnosis of a case. Mental age and I. Q. are not sufficient data upon which to base diagnoses but need qualitative interpretation.

Our study so far shows three things which give significant contributions to the knowledge of a case from its functional or qualitative side. These are: (1) The range of distribution of pluses and minuses from highest ability to lowest failure, (2) The relative distribution of successes and failures, (3) The quality of each response, be it creditable or not. It is the use of these three criteria which differentiates the psychopathic individual from the non-psychopathic, be he of normal mental age, a moron, idiot or genius, so-called. In the past year's work our attempts at qualitative analysis have led us farther. They have shown us the differentiation of various groups of psychopaths. One of these groups, with a typical distribution, is that of the syphilitic, be he congenital or primary in type. To a surprising degree this distribution seems to be pathognomonic. For seven months we have been testing out these findings and re-evaluating former cases in the light of them. Data are available on over seventy syphilitics, representing about twenty per cent. of the cases which have been studied intensively from the psychological and medical laboratories.

The syphilitic distribution shows that syphilis is a selective agent and its selection means a definite reduction of certain test functions. These are distinctive enough to render possible a diagnosis of syphilis before laboratory findings are available. Even when he tests at a feeble-minded level the syphilitic is a psychopathic deteriorate. He looks like a feeble-minded person but he is different. The psychopathy may be modified by the low level of deterioration. The congenital syphilitic becomes delinquent in a larger per cent. of the cases than the non-syphilitic of similar

mental level. His delinquencies form a syndrome as distinct and pathognomonic as his distribution on tests.

The Clinical Psychologist. D. MITCHELL, Pelman Institute.

Clinical psychology deals with individuals but it may follow group experimentation and classification. Diagnosis, prognosis, and therapeutic treatment are the main features.

Clinical psychology is not synonymous with applied psychology, nor is the field of clinical psychology coterminous with the field of applied psychology. Psychology may be applied in the fields of advertising, salesmanship, or law, but in those fields it may have no relation to an individual, whereas in the clinical field individual examination, diagnosis, and prescription are the chief functions.

The psychology of the laboratory is frequently individual but its aim is different. The determinations of standards of present position, of rate of learning, of differences in groups, and so on, are made frequently by individual laboratory experimentation but it is with the notion of developing scientific knowledge rather than helping the subjects.

In other words, the psychology of the laboratory is a science while clinical psychology is a professional practice. Among the problems with which it may deal are; the determination of mental status in order to prescribe kinds and methods of education, the ascertainment of specific abilities or disabilities which may be aids or handicaps in following some particular vocation, and the emotional and instinctive factors which may militate against, or assist in the development of desirable social reactions.

The Phenomena and Mechanisms of Mental Conflicts involving Sub-conscious Processes. M. PRINCE, Boston, Mass.

Mental conflicts as interpretations of behavior are ordinarily inferred from known mental antecedents. Further, generally one, at least, of the conflicting factors has to be inferred as a sub-conscious process. The resulting behavior becomes an interpretation of the inferred conflict.

By certain technical methods of dissociating the mind and by observation in cases where the mind has been already associated, the conflicting factors, the precise conflict and the resulting phenomena can be determined by direct evidence. The phenomena thus becomes subject to experimental investigation.

In this paper conflicts are studied by this method. The ob-

served results are given as examples of different types of conflict, with the evidence for the precise character of the subconscious factor thus determined.

General conclusions: Conflicts are normal processes belonging to mental mechanisms; any two (or more) antagonistic "sentiments," motivated by the impulsive forces of their emotions, may come in conflict and the stronger inhibit, or repress the other, or otherwise produce "defense" phenomena of various sorts; one may be subconscious, or both may be subconscious.

Any of the primary or compound emotional innate systems, or any of the instincts, or innate impulses belonging to personality (fear, anger, curiosity, sex, love, repugnance, jealousy, hatred, etc.) may provide the motive force.

The conflict may involve large systems of the mind and then results in gross alteration of personality.

On the Systematic Expansion of Terminology for Mental Symptoms and Processes. E. E. SOUTHARD, Psychopathic Hospital, Boston.

The suffix *-ia* is proposed for symptoms, *-is* for processes. The prototheme contains the modifier, the deuteriotheme the quality of mind under discussion, in terms for symptoms. In terms for processes the prototheme contains the quality of mind under discussion and the deuteriotheme contains the modifier. E.g. *schizophrenia*, the symptom; *phrenoschisis*, the process. Tables of terms are presented.

EDUCATIONAL AND COMPARATIVE PSYCHOLOGY

The Correlation between Interests and Abilities in College Courses.

J. W. BRIDGES, Ohio State University.

Previous studies of this subject have been based upon subjective estimates of both interests and abilities; and correlations as high as .89 have been obtained. This is no doubt much higher than the actual correlation; for judgments of interest and of ability cannot be made independently of each other. A more valid result would be obtained, if objective measurements of ability were used. Such measurements seem to be afforded by college grades, especially when the proportions of the various grades assigned conform approximately to the normal distribution.

To try out this method, about five hundred students were

requested at the beginning of the semester to arrange their courses in order of interest, and also in order of their ability in them. At the end of the semester the grades in these courses were obtained; and correlations between these grades and order of interest, as well as between order of interest and estimated order of ability were determined.

Pearson's coefficient of mean square contingency was used, as it seemed to be best adapted to this rough form of evaluation of traits. Coefficients were calculated for boys and for girls, for each college year, for all courses combined, and for certain courses taken separately. The coefficients for interest and ability as measured by grades range from .25 to .28, while those for interest and ability as estimated range from .50 to .59. The latter high correlations and those of previous studies are thus in large part due to the subjective method of evaluating ability; and it is likely that the actual relationship of interest and ability is more accurately represented by the smaller figures.

There are, however, many obvious objections to the use of college grades as measures of ability. Among others are: (1) College grade is also in part dependent upon interest. The effect of this would be to increase the correlation. (2) College grades are not sufficiently discriminative; and consequently many students get the same grade in all their courses when their actual abilities are perhaps not so even. The effect of this would be to decrease the correlation. It is difficult to say how far these two factors counteract each other.

Psychological Tests in the Training of Teachers. E. A. KIRKPATRICK, Fitchburg State Normal School.

Present-day conditions justify normal schools in giving their students some knowledge of psychological tests and of their uses in education, but it is an open question as to how much time should be devoted to training students to give tests. Experiments of the writer indicate that ten to fifteen hours training in giving the Binet Tests prepares most students for using the tests as an aid in the proper classification of children. Students can be trained in giving group tests in a much shorter time, but if they are also trained to score, tabulate and interpret the results of several kinds of group intelligence tests the time required is considerable.

Results Obtained from Children in the First Three Grades, by Means of a Group Scale of Intelligence. L. C. PRESSEY, Indiana University.

It is pointed out that a group scale applicable to children in the first three grades contributes unique material for the study of many psychological and educational problems, since (a) results obtained from children soon after they begin school are free from any possible influences of school training or other related factors, (b) entering classes are groups as yet unaffected by such selective influences as school retardation and elimination, and (c) extensive data from such young children should have great value in contributing to the study of mental development.

As evidence for these contentions three brief studies are presented. In each instance, the material presented is part of a of a complete survey covering all the children in school, from the first grade through high school, in the communities studied; the writer's scale was used in the first three grades, and a variety of tests of intelligence with the older children. And in each instance comparison is made between results obtained from the upper grades and results obtained from the six and seven year old children, with reference to the factors mentioned above. (1) Results from a poor country district, having six month schools and poorly trained teachers, are presented, to determine the extent to which inadequate schooling may influence results from the upper grades—the "Primer" scale giving a check on this factor. (2) Children of professional men are compared with children of day laborers, to determine whether the greater school retardation and greater elimination among children of the poorer classes may not play a part in the findings, if such a comparison is made on the basis of results from children in the upper grades only; again the writer's scale is used as a check. (3) A comparison is made of the relative standing of colored and white children six and seven years old, and colored and white children twelve and thirteen years old, to investigate whether there may be a more rapid early development among colored children and so a greater similarity of the races at the earlier ages.

It is urged that group tests of intelligence applicable to children in the first three grades may contribute data of great value to the study of many such problems, and that such data may be essential, in not a few such instances, to an adequate understanding of the situation.

A Study of Factors other than General Intelligence Important for the Prognosis of School Success. S. L. PRESSEY, Indiana University.

The paper is a report of first findings in an extensive study attempting analysis of the factors which contribute to success or failure in junior high school. The data include school marks, systematised teacher's estimates (not only of general ability, but also of specific abilities, and of such factors as general health and school attitude), the results of a large number of tests of general intelligence, and also findings with standard tests of achievement in arithmetic, spelling, geography, and other special subjects.

The preliminary analysis emphasized (1) previous preparation and (2) character traits, such as persistence, conscientiousness, application, as very important factors, measurements of which were desirable for the prognosis of school success. An effort is, therefore, made to obtain measures of these two factors which may be of value for purposes of prognosis.

1. It is suggested that we need to know more of the prognostic, as distinct from the supervisory and the pedagogic significance of data obtained with the "standard" educational tests. An attempt is, therefore, made to evaluate certain of these tests: the method of partial correlation is used, and an indication as to the interrelation of these abilities, and an appraisal of the independent value of each test as a means of forecasting school progress, are sought.

2. A scale designed to measure emotional control is presented, with data as to its validity from the twenty best and twenty worst children, from the point of view of discipline, in a large junior high school, from a similar double group of high-school children, from a university class in experimental psychology, from a group of girls at the State Industrial School, and from a group of cases from a State Hospital for the Insane. It is argued that the group test method has exceptional advantages for the investigation of such complex problems, since a large number of cases can be examined, and type reactions obtained. Suggestions with regard to further tests are offered.

Concerning the Influence of Education and Environment on the Religious Ideas and Beliefs of Children. W. F. SHEPHERD, Washington, D. C.

The purpose of the study was to determine the importance of

the above factors in moulding the ideas and beliefs of children as to the more important objects and conceptions of religion. The questionnaire method was employed, supplemented by cross-questions. The subjects were of different classes and denominations. 148 children were studied, ages 8 to 13 years.

The writer concludes: (1) Education has been a very important factor; (2) Social environment has been an influence; (3) Children's confidence in others has been a very important factor; (4) Authority has been concerned; (5) Thought has been concerned; (6) The confidence shown has been like that of primitive man in gaining his religious ideas; (7) The writer believes that these conclusions apply to greater or less extent to the religious ideas and beliefs of children of other ages than eight to thirteen years.

The Combined Use of Mental and Educational Tests Illustrated in the Case of Language. D. STARCH, University of Wisconsin.

This investigation attempts to show the use of mental tests in the interpretation of the results of educational tests. A series of mental tests and a series of language tests were given to about one thousand first-year pupils in twelve high schools. The results show large group differences in language abilities accompanied by little or no difference in general mental ability.

The Need for Analytical Study of the Maze Problem. J. F. DASHIELL, University of North Carolina.

The maze method of studying the process of learning, in both human and animal psychology, has shown little analytical attention given to the exact forms of mazes used. This introduces uncontrolled factors that may render comparisons between one maze learning process and another unreliable. It follows that an intensive study of just what rôle each element in a labyrinth plays in the whole complex should yield results of value.

As a sample of how this can be approached an experiment is reported upon white rats with mazes built upon a multiple unit system. Criticism of a point in Watson's *Behavior* is used as a point of departure, and a study made of the questions: (a) Is the probability of an animal's passing into a straight-ahead pathway the same as that of its turning into one at the side? (b) Again, upon its exit from a blind alley is it as likely to reënter the old path as to enter upon the new one? (c) Finally, does the position of this blind alley with reference to the true path affect the direction taken

upon exit from it? Fifty rats were used on ten different mazes, five to each. Records of entrances and exits at blind alleys led to the conclusions: (1) A blind alley opening straight ahead is more likely to be entered than to be passed, in about the ratio of 5 to 3. (2) A blind alley opening at the side is about as likely to be entered as to be passed. (3) The exit from a blind alley opening straight ahead is more likely to be in the forward than in the reverse or backward direction, in about the ratio of 3 to 2. (4) The exit from a blind alley opening at the side is more likely to be in the forward than in the reverse direction, in about the ratio of $3\frac{1}{2}$ to 1.

Some other problems arising in the analysis of the maze experiment are suggested.

Integration of Movements in the White Rat in the Maze. J. L. ULRICH, Johns Hopkins University.

In the investigation of learning in the maze, the reflex extension and flexion of the rat's limbs were discovered to be of great importance. Passively moving the head of a well-developed rat to the left or to the right evokes movements of the limbs in the manner of rhythmic progression, and dorsally extending the head or the tail produces posture of the limbs and of the body for jumping. The extensor thrusts of the fore limbs are the most important in learning. In rats a predominant right extensor fore thrust is more often evoked than a left. Excitations from the labyrinth of the ear, from the sense organs in the skin, muscles, and tendons evoke the extensor thrusts.

When the reflex extensor thrusts of the limbs were well developed, direct progression in the Watson maze was soon acquired. On the fourth or the fifth trial progression through consecutive alleys and turns occurred and was continued for many trials. With rats possessing a predominant right fore extensor thrust, progression to the left through acute turns 1 and 3 was difficult, but progression to the right through acute turns 2 and 4 was easy; the reverse was the rule with rats with a predominant left extensor thrust. With two square mazes on the plan of the Watson maze, necessitating in one, progression to the right through acute turns 1 and 3, and in the other maze, progression through obtuse turns 1 and 3, the same results were obtained. In another maze in which progression could be to the right through acute turns, or to the left through obtuse turns, progression was with rats with a predominant right reflex thrust to the left through obtuse turns, and

with rats with a left extensor thrust it was to the right through acute turns. Retracing of steps and stops occurred in alleys leading to or from the difficult turns. Fluctuations in the reflex extensor thrusts with the appearance or disappearance of any thrust conditioned the production of so-called errors, and progression through different sets of turns was reversed or was irregular. Stability of the thrusts in a great measure conditioned "retention" or reintegration. Learning, then, is conditioned by reflex mechanisms and not by sensory motor connections or "sensory impressions."

SOCIAL AND APPLIED PSYCHOLOGY

Behavior and Experiment in Social Psychology. F. H. ALLPORT, Harvard University.

It is our purpose to present a brief program for the observation of social behavior and the experimental analysis of social response. Social psychology, we may say, studies responses which are conditioned in whole or in part by the social environment. These responses are either (1) *caused* by social stimuli, or (2) *influenced* by social stimuli.

A social stimulus may be defined as the stimulation resulting from some movement, sound, gesture, or attitude of another individual of the same or somewhat closely related species. Social and individual psychology, from the genetic viewpoint, show a close interpenetration through gesture, language and thought. In practice however it is possible to separate them by distinguishing between social and non-social stimuli.

The direct response to a social stimulus occurs at least as low in the animal scale as the arthropoda. It achieves great importance in the behavior of primates, giving rise to responses which might be termed "social intelligence." This type of action Prof. G. H. Mead has effectively characterized as a "conversation of attitudes."

The response influenced by a social stimulus has been experimentally studied by the writer under conditions of co-working, co-feeling, co-thinking, etc. The individual in the group performed the same sort of task that the others were doing, or he experienced the same feeling or suggestion. The results indicate an important set of influences of the group upon the general attitude of the subject toward his task. There are to be noted (1) a facilitation of movement, (2) a compulsion toward haste at the expense of quality, (3) an objective direction of attention, (4) experiences of rivalry,

and (5) an important attitude toward social conservatism in the returning of judgments.

The direct response to social stimulus means the assumption of an attitude or disposition toward reaction of a given type; the response influenced by social stimuli is evinced by a modification of the subjects general attitude. Progress in social psychology as an empirical science demands observations and experimental analysis of both these forms of influence of the group. To understand the *crowd* we must first learn the social behavior of the *individual*.

The Psychology of the "Sense" of Unutterable Revelation. J. H. LEUBA, Bryn Mawr College.

Among the once mysterious psychological phenomena that have exerted and still exert a far-reaching influence, particularly in religious life, few are as interesting to the psychological student of religion as the conviction or "sense" of unutterable revelation which at times follows upon certain states of unconsciousness.

The paper consists of an analysis of instances of that curious phenomenon and of an explanation of it. In that explanation it was not found necessary to have recourse to subconscious, or co-conscious mental processes, and still less to superhuman agents such as were suggested by Wm. James.

Psychological Tests of Aviators used in the A. E. F. F. C. DOCKERAY & S. ISAACS.

Medical aviation in England, France and Italy, as well as in the United States, has recognized psychological aspects and methods in the selection and subsequent testing of pilots as distinct from the more purely medical and psychiatric. A variety of tests and methods have been developed in the several countries, Italian and French psychologists stressing simple reaction-time and bodily reactions to "emotional" stimuli, and the English, motor coördination. Italy, perhaps more than any of the other countries, has installed psychological tests in the routine examination of aviation candidates, and engaged in research along these lines. Thus, at the psycho-physical laboratory at Turin of the 2,702 candidates (30.7 per cent.) rejected out of 8,799 examined in 1918, 7.1 per cent. were disqualified on "excessive emotional reaction," and 6.3 per cent. on "long reaction-time," 2.2 per cent. and 1.9 per cent. respectively of the total number examined. The writers, as members of the Psychology Department of the Air Service Medical Research

Laboratory in the A. E. F., used the method of the French in applying simple reaction-time tests to American chasse pilots returned from service on the front, and to moniteurs instructing at the 3rd Aviation Instruction Center, A. E. F. These results were correlated with the findings of the Medical Department of the Laboratory, and with the rating in aviation ability by the Training Department of the flying field. A definite tendency to correlation of aviation ability, and fitness found by the Medical Department, with auditory reaction-times, and the coefficient of variation, considered by the French as an index of stability or emotional control, was indicated. Tests of control of involuntary movements, regarded as important by the English, were likewise applied to the same groups. A high and reliable coefficient of correlation was obtained between degree of tremor in the steadiness test and aviation ability. A test of aërial observers in observing and reporting was also used. The discriminative recognition reaction-time was decidedly better in the group of observers rated as good in their performance at the front than in the group rated as poor or indifferent.

A Study of Ocular Functions with Special Reference to the Look-Out and Signal Service of the Navy. C. E. FERREE & G. RAND, Bryn Mawr College.

The incentive for this work was the need for establishing a system of testing for those branches of service in the Navy requiring especially keen scotopic acuity. The first step towards the accomplishment of this purpose was the devising of a suitable apparatus and test method. A further need was to find out what range of difference in scotopic acuity might be expected among eyes graded as fit on the basis of the tests of other functions and capacities. A consideration of this need has led us to make a preliminary survey of eyes graded as normal with regard to photopic acuity and other commonly tested functions in order to determine whether such eyes may be expected to show a significant difference in keenness of functioning at low illuminations.

In a thorough test for vocations requiring keenness of discrimination at low illuminations, the following points should be taken into account: (1) the minimum amount of light required to discriminate the test-object before dark adaptation; (2) the minimum amount after a properly selected period of dark adaptation; and (3) the rapidity as well as the amount of gain in acuity in the process of adapting. Determinations covering all of these points have been made in this study.

Results have been obtained also showing the sensitivity of the illumination scale for determining the exact amount and placement of the correction of astigmatisms. In securing these results cases with and without a cycloplegic have been employed. The usefulness of the test method for detecting irregular astigmatisms has also been demonstrated.

What Industry Wants and Does not Want from Psychology. E. FROST, Rochester Chamber of Commerce.

In making suggestions for the application of the principles of psychology, it is assumed that the psychologist is now freely and fully committed to the application of psychology where such application can be of genuine service.

At the present moment the needs of industry are conspicuously great. Their satisfaction, however, is complicated not by the poverty but rather the multiplicity of alleged panaceas, most of which, valuable as they are, represent only a partial and therefore an inadequate remedy.

Industry must make money to live and consequently psychology in assisting industry must expect to have its value questioned in terms of money return. This is notoriously difficult to demonstrate of any intangibles.

The broad problems facing industry to-day are:— (a) Unionism and shop committees, (b) wage and hour adjustments, (c) labor turn-over, (d) americanization, (e) avoidance of wastage, (f) better housing and conditions of workers, (g) taxation, and in some states the further problems of, (h) compulsory health insurance, (i) continuation schools.

The problem of workingmen's compensation and of industrial safety has been rather generally and successfully met.

Four of these problems offer possible opportunities for the psychologist. Psychology can help in reducing *labor turn-over* if it can devise a simple test for intelligence, temperament, and adaptability to a particular task. It can assist in *americanization* by programming a wise education for the foreigner and illiterate, both in English and American ideals. It can make specific tests, in the third place, of the problems faced by the *shop foreman*, both as to the management of labor and in the conduct of the vestibule or training school, and finally, it can in many states, contribute to the effectiveness of *continuation schools* where theoretical instruction is given during the periods of the working day.

Industry is not at the present time agreed upon the commercial value of so-called army intelligence tests, even granting their competency to detect intelligence or the lack of it. Industry suspects the conclusions drawn from a knowledge of mental ratings since it suspects that many factors of significance in determining efficiency are not analyzed out by any examinations thus far devised.

Psychology can always offer help to industry here and there but if it is to do so generally and with success, it must dissect the problems of industry with care and apply specific remedies rather than generalizations.

Recent Developments in Trade-Test Theory. A. KORNHAUSER & B. RUMML, The Scott Company.

Recent developments in trade test theory are a departure from two particular features of the army method. (1) The army oral trade test was a fixed list of questions with norms established for the total list, very much as there are set norms for an arithmetic scale or an opposite test taken as a whole. (2) The army trade test made use, as do almost all mental tests, of the wrong regression line in predicting ability from test score.

A method has been developed which uses the proper regression relation and which treats individual questions as standardized units. From a practical point of view, this makes the test flexible as to questions included and excluded in a particular examination. Hence, (1) a test may be made as brief as desired. (2) It may be varied at will to prevent coaching and to meet unusual circumstances. (3) In testing, it is unnecessary to give questions less difficult than those already passed or more difficult than those already failed. (4) The test may be continually developed by the incorporation of new questions standardized in connection with the use of existing questions (5) Questions proving undesirable may be dropped without necessitating restandardization or change of norms.

The treatment of each question makes use of the relation of trade ability to score. The army method used the reverse relation—the average score for each grade of trade ability. Obviously, however, our diagnosis must proceed from score to trade status, not from trade status to score.

In using the regression of trade status on score, the new method does not consider simply the average (or most probable) trade status for a given score, but expresses the actual numerical chance

that a man making a particular score on the individual question is a novice, apprentice, journeymen or expert.

With these probabilities as a criterion, the questions are classified into three levels—apprentice, journeyman and expert—analogous in some respects with Binet year levels. There are several important differences, however, in addition to the use of the new regression relation and the employment of probabilities. (1) Questions are placed at the level where they differentiate best, not where a certain percent have passed. (2) Questions are weighted in proportion to their differentiating value. (3) Questions are weighted differently if passed and if failed.

Applications of this method of determining the value of test elements, placing them and assigning weights by means of probabilities are suggested for several types of mental tests.

The Extension of Rating Scale Theory and Technique. D. G. PATERSON & B. RUMI, The Scott Company.

Standardized subjective measurements of ability are made by means of the so-called "Rating Scale." The objection that you cannot combine measures of disparate qualities such as "leadership," "coöperativeness," etc., into a single quantitative expression is evidence of faulty logic. Such an objection is usually argued by analogy to the impossibility of adding two apples, four oranges and six pears. The rating scale is not such an adding device. On the contrary, it secures a numerical measure of disparate qualities each of which is correlated with general value in a particular line of work. The measures then are measures of varying reliability of the individual's general value. These several measures, each inferentially diagnostic of general value, can logically be summated.

The type of rating scale here considered marks a distinct advance in principles of construction over the rating scales we are familiar with. Each element is a definition of one type of activity carried on or of one type of result achieved by those being rated. It is more objective and involves less of an attempt to measure intangible elements of personalities. A contrasting example of the newer and the older type of definition is as follows:

Older definition: "Leadership: Judge initiative, force, self-reliance, decisiveness, tact, ability to inspire men and to command their obedience, loyalty and coöperation."

Newer definition "Leadership: Judge his ability to develop

a loyal and effective organization by administering justice, inspiring confidence and winning the coöperation of his subordinates."

In using the "Man to Man" comparison type of rating scale, we find it essential to demand extensive experimental ratings from small groups of executives in order that the "Master Scales" may be properly calibrated. The probable error of the ratings of one judge compared to the ratings given the same employees by other competent judges is determined. Tendencies to rate too high or too low are corrected by indicating the precise type of revision of the "Master Scales."

The rating scale in industry is a valuable educational tool. The analysis of work into fundamental elements leads the executives to think more analytically with regard to essentials. It also encourages a more introspective attitude on the part of those subject to the operation of the rating scale.

The rating scale needs careful analytic work and follow up in order properly to safeguard the rights of those being rated by superiors.

An Important Constant Error in Psychological Rating. E. L. THORNDIKE, Teachers College.

In a study made in 1915 of employees of the General Electric Company and the Westinghouse Electric Company, it appeared that the estimates of the same man in a number of different traits, such as intelligence, industry, technical skill, reliability, etc., were very highly correlated and very evenly correlated, much more so, than general observations of human nature would lead one to expect. It consequently appears probable that those giving the ratings were unable to analyze out these different aspects of the person's nature and achievement and rate each in independence of the others. Their ratings were apparently affected by a marked tendency to think of the person in general as rather good or rather inferior and to color the judgments of the separate qualities by this general feeling. This same constant error toward suffusing ratings of special features with a halo belonging to the individual as a whole appeared in the ratings of officers made by their superiors in the army.

Recently Miss Clara Chassell, working on estimates of intellect and various traits of character, has likewise found that correlations of subjective ratings, in spite of the attenuation due to their accidental error, are higher than objective facts make probable and are more uniform than objective facts make probable. The fact

is brought out in almost indisputable form by an investigation made at Teachers College by Mr. Knight with judgements upon intellect, general teaching ability and ability to maintain discipline in the case of teachers.

The writer has become convinced that even a very capable foreman, employer, teacher or department head is unable to treat an individual as a compound of separate qualities and to assign a magnitude to each of these in independence of the others. The magnitude of the constant error of the halo, as we may call it, also seems surprisingly larger, though we lack objective criteria by which to determine its exact size. As a consequence science seems to demand that in all work on ratings for qualities and the like the observer should report *the evidence*, not a rating, and the rating should be given on the evidence to each quality separately without knowledge of the evidence concerning any other quality in the same man.

BOOKS RECEIVED

- DELGRADO, H. F. *El Psicoanálisis*. Lima: Sanmarti, 1919. Pp. 58.
- Revista de Education*. Santo Domingo: J. R. Vda. Garcia, 1919. Pp. 271-476.
- MONTESANO, G. *L'assistenza dei Minoreni Anormali*. Bollettino della Scuola Magistrale Ortofrenica de Roma. Roma, 1919. Pp. 200.
- La Faculté de Médecine de l'Université de Paris*. Paris: Masson & Cie., 1919. Pp. 84.
- DENIS, H. *Discours Philosophiques*. Paris: Giard & Brière, 1919. xlix + 332.
- PERRETT, W. *Some Questions of Phonetic Theory*. Chapter V, *The Perception of Sound*. Cambridge: Heffer & Sons, 1919. Pp. 39. 2/- net.
- RIVERS, W. H. R. *Mind and Medicine*. Manchester: Longmans, Green, 1919. Pp. 23. 1/- net.
- MCGEOCH, J. A. *The Present Status of Psychology*. Colorado College Publications: General Series No. 103, 1919. Pp. 100.
- GINNELL, L. *The Irish Republic. Why?* New York: 280 Broadway, 1919. Pp. 139.
- Bulletin of the National Association for the Study and Education of Exceptional Children*. Vol. I, No. 1. Plainfield, N. J.; 1919. Pp. 31.

NOTES AND NEWS

WE regret to announce the death, on February 8, of Dr. Elmer Ernest Southard, professor of neuropathology in the Harvard Medical School, and medical director of the Boston Psychopathic Hospital. For a number of years Dr. Southard has been the responsible editor for psychopathology on the BULLETIN staff. His scientific contributions have been in the fields of neuropathology, psychiatry, and mental hygiene, and he has contributed much to a psychiatric-psychological rapprochement.

MR. FRANK WATTS has been appointed lecturer in psychology in the University of Manchester.

At the recent meeting of the American Psychological Association the following officers were elected: President, Dr. Shepherd Ivory Franz, Government Hospital for the Insane; Secretary-Treasurer for three years, Professor Edwin G. Boring, Clark University; Members of Council for three years, Professor H. S. Langfeld, Harvard University, and Professor C. S. Yoakum, Carnegie Institute of Technology.

PROFESSOR RALPH B. PERRY, Harvard University, was elected president of the American Philosophical Association, and Professor Alfred H. Jones, Brown University, was elected secretary at the recent meeting of the Association.

PROFESSOR E. K. STRONG, JR., Carnegie Institute of Technology, has been elected chairman of the newly organized section of psychology of the American Association for the Advancement of Science.

ANNOUNCEMENT is made that the prize of one hundred dollars offered in 1914 for the best paper on the availability of Pearson's formulæ for psychophysics, to be judged by an international committee consisting of Professors W. Brown, E. B. Titchener, and F. M. Urban, has been awarded to Dr. Godfrey H. Thomson, of Armstrong College, Newcastle-upon-Tyne, for an essay entitled "On the Application of Pearson's Methods of Curve-Fitting to the Problems of Psychophysics."

THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

SOCIAL PSYCHOLOGY

BY FLOYD H. ALLPORT

Harvard University

Slowly but surely, social psychology is coming into its own as the study of the social behavior of the individual. Many writers are noting, and some are investigating, social stimulus and response, and the specific effect of a social environment upon individual reaction. In spite of the persistent speculative essays of the old school, the trend is encouragingly toward observation and experiment. Recent literature echoes the cry for "socialization" in social theory, in government, in education, and in life. If the war has rescued individuality, it has also taught the value of coöperation and the stern necessity for the reconstruction of individual interest so as to include a regard for the social welfare. Here again lies the need for study and control of the socially significant aspects of individual response.

Our survey reveals three dominant topics of interest which may serve for classification. They are (1) "social mind" theories, (2) the social behavior of the individual, and (3) social behavior in relation to society.

I. "SOCIAL MIND" THEORIES

The sterile controversy over the reality of a group mind still drags along. Most of the discussions are purely philosophical and so outside our present interest. Bosanquet (3) argues for the existence of a "general will" which gives definition to individual wills. Its existence is grounded in (1) the implication of the rights of others to choose for themselves in matters in which we ourselves

have option, (2) a supporting system of universally agreeing wills, and (3) the permanent inclusion in an act of legislation of the life experiences, sufferings, and purposes of thousands of individuals.

Sageret (37) is concerned with a "collective mind," existing only in individuals. Its substance is social heredity, and its work is the enrichment of individual life as the fertile soil enables the acorn to develop into a giant oak. Without the social inheritance of tools and crafts we should revert to savagery. Newton, stripped of the collective gift of civilized language and concepts, could scarcely have aspired to mediocrity in the primitive horde. The collective mind operates like the swift, automatic reflexes of the bee always in the interest of the hive. There is the "bee-man" in whom the collective mind functions like breathing, without his knowing how or why. The soldier who in one moment scoffs consciously at patriotic ideals, in the next gives his life without thought for his country. In another paper, the same author (36) considers opinion to be equivalent to the collective consciousness of a community or nation. It operates in the same reflex manner with the force of a sentiment, affective rather than rational in character. It is non-constructive, critical, and readily exploited by demagogue and journalist.

II. SOCIAL BEHAVIOR OF THE INDIVIDUAL

Beginning with social behavior in animals, Lameere (24) observes as chief principles (1) mutual aid, (2) division of labor, and (3) collective coördination of labor. The last is illustrated by beavers building a dam. Social heredity of constructive habits is considered possible among animals. Kempf (21) describes some interesting personality types and their interaction among monkeys. There is the socially dominant monkey taking food away from the others, as well as the weak and timid individual who constantly watches the facial expressions of the stronger. Strategy is displayed in food getting, sex behavior being sometimes used as a decoy. Human homo-sexuality, prostitution, and sex psychoses are traced by Kempf to our simian ancestors.

We owe to Giddings (16) a suggestive program of pluralistic, as distinguished from individually isolated, behavior. Into every social occurrence there enters a degree of "like-mindedness" which consists of the "sum of like reactions, instinctive, habitistic, and rational." Social life is further complicated by the fact that each man serves as a complex stimulus to his fellows. Like responses

are produced more readily than unlike. The "caw" of one crow readily stimulates the "caw" of another. Hence aggregation follows upon the line of least resistance in stimulation, and the assumption of a gregarious instinct is unnecessary. That animals of like structure tend to associate no one would deny. But we can hardly follow Giddings further; for like responses are probably more often the result than the cause of aggregation, unless we are speaking of small and specialized groups. Pluralistic behavior, says Giddings, may arise as a "dramatization" of originally isolated or socially meaningless behavior. For reasons important to the individual his "action" develops into "acting." The author does not enter into the process of this development as a method of social control, nor into its significance for the psychology of communication; but these implications appear to be far reaching in their importance. "Consciousness of kind," "social pressure," and "social solidarity" are treated in the remainder of the paper.

Allport (1) agrees with Giddings in the denial to instinct of a fundamental rôle in social psychology. The "instinct fallacy" errs in injecting social experience and habit into the germ plasm. Social response is as truly *learned* as any other aptitude. Another besetting error is the "group fallacy." The locus of all psychology is the neuro-muscular system of the individual. Discussion of groups adds nothing but confusion. The need for direct observation of the individual in a social situation is emphasized. For convenience we may distinguish two forms of social behavior: (1) making and responding to *direct* social stimuli, as in conversation, hunting, and reaction to facial expression; and (2) response to indirect or *contributory* social stimuli, as in performing any action in the presence of others or in common with them. The latter type would include the behavior of the individual in the crowd. Giddings' "dramatization" of action would represent the development of a contributory into a direct social stimulus. The results of the writer's experiments measuring the effect of contributory social stimuli upon the members of a group are given in brief summary.

The social influence under the condition of *rivalry* has been studied by Moede (29) in a group of boys 12 to 14 years of age. Tests of rate of tapping showed that competitive tapping produced a higher speed than solitary work. Dynamometric grip tests were given (a) with the individual alone, (b) in dual contest, and (c) in teams of five boys each. The strength records made increase in

the order stated. An inverse correlation is shown between the ability of the subjects in the tests and the degree of beneficial effect of the social stimulus. In dual contests differences of temperament as well as of ability affect the character of the rivalry.

An important contribution to our knowledge of response to social stimulus in facial expressions is made by Langfeld (25, 26). The subjects gave names to 105 different emotional states expressed in photographs of an actor. Laughter, fear, aversion, and anger were successfully named. In mixed expressions the more evident components often obscured the weaker. Subtle states and permanent moods were not well interpreted. In making their judgments the subjects employed methods of (a) empathic response, and (b) imagining the whole social situation appropriate for the expression concerned. Further results in judging the expressions under the influence of suggestion were obtained.

These three studies represent the recent experimental literature.¹ The results, though numerically few, are probably of greater value than all the rest of the theoretical writings combined.

An allusion to social behavior is made by Kitson (23) who notes the subtle cues of breathing, head and eye movements, facial expressions, and the like, which tell the salesman that the "psychological moment" has arrived to press the closing of the deal. Sidis (40) bases crowd and mob phenomena upon the laws of suggestion and dissociation deduced by him from normal and abnormal individual suggestibility. In the mob the "sub-waking, reflex, and automatic self" is dissociated from the "rational or waking self," and suggestion, favored by all the necessary conditions of inhibition, limitation, and monotony, reigns supreme. War and other "social manias" are discussed in this light, and the need for rational individual expression in national life is emphasized. George (15) defines the social mind as a newly acquired "social attitude" of the individual. One's movements must be so regulated as to keep pace with the movements of others. In the war this regulatory attitude was seen in the "marching self," and in all forms of coöperation. Social efficiency is the war's great teaching.

Thought, from the standpoint of Creighton (9), is behavior socially conditioned. The contribution of each individual has its social origins. The social environment is seen to be indispensable in the formulation of the problem, the discussion which aids its

¹ Excepting studies on suggestion of which a number have appeared recently. This topic will be covered in a separate review.

solution, and the final test of verification. Peterson (32) shows more specifically that ideas are essentially ways in which a large number of persons respond in the same manner to certain symbols or objects. The stability of concepts and the stability of custom are one.

Inexorably the Freudian psychology has found its way into social thinking. Jordon (20) declares the need of a "social psychoanalyst" to reveal to groups the true nature of their suppressions, and to redirect the "economic creative impulse" (libido) away from radicalism and into more intelligent adjustments. Follett (13) desires to apply Holt's concept of "integration" to the present social discord. Interpenetration of thought (integration) should take the place of compromise (repression). Community must be a process, like an integrated personality, creating its own purpose through its very integration. Finally, Bruce (4) turns the Freudian tables by postulating, in self-centered mankind, a repression of the gregarious instinct and feelings of sympathy for others(!). This repression has found its release in the widespread fervor of the Red Cross movement.

III. SOCIAL BEHAVIOR IN RELATION TO SOCIETY

As heretofore, much of our social psychology has been produced by sociologists. Since it deals mainly with social movements, formations, and problems, rather than the social aspects of individual behavior, its contribution to our present need is somewhat casual. We shall therefore emphasize only the facts of importance for social psychology proper. The following sub-interests of social science will afford a useful classification: (1) sociological theory, (2) psychology of racial temperament, (3) marriage and family problems, (4) social movements, (5) social control and government, (6) rural problems, and (7) educational problems.

1. *Sociological Theory*.—Chapin's book (6) appears in the fourth edition. It is a clearly written and well (though rather hypothetically) illustrated text-book of prehistoric sociology. The chapters on "Association" and "Social Heredity" give concise elementary statements of the prevailing conceptions and theories. The specific contribution of this edition is the writer's treatment of social selection (appendix). "Social" selection, *producing group conformity* by killing the offender or innovator, is contrasted unfavorably with "societal" selection by which new ideas and unusual conduct are themselves directly suppressed. The second type

works by modification of habit, the first by innate disposition controlled by social (natural) selection. Social selection founded upon eugenic birth-rate control, rather than upon death rate, is advocated by the author.

A convenient summary of the theories of Giddings is presented by Northcott (30). The doctrines of "kind" as a specific stimulus and response, toleration, and social mind as concerted feelings and acts are explained. Unlike responses are valuable in promoting interest and rivalry. Agreement is founded more often upon emotion than upon belief or reason. Ross (33) discusses socialization in a less psychological way. There are various socializing factors, such as commensalism, compatriotism, sport, community of interest, and nationalization. Obstacles to socialization are Bolshevism and unrest, differences of race, food, manners, and traditions, and a resented imputation of inferiority. The question of the individual versus the aggregate is discussed by the same author (34). Ross shows how, in all social fields, our earlier notion of a standard "average" treatment for all is giving way to the more enlightened concept of "the individual." In a third paper (35) Ross uses the term "individuation" to designate the "pulverization of social lumps" that releases the individual members. In the clan, the family, the village, the church, and the state, the dissociation of individual life from social bonds has been in progress.

Like considerations lead Boodin (2) to describe the "unit of civilization" as the small "moral unit" composed of free individuals with a "community consciousness" and a "joy in common creativeness." Only this unit is productive and enduring. Power organization is ephemeral. The same theme appears in Clow's paper (7). Small "primary" groups, rarely exceeding six members, are based on sympathy and congeniality. Interesting examples among children are presented. Such groups are marked by loyalty and coöperation within. Their bearing upon educational practice is important.

2. *Psychology of Racial Temperament.*—Tolfree (44) portrays the social aspect of Russian character. Their profound and mystical sense of communism is expressed, not as a deliberate policy, but as a "kind of organic propulsion," inarticulate and unreasoned. There is a spontaneous "sense of primordial life." The Russian is intolerant of any abridgment of his personality, dreading even connubial bondage. Shepherd (39) presents the Latin American traits as egotism, exclusiveness, stiff conventionality, bombast, impulsiveness, non-morality, inability to coöperate, and lack of power to obtain another's viewpoint.

3. *Marriage and Family Problems*.—Galbraith's readable book (14) includes a discussion of the psychology of love, courtship, modesty, and coquetry. Wise choice of a mate requires psychological insight. The maladjustments, or "danger zones," of married life are man's over-assertiveness, poor domestic economy, the "spirit of martyrdom," jealousy, and woman's ignorance regarding her husband's leading interests. Woman's success as wife and mother demands that she have a vocation outside the home thus keeping abreast of the life of the world. How this can be done in practice is a problem left to the reader's imagination. Egress from the danger zones, among persons of inferior nature, is often through home-wrecking and desertion. The psychology of this subject is included in parts of Colcord's book (8). Sex maladjustments are the most frequent causes of desertion. Incompatibility of temperament is third in importance. It is common for the deserter to "rationalize" his offense and shift the blame to the spouse.

4. *Social Movements*.—War, as considered by Partridge (31), is a kind of movement based psychologically upon "reversions," "intoxications," "social instincts," esthetic motives, ideals, and "causes." The author lays stress upon the "mood," a vague synthesis of feelings, sentiments, desires, instincts, and habits, producing a restless activity without specific object. "Warlike moods" are usually precipitated by fear and anger. It is the purpose of education to analyze the part forces of these great springs of action in order to redirect their energy away from destructive wars to social achievement. Spargo (43) calls attention to the psychological peculiarities, bordering on abnormality, found in all social levels among the devotees of Bolshevism. This movement is to be reckoned with only by a sympathetic understanding of the mental state and motives of its adherents. Psychologically it is symptomatic of a deep lying social maladjustment. Maudsley's book (28), which contains more generalization than act, criticizes the psychological foundations of socialism. Humanity is better off under individualizing conditions. An error exists in attempting to re-make human nature simply by changing the form of government. The negro population, according to Haynes (18) is becoming class-conscious, and desires to share the fruits of the new international doctrine of self-determination. Sensational newspaper publicity has done much to precipitate race riots between the negroes and whites.

5. *Social Control and Government.*—Democracy, according to Ellwood (11, 12), must run through the whole of social life if it is to succeed as a form of government. As the "rule of public opinion" it must be based on "rational like-mindedness." The negative *laissez-faire* policy is fatal to it. There must exist a positive spirit of fraternalism and coöperation throughout the nation. In other words the individual should be socialized in his interests and desires. This is also the opinion of Kern (22). Citizens must desire to set up a government which will benefit society as a whole, not their own class preëminently. The ideal of democracy is to develop the "social attitude" in the individual, to make him feel himself, not as "subject" of an impersonal government above and remote from him, but as a part of that government itself. The ethical theory of Hirst (19) is founded upon the same idea of socialization. No man can be good in and for himself. Society, he argues, is based upon an extension of the "other-regarding sentiments," developing from the parental instinct, first to the weak and helpless, then to all mankind. Tribal government is protective in purpose, and "conscience is an imitation of tribal government set up in the breast of the individual." Just as in gestation the mother in feeding herself also nourishes her child, so in human affairs generally desire to succor others becomes indistinguishably fused with our regard for self. Not only "feeling for" the helpless infant, but the very "apperception" of it are alleged to be instinctive.

6. *Rural Problems.*—Groves (17) preaches the need for socialization in rural life. The country church and school should become organized centers of community life. The country home, unusually potent in the lives of the young, is in need of spiritualizing influences. The mind of the farmer is patient and conservative. Isolation has done little to foster in him an amiable, social feeling. Public opinion is sadly lacking in rural life, and the voice of the farmer is seldom heard abroad. The suggestive influence of the city press is strong upon the farmer. Suggestion also operates upon the children producing discontent with rural life, jealousy of one's neighbors, and harmful precocity in sex life. According to Schoen (38), the influence of the gregarious army life swells the ranks of rural youth who go from the service to the city rather than back to the farm.

The "little town" as described by Douglass (10) also stands in need of socialization and of affiliation with the rural life about it rather than with the city which it so fatuously imitates. Along

with the intensely personal and often narrow character of their interests, the little-towns-folk possess great opportunities for social enterprise and community leadership.

7. *Problems of Education*.—In no practical field is the need of socialization more keenly felt than in education. Smith (41) advocates the addition of social teaching to the regular curricular education in all departments, physical, cultural, and vocational. Such instruction would train the student in the exercise of his knowledge in citizenship. The very nature of education, says Smith (42), is social. The child learns more matters, and more important matters, from the social inheritance in the home and about him than from the curriculum of the school.

Lull (27) introduces the socializing principle into school practice. In extra-curricular activities such as debates, sports, and school magazines, the social incentive to achievement is great. In the class work also both interest and volume of thought can be increased by having practical problems arising in the lesson worked out by class discussion. Burns (5) applies the idea by dividing the class into discussion groups of five members, with a leader in each group. Each member contributes something to the discussion, and the group leaders report to the class as a whole. To the social psychologist such methods are of interest as rough but practical experiments in measuring the specific social influence.

REFERENCES

1. ALLPORT, F. H. Behavior and Experiment in Social Psychology. *J. of Abnor. Psychol.*, Dec., 1919.
2. BOODIN, J. E. The Unit of Civilization. *Int. J. of Ethics*, 1920, 30, 142-159.
3. BOSANQUET, B. The Notion of a General Will. *Mind*, 1920, 76-81.
4. BRUCE, H. A. The Psychology of the Red Cross Movement. *North Amer. Rev.*, 1919, 209, 59-67.
5. BURNS, H. F. The Group Socialized Recitation. *Education*, 1918, 39, 176-181.
6. CHAPIN, F. S. *An Introduction to the Study of Social Evolution*. New York: Century, 1919. Pp. xxii + 320.
7. CLOW, F. R. Cooley's Doctrine of Primary Groups. *Amer. J. of Sociol.*, 1919, 25, 326-347.
8. COLCORD, J. C. *Broken Homes*. New York: Russell Sage Foundation, 1919. Pp. 199.
9. CREIGHTON, J. E. The Social Nature of Thinking. *Phil. Rev.*, 1918, 27, 274-295.
10. DOUGLASS, H. P. *The Little Town*. New York: Macmillan, 1919. Pp. 244.
11. ELLWOOD, C. A. Democracy and Social Conditions in the United States. *Int. J. of Ethics*, 1918, 28, 499-514.
12. ELLWOOD, C. A. Making the World Safe for Democracy. *Sci. Mo.*, 1918, 7, 511-524.
13. FOLLETT, M. P. Community is a Process. *Phil. Rev.*, 1919, 28, 576-588.

14. GALBRAITH, A. M. *The Family and the New Democracy*. Philadelphia: Saunders, 1920. Pp. 374.
15. GEORGE, W. H. Economic and Social Factors in War. *Amer. J. of Sociol.*, 1918, 23, 747-753.
16. GIDDINGS, F. H. Pluralistic Behavior. *Amer. J. of Sociol.*, 1920, 25, 385-404.
17. GROVES, E. R. *Rural Problems of Today*. New York: Association Press, 1918. Pp. viii + 181.
18. HAYNES, G. E. Race Riots in Relation to Democracy. *Survey*, 1919, 42, 697-699.
19. HIRST, E. W. *Self and Neighbor*. London: Macmillan, 1919. Pp. xx + 291.
20. JORDON, V. The New Psychology and the Social Order. *Dial*, 1919, 67, 365-368.
21. KEMPF, E. J. The Social and Sexual Behavior of Infra-human Primates. *Psychoanalytic Rev.*, 1917, 4, 127-154.
22. KERN, R. R. The Supervision of the Social Order. *Amer. J. of Sociol.*, 1919, 24, 423-453.
23. KITSON, H. D. The Psychological Moment. *Sci. Mo.*, 1919, 9, 246-252.
24. LAMEERE, M. A. Les mœurs sociales des animaux. *Bull. de l'Institut Général Psychol.*, 1916, 16, 23-39.
25. LANGFELD, H. S. The Judgment of Emotions from Facial Expressions. *J. of Abnor. Psychol.*, 1918, 13, 172-184.
26. LANGFELD, H. S. Judgments of Facial Expression and Suggestion. *Psychol. Rev.*, 1918, 25, 488-494.
27. LULL, H. G. Socializing School Procedure. *Amer. J. of Sociol.*, 1919, 24, 681-691.
28. MAUDSLEY, H. *Organic to Human: Psychological and Sociological*. London: Macmillan, 1916. Pp. viii + 386.
29. MOEDE, W. Der Wetteifer, seine Struktur und sein Ausmass. *Zsch. f. pad Psychol.*, 1914, 15, 353-368.
30. NORTHCOTT, C. H. The Sociological Theories of Franklin H. Giddings. *Amer. J. of Sociol.*, 1918, 24, 1-23.
31. PARTRIDGE, G. E. *The Psychology of Nations*. New York: Macmillan, 1919. Pp. x + 333.
32. PETERSON, J. The Functioning of Ideas in Social Groups. *Psychol. Rev.*, 1918, 25, 214-226.
33. ROSS, E. A. Socialization. *Amer. J. of Sociol.*, 1919, 24, 652-671.
34. ROSS, E. A. Lumping versus Individualism. *Int. J. of Ethics*, 1919, 30, 58-67.
35. ROSS, E. A. Individuation. *Amer. J. of Sociol.*, 1920, 25, 469-479.
36. SAGERET, J. L'opinion. *Rev. phil.*, 1918, 86, 19-38.
37. SAGERET, J. Remarques sur la psychologie collective. *Rev. Phil.*, 1919, 87, 455-474.
38. SCHOEN, M. The Rural School and the Rural Society after the War. *School & Society*, 1919, 9, 89-90.
39. SHEPHERD, W. R. The Psychology of the Latin American. *J. of Race Develop.*, 1919, 9, 268-282.
40. SIDIS, B. The Source and Aim of Human Progress. *J. of Abnormal Psychol.*, 1919, 14, 91-143.
41. SMITH, W. R. The Sociological Aspect of Our Educational Aims. *Amer. J. of Sociol.*, 1918, 24, 81-95.
42. SMITH, W. R. The Role of Social Heredity in Education. *Amer. J. of Sociol.*, 1919, 24, 566-580.
43. SPARGO, J. *The Psychology of Bolshevism*. New York: Harper, 1919. Pp. 150.
44. TOLFREE, A. G. The Russian Character. *Atlantic Mo.*, 1918, 121, 596-600.

THE PSYCHOLOGY OF RELIGION

BY GEORGE A. COE

Union Theological Seminary

Whoever undertakes to make a general survey of recent publications in this field meets the problem of deciding upon the range within which titles should be chosen. Shall the choice be restricted to technical contributions to science, or shall account be taken, rather, of the entire movement through which a psychology of religion is beginning to assume a definite place in all informed thinking about religion? "Popular psychology" is, for excellent reasons, a sore point with real psychologists. Nevertheless, religious reactions to the psychology of religion become fresh data for the psychologist. Moreover, a psychologist's criticism of them may ultimately assist religious thinkers to see clearly just what the psychology of religion is about, and what its methods and results are. For these reasons the present survey includes, along with a few technical works, and a few that provide fresh data, a considerable number that indicate changes of religious thought and of practice that can be traced to the psychology of religion as one of the prominent causes.

Origin and Early Forms of Religion.—For a number of years the theory of a "pre-animistic religion" has supported itself chiefly upon an interpretation of *mana* that makes it impersonal or what modern man calls simply "power." Upon the validity of this interpretation depends, to no small degree, the true distinction between religion and magic. In 1910 the present reviewer questioned, upon purely critical grounds, whether the attribution of impersonality to *mana* does not reflect the psychologist's distinction-making mind rather than the standpoint of early man (*Harv. Theol. Rev.*, 1910, 3, 368). From a new and extended review of primary sources (with a bibliography of 80 titles) Miss Campbell (6) concludes that one has when one acts with a group; that therefore *mana* is not impersonal but has the qualities that early man attributes to himself; that it is conceived of at the same time as one's own power and yet more than one's own, and that these two aspects underlie respectively magic and religion; that religion, accordingly, grows out of an attitude of dependence and conciliation toward *mana* (an eject), and magic out by a sense of power already in one's possession. A partly parallel conclusion is drawn by Thomas (30),

to the effect that in the mind of the believer himself no final division can be discovered between magic and religion. Wright (34) emphasizes the ability of the savage mind to observe phenomena and make causal inferences. DeBancels (4), inquiring into the reason why the Pythagoreans forbade the eating of beans, finds an explanation in early man's identification of the soul with air. He discovers much evidence besides Pythagorean writings that intestinal air and the air of respiration were interpreted alike, and he finds that the belief in virgin conception by divine inspiration is connected therewith.

The Fundamental Impulses of Religion.—Wells (32) agrees with most psychologists of religion that there is no religious instinct. He accepts McDougall's view that curiosity, self-abasement, flight, and parental instinct are driving forces, but he desires greater stress upon the influence of sexual love. Freudian psychology, he thinks, puts in plain words what Plato, Emerson, and Browning have uttered in less prosaic language. Not only does thwarted love find sublimation in religion, but also love that is not thwarted, for "falling in love" often contains a religious overplus. It is remarkable that Wells makes no mention of economic motivation in religion. Schroeder also (26) presents the sexual instinct as a source, rather the source, of religious experience in a Negro revival that he circumstantially describes. He infers that the physiological automatisms that he witnessed spring from "psychical sexual organisms" which are determined as to their intensity by varying degrees of repression, sensitiveness, and shame. Woodburne (33) holds that religion and science originate in the instincts as a whole, that these form an interpenetrating mass, and that while science builds out therefrom a social technic, religion develops social attitudes. Randall (23) finds that mythology and philosophy (which is mythology "grown less colorful and more respectable") do not describe what is, but endeavor to control it in the interest of "consolation" or of improvement. Religious ideals represent what is present in our own nature, but only in subordinate degree. "Man creates the gods, not in his own image, but in the image of that he would most like to be." Stern (27) holds that the abnormal mental processes of religious revealers are not the source of religion; the religiousness of these processes springs from an antecedent background of affective qualities. Therefore the normal religious consciousness is the primary source for a definition of religion. Lloyd (16) points out that so-called 'reversions' of civilization to

"instinct, passion, force," as at the present moment, do not reinstate barbarism. The new conflicts are upon a higher plane, great leaders appear ("gods are born"), and thus the true nature of the elemental forces is revealed. These forces are not brutish, and progress is not a growing away from them, "but a growing in and through them, a growing *up* to them."

Psychoanalysis and Religion.—Two authors have made extensive psychoanalyses of religious individuals. Berguer (5, see special review in this number) has chosen Jesus for such analysis. Morel (21) has made an extensive study of Pseudo-Dionysius and a briefer study of a half dozen better known Christian mystics. "Introversion" is Morel's clue to all these experiences. By this term he designates the retraction of attention and the regression of mental powers that Janet found in the neuroses, but he includes in it also the causal principle of Freud, repressed desire. The mystic's mind, lamed by this internal pressure, is unable to grasp the objective world, and therefore turns to a world of mere desire which, expressed in thought, is revery, theology, or metaphysics. Two main types of introversion are found. The first, mostly women, and characterized by strong autoerotism, is traced to a relatively late arrest of sexual development. The second, mostly men, and marked by a tendency towards metaphysical abstractness, is traced to a relatively early arrest of such development. In the experience of ecstasy the mind of the mystic moves towards pure function without objects, but it never arrives. There remains some consciousness of obscure bodily states of pressure, kinesthesia, etc., which are ordinarily subconscious or unconscious. Thus ecstasy is simply a displacement of attention.

Studies of Mysticism.—Leuba (15) finds that the yoga practice is continuous on the one hand with religious drug-intoxication and on the other with Christian mysticism. All three seek connection with the divine by reduction of mental activity. The resulting dissociation of the individual from his world includes more or less liberation also from the physical pain and the moral evil of it, and this liberation leads on to an illusory sense of possessing various divine or magical powers, of which unutterable revelation is one. The yogin, under the rubric of the extinction of desire, really desires self-realization and moral perfection. Ackerman, on the other hand (1), questions the ordinary view that the mystic's illumination is altogether illusory. It is true that the 'absolute other' is a projection of the mystic's own idealized self. This makes improb-

able any direct acquaintance, in this experience, with a transcendent deity, but the case is not the same if the mystic claims to apprehend an immanent absolute. Taken dynamically, the consciousness of a super-self may be a true apprehension. Ackerman argues this upon the basis of the category of cause. The heightening of psychic energy, he thinks, justifies the impression that a being of higher order is present as source. To the present reviewer it does not appear to be established that consciousness of God requires the expenditure of a greater quantum of mental energy than, say, the establishment of a scientific law. One might argue from history that scientific thinking is the more difficult for the human mind. Nevertheless this objection does not lie against the claim that a higher self is actually resident in a lower self, the term "self" being used in the same sense for both. Another argument for the objectivity of some (not all) mystic states is that of Jones (in "Prayer and the Mystic Vision," one of the essays in 28) who combines rich acquaintance with the literature of the inner life with ungrudging appreciation of psychological research. He recognizes in mysticism the factor of auto-suggestion, the prevalence of illusion, the emptiness of the destination towards which the *via negativa* leads, the historic and social sources of every articulate doctrine. But at the heart of prayer, and of religion as a whole, he finds at once a gathering of one's powers into unity and realization of a superior and saving presence. There occurs an inflow of energy that by its applications, its individual and social values, makes good its claim as to its source. Into the logical character of such pragmatic arguments this is not the place to inquire, but it is worthy of note that this conclusion of our most informed American mystic is an acknowledgment that modern psychology has disproved the quasi-psychology of traditional mysticism. The sphere within which the reality of the mystic's insight is to be made good is neither the moment of vision, nor the heightened individual energy, but rather the fitting of this energy into the life of society.

Religion and Social Consciousness.—Scott, in "What happened at Pentecost" (an essay in 29), maintains, from a critical study of the New Testament, that the event that figures so prominently in the origins of the Christian church was realization by the group of disciples of a common life, a *koinonia*, which interpreted itself as the coming of the Spirit, and symbolized itself by the loaf. It is important as well as interesting to find thus early in Christianity a counterpart of the present-day tendency to think of God as the

common will. "Saintliness," says Scott, "according to the New Testament conception of it, is a social phenomenon. An isolated or individual 'saint' would have appeared to its writers as little less than a contradiction in terms." Apparently Scott sees no economic significance in the choice of the loaf as a symbol of fellowship. In the same volume, Hadfield, writing on "The Psychology of Power" much in the vein of James's "Energies of Men" (though with even less psychological precision), concludes that a religion of love, if it could make credible a belief in a present divine spirit might furnish the great organizing power whereby our conflicting instincts should become a source of strength rather than of dispersion of energy. Lyman (17) finds in the Hebrew prophets, Jesus, and several moderns instances of "moral creativity." This is not merely inner harmony and increased power for work, but also realization of participation in an objective and inclusive process of creative control, an eternal creative good will. This good will is not here inferred as the cause of a psychical process. On the contrary, "in this type of religion the process of discovering values and reconstructing facts in accordance with those values—which is what moral creativity means—is felt to be more real than the facts taken by themselves. It is felt to be the fullest contact between the individual soul and the environing world," and "continuous with a greater moral creativity in the universe at large." The reviewer would point out that a remarkable convergence appears in the conceptions of religion arrived at respectively by Campbell from a study of *mana*, Jones from a study of mysticism, Scott from a study of primitive Christianity, and Lyman from a study of creative personalities.

Contemporary Religious Indifference and Religious Unrest.—Extensive studies of British (3) and American (7) soldiers—studies undertaken in the interest of religion rather than of science—reveal widespread ignorance of religious tenets among the non-Catholic, non-Jewish parts of the population, and likewise great indifference or opposition to the churches. The actual religion of the general run of the soldiers is a rather vague faith in God which in emergencies easily becomes quasi-magical. Deamer (9) says that church-going has declined steadily and rapidly, and that there is, in fact, little to draw average sensible folk to church. The remedy, he thinks, lies in making a better appeal to esthetic appreciations. In contrast to this is Drake's array (10) of literary evidence that our intellectuals, though they are letting go older conceptions of

God, are acutely interested in finding some compensating expression for the deeper phases of moral experience. Another active interest, Pratt says (22), concerns the future life. From question-circular returns he infers that belief in immortality is still general and vital among Christians, but unfortunately neither his questionnaire nor the distribution of his respondents is given. That there is a diminution of belief, however, he admits. He accounts for it as follows: (1) This life has grown more attractive. (2) Authority over beliefs has been shattered, and a negative attitude created. (3) The negative attitude in scientific circles is not due to superior knowledge but to a habit of viewing mind from a particular point of view. (4) This intellectual habit has acquired the force of authority. There is a will-not-to-believe as well as a will-to-believe. (5) It is difficult to imagine any details of a future life.

Religious Growth and Religious Education.—Hartshorne (12) presents a critically considered method for observing the religious growth of children, together with first-hand data and analyses. The tendency of these data and analyses is to show a larger degree of continuity in the moral and religious life at different ages than has been assumed. Lysander (*pseud.*) (18) gives interesting evidence as to the manner in which the social environment can control an individual's inner experience. Vorbrodt (31), considering the problem of religious instruction in the state schools of the new Germany, maintains that a scientific and therefore universal basis for religious instruction can be found in "psychobiology" only. Official theology has not pursued this route. The necessary psychological approach to religion can be included in the instruction in morals.

Tendencies in the Direction of Empirical Theology.—Drake (11) maintains that the experience upon which belief in God rests relates to (1) Natural forces, (2) Our spiritual heroes, and (3) Our inner moral life. This three-foldness of the experience gives more countenance to the trinitarian formula than to the unitarian. A group of writers, chiefly English (28, 29) has produced two volumes of essays that have the intent of reinforcing and reconstructing Christian faith by the help of the sciences, particularly psychology. Reference has already been made to the more significant (psychologically) of these essays. In others there is an over-confident, insufficiently technical use of psychological concepts. A "psychology of grace" (29), a "psychology of inspiration" (29), and a "psychology of public worship" (28) are offered, but

none of them can properly be considered as psychology at all. "The language of the soul" (29) in the sacraments includes the remarkable assertion that in infant baptism "parents and sponsors offer, not only their own faith, but the faith of the church at large, on the child's behalf; and if they are godly they thus bring to the delicate mind of the unconscious infant the telepathic force of love and hope." Of three other works (2, 19, 20) it is sufficient to say that they are symptomatic of an increasingly intelligent use of psychology in religious and theological discourse.

Miscellaneous Topics.—Lalo (13) finds that the earliest art products are connected with religion rather than magic. The notion of the totem contains in itself virtually all forms of the ideal—moral, scientific, esthetic. In the representations of the totem we have art as an integral part of religion itself. The religious festival tends, however, to liberate art by stimulating sentiment so much that it overflows the bare demands of ceremonial tradition. In the end esthetic consciousness and religious consciousness pursue relatively independent lines of development, though they maintain close relations of interaction. Lawrence (14) calls attention to the early appearance and the persistence of ethical elements in prayer. Schroeder (25) continues a discussion that has been going on for some years concerning the authorship of the Book of Mormon.

In addition to the work of Berguer already mentioned, special reviews are devoted in this number to works by Cooke (8) and Schleiter (24).

REFERENCES

1. ACKERMAN, H. C. *The Psychology of Mysticism and the Divine Immanence.* *Harv. Theol. Rev.*, 1919, 12, 427-434.
2. ANDERSON, J. B. *Applied Religious Psychology.* Boston: Badger, 1919. Pp. 83.
3. ANON. *The Army and Religion; An Enquiry and its Bearing upon the Religious Life of the Nation.* London: Macmillan, 1919. Pp. xxxi + 455.
4. DE BANCELS, J. L. Sur les origines de la notion d'âme. A propos d'une interdiction de Pythagore. *Arch. de psychol.*, 1918, 17, 58-66.
5. BERGUER, G. *Quelques traits de l'avis de Jésus au point de vue psychologique et psychanalytique.*
6. CAMPBELL, I. G. *Manaism: a Study in the Psychology of Religion.* *Amer. J. of Psychol.*, 1918, 29, 1-49.
7. THE COMMITTEE ON THE WAR AND THE RELIGIOUS OUTLOOK. *Religion among American Men as Revealed by a Study of Conditions in the Army.* New York: Association Press, 1920. Pp. xvi + 155.
8. COOKE, G. W. *The Social Evolution of Religion.*
9. DEARMER, P. *The Art of Public Worship.*
10. DRAKE, D. *Seekers after God.* *Harv. Theol. Rev.*, 1919, 12, 67-83.

11. DRAKE, D. An Empirical View of the Trinity. *Monist*, 1918, 28, 135-141.
12. HARTSHORNE, H. *Childhood and Character*. Boston: Pilgrim Press, 1919. Pp. viii + 282.
13. LALO, C. L'art et la religion. *Rev. Phil.*, 1919, 88, 257-296.
14. LAWRENCE, E. Prayer: its Origin, Meaning and Ethical Significance. *Monist*, 1918, 28, 410-432.
15. LEUBA, J. H. The Yoga System of Mental Concentration and Religious Mysticism. *J. of Phil., Psychol., &c.*, 1919, 16, 197-206.
16. LLOYD, A. H. When Gods are Born. *Int. J. of Ethics*, 1919, 29, 273-283.
17. LYMAN, E. W. *The Experience of God in Modern Life*. New York: Scribner, 1918. Pp. ix + 154.
18. LYSANDER, G. (Pseud.) A Boy's Religious Autobiography. *Relig. Educ.*, 1920, 15, 23-26.
19. MACKAY, W. M. *The Disease and Remedy of Sin*. London: Hodder & Stoughton, 1919. Pp. xii + 308.
20. MAHONEY, C. K. *Social Evolution and the Development of Religion*. New York: Methodist Book Concern, 1919.
21. MOREL, F. *Essai sur l'introversion mystique; étude psychologique de Pseudo-Denys l'Areopagite et de quelques autres cas de mysticisme*. Geneve: Kündig, 1918. Pp. 338.
22. PRATT, J. B. Some Psychological Aspects of the Belief in Immortality. *Harv. Theol. Rev.*, 1919, 12, 294-314.
23. RANDELL, J. H., JR. Instrumentalism and Mythology. *J. of Phil., Psychol., &c.*, 1919, 16, 309-324.
24. SCHLEITER, F. *Religion and Culture: A Critical Survey of Methods of Approach to Religious Phenomena*.
25. SCHROEDER, T. Authorship of the Book of Mormon. *Amer. J. of Psychol.*, 1919, 30, 66-72.
26. SCHROEDER, T. Revivals, Sex and the Holy Ghost. *J. of Abnor. Psychol.*, 1919, 14, 34-47.
27. STERN, E. Beitrag zur Religionspsychologie. *Zsch. f. angewandte Psychol.*, 1919, 15, 55-69.
28. STREETER, B. H., and others. *Concerning Prayer: its Nature, its Difficulties and its Value*. London: Macmillan, 1916. Pp. xiii + 502.
29. STREETER, B. H. (ed.) *The Spirit—the Relation of God and Man considered from the Standpoint of Recent Philosophy and Science*. By A. Seth Pringle-Pattison, and others.
30. THOMAS, N. W. Magic and Religion. *Folk-Lore*, 1918, 29, 99-112.
31. VORBRODT, G. Religionspsychologische Grundlagen zum Gutachten über Religions- und Moralunterricht. *Zsch. f. angewandte Psychol.*, 1919, 15, 411-419.
32. WELLS, W. R. The Biological Foundations of Belief. *J. of Phil., Psychol., &c.*, 1919, 16, 259-271.
33. WOODBURN, A. S. The Relation of Religion to Instinct. *Amer. J. of Theol.*, 1919, 23, 319-344.
34. WRIGHT, J. The Foundations of Belief among Primitive Men. *Scien. Mo.* 1918, 7, 495-510.

CRIME AND SOCIAL PSYCHOLOGY

BY ANGIE L. KELLOGG

Waterman, N. Y.

During the past year, the emphasis in articles on crime has been very largely upon psychiatric problems. Malzberg (10) in a study of 395 sample cases of felons disposed of in the Court of Special Sessions found that 16.2 per cent. were mentally disordered. Of these, 2.3 per cent. were insane; 2.0 per cent. were psychopathic; .3 per cent. were emotionally unstable; and .5 per cent. were alcoholic psychoses. Healy (6) and Bronner (3) argue that the only approach to rational treatment of criminals is the recognition of conditions due to epilepsy, chorea, syphilis, hysteria, psychoses, mental defect, etc. Jarrett (8) stresses the need of the early discovery of psychiatric difficulties in the individual criminal so that social agencies shall waste less effort through misdirected treatment. Salmon (14) likewise sets forth the importance of psychiatric research not only as an aid to courts and prisons in their dealings with individual delinquents, but also as a part of the general progress in psychiatry. Spaulding (15) reports and interprets three interesting cases of larceny in which the anti-social conduct appeared to represent an effort to compensate for emotional repression. The analyses of these cases indicates the value of a knowledge of mental hygiene principles, court clinics, and institutional laboratories for recognition of the mental conflicts and social maladjustments which make for anti-social conduct.

Glueck (5), Spaulding (16), and Taft (18) consider the question of special training for psychiatric social workers. All agree that their preparation should include a knowledge of the more normal and general principles of psychology and sociology; and, as to the more abnormal conditions of psychiatric difficulties, such a knowledge of them as would be sufficient to enable the workers to recognize these cases and refer them to the proper expert.

Davis (4) discusses typical cases of psychopathic delinquents from the point of view of institutional management showing the need of scientific training for the head and staff of a correctional institution and a proper equipment for dealing with cases of mental disturbance. Reference is made to types of such disorders met with in these institutions, such as, manic depressive temperament and neuroses, including pathological lying and stealing, epilepsy

with hysteroid manifestations, neuro-syphilis, alcoholic deterioration, psychopathic personality with a varied assortment of traits, including paranoid tendencies, aggressive sex manifestations, excited and even assaultive behavior when whims of the moment were not obtained. Several cases of psychopathic delinquents at Bedford Reformatory are described and analyzed in detail.

Anderson (1) says the existence of the recidivist proves our failure to cure crime; and that the most important underlying causative factor in this failure is mental disease. McCord (9) urges not only that the courts and institutions be provided properly with psychiatric facilities, but that there be proper psychiatric commitment laws so that mentally disturbed and defective delinquents shall not be sent to reform schools. Arnold (2) recommend that in cases of crime punishable by imprisonment, the question of responsibility be not submitted to a jury; that the sentence imposed shall be based upon a study of the offender by experts; that legal provision be made for the transfer of criminals from one institution to another where it seems that treatment best suited to the individual needs can be given; that there be no maximum sentence; and that, in matters of pardons and commutations, careful consideration be given to mental age and stability.

To give insight into drug addictions, Stanley (17) narrates several case histories of drug addicts who had been sentenced to San Quentin Prison. A study of delinquent girls by Purcell-Gould (13) shows the complexity and inter-activity of the causes of delinquency by means of tables and examples. The tables include ages, birthplaces, occupation, wages, nationality, religion, church attendance, education, recreation, ability to cook and sew, fondness for dancing, participation in games and sport, shows, reading, family relations. Examples are given showing relation between the Uniform and Delinquency, of an illegitimate girl who became immoral, of a prostitute mother who encouraged the delinquency of her daughter, of a delinquent girl with immoral father, of girls who were immoral for gain, etc.

Hoffman (7) states that statistics of the Cincinnati Court of Domestic Relations reveal that a psychological situation or psychopathological condition exists in 75 per cent. of the cases of divorce. For proper treatment of family troubles, such as desertion, non-support, divorce, and the like, it is as necessary to have a Family Court equipped with facilities, such as psychological clinics, social investigators, etc., as it is necessary to have such facilities in ascer-

taining the mental, physical and social causes in juvenile delinquencies; which are after all but one phase of family disorders.

Very few books on crime have appeared recently. Mercier (11) sets forth the theory that crime is the product of two factors, opportunity and temperament, proclivity and temptation, heredity and stress, the inner and the outer aspects of conduct, the environmental factor and the inherent. Every person is a potential criminal; every person has his possible breaking point; the more powerful the one factor is, the less of the other is necessary to reach this point of yielding to crime. The difference between a criminal and a law-abiding man is not one of absolute qualities, but a difference in combinations of degrees of similar qualities.

Williams (19) has published an interesting study of 470 boys and men between the ages of six and twenty two committed to the Whittier school; Mexican Indian, Colored, and Native American White Stock.

Miner (12) argues that deficiency and delinquency are not mutually inclusive; that present day tests, inasmuch as they exaggerate qualitative differences, are not reliable for diagnoses; that that unscientific character of the tests has been demonstrated by the several various estimates that have been made as to the proportion of defectives in the school and general populations. He therefore suggests a "percentage definition" of mental deficiency; and discusses what he means thereby at length.

REFERENCES

1. ANDERSON, V. V. Mental Disease and Delinquency. *Mental Hygiene*, 1919, 3, 177-198.
2. ARNOLD, V. P. Insanity and Criminal Responsibility. *J. of Amer. Inst. of Crim. Law & Criminol.*, 1919, 10, 184-187.
3. BRONNER, A. F., & HEALY, W. Medico-Psychological Study of Delinquents. *Mental Hygiene*, 1919, 3, 445-452.
4. DAVIS, K. B. Some Institutional Problems in Dealing with Psychiatric Delinquents. *J. of Amer. Inst. of Crim. Law & Criminol.*, 1919, 10, 485-408.
5. GLUECK, B. Special Preparation of the Psychiatric Social Worker. *Mental Hygiene*, 1919, 3, 409-419.
6. HEALY, W., & BRONNER, A. F. Medico-Psychological Study of Delinquents. *Mental Hygiene*, 1919, 3, 445-452.
7. HOFFMAN, C. W. Social Aspects of the Family Court. *J. of Amer. Inst. of Crim. Law & Criminol.*, 1919, 10, 409-422.
8. JARRETT, M. C. The Psychiatric Thread Running through all Social Case Work. *Mental Hygiene*, 1919, 3, 210-219.
9. McCORD, C. P. Physical and Mental Conditions of Delinquent Boys. *J. of Delin.*, 4, 1919, 165-185.

10. MAL-BERG, B. On the Relation of Mental Defect to Delinquency. *J. of Amer. Inst. of Crim. Law & Criminol.*, 1919, 10, 218-222.
11. MERCIER, C. A. *Crime and Criminals*. New York: Holt, 1919. Pp. 290.
12. MINER, J. B. *Deficiency and Delinquency, An Interpretation of Mental Testing*. Educational Psychology Monographs, 21. Baltimore: Warwick & York, 1918. Pp. 355.
13. PURCELL-GOULD, J. Study of One Hundred and Thirty-one Delinquent Girls Held at the Juvenile Detention Home in Chicago, 1917. *J. of Amer. Inst. of Crim. Law & Criminol.*, 1919, 10, 442-476.
14. SALMON, T. W. Some New Problems for Psychiatric Research in Delinquency. *J. of Amer. Inst. of Crim. Law & Criminol.*, 1919, 10, 375-384.
15. SPAULDING, E. R. Three Cases of Larceny in which the Anti-Social Conduct Appeared to Represent an Effort to Compensate for Emotional Repression. *Mental Hygiene*, 1920, 4, 82-102.
16. SPAULDING, E. R. The Training of the Psychiatric Social Worker. *Mental Hygiene*, 1919, 3, 420-426.
17. STANLEY, L. L. Drug Addictions. *J. of Amer. Inst. of Crim. Law & Criminol.* 1919, 10, 62-70.
18. TAFT, J. Qualifications of the Psychiatric Social Worker. *Mental Hygiene*, 1919, 3, 427-435.
19. WILLIAMS, J. H. *The Intelligence of the Delinquent*, J. of Delin. Monographs, 1, Whittier State School, Calif., 1919. Pp. 198.

SPECIAL REVIEWS

Quelques Traits de la Vie de Jésus au point de vue Psychologique et Psychanalytique. G. BERGUER. Genève, 1920. Pp. cviii + 267.

As long ago as 1855, Littré, in his preface to the *Life of Jesus* by Strauss, wrote of the biblical stories, "Their reality is mental or psychological. If they do not represent facts that have actually happened, they express intellectual and moral motives which have modified society more profoundly than the gravest material events could have done" (quoted by Berguer). It remained for G. Stanley Hall¹ to write from this point of view the first systematic life of Jesus. It is most unfortunate that when he wrote the book under review, Berguer was not acquainted with Hall's pioneer's work. In the treatment of several of their common problems, Berguer would have found useful anticipations in that work, both in the application of ordinary psychological principles and of Freudian doctrines. With Hall, these doctrines occupy a secondary place. The distinctive characteristic of Berguer's study is that it represents a thorough attempt to use the Freudian doctrines in explanation of the wonderful traditions connected with the birth and life of Christ.

We need not concern ourselves here with the merely historical criticism, nor with the exposition of Freudian theories which take up a considerable part of the book. The main question this book raises for us is concerning the utility of the Freudian theories—a question connected with that of their validity. What is gained, for instance, by introducing the concepts "censor," and "introversion" in the explanation of the mystery religions? Is anything valuable added to the interpretation of the legend of Christ's birth by regarding it as a product of the "*roman familial*." Does the baptism of Christ and his temptation in the desert receive any new light from being called an introversion crisis? Again, can the Œdipus complex be used to explain in a probable and useful manner the three incidents of the baptism: the dove, the open heavens, and the voice announcing Christ's divine sonship? The opinion of some psychoanalysts that the parted clouds symbolize

¹G. STANLEY HALL. *Jesus, the Christ, in the Light of Psychology.* 2 volumes. 1917.

the female genitals I would be tempted to regard as a libidinous jest, did I not know how seriously interpretations of that type are offered. Is it legitimate and enlightening to regard Christ's conception of the divine Father and the perplexing saying about hating one's own father and mother and wife and children and brethren and sisters, in the light of that same Œdipus complex and of the principle of the "ambivalence of the feelings"? I confess that despite the ingenuity and real psychological acumen of the author, I have not been won to the opinion of the Freudians with regard to the value of the complicated obstetrical psychology of the Viennese physician when applied to the problems of this book. A well equipped psychologist could, perhaps, have brought out whatever in this interesting book is really significant and valuable, even though he should have been ignorant of most of the Freudian doctrines.

In closing the book, I reread with a sense of deep gratification Professor Flournoy's utterance about the meaning to be attached to the Œdipus complex. He would interpret it in a sense "*doublement ou triplement métaphorique*." One wishes that the author, who quotes this passage approvingly, had conformed more closely than he did to that interpretation. But, whatever the conclusion to which one may come regarding the value of the Freudian conceptions, Berguer has undoubtedly placed all psychologists in his debt by this competent application to religious problems of a group of conceptions now claiming attention.

I. H. LEUBA

BRYN MAWR COLLEGE

The Relation between Religion and Science: A Biological Approach.

A. S. WOODBURN. Chicago: University of Chicago, 1920.
Pp. 103.

Religion and science are different attitudes referring to the same extra-human environment, but they have a different technique (pp. 30, 33). Both religion and science owe their origin to a multiplicity of causes of an instinctive nature (p. 89). These propositions express the main theses of Woodburne's monograph. Following two introductory chapters on method and on the influence of philosophical thought upon the understanding of religion, the author takes up in four chapters (pp. 44-90) the definition of instinct, the description of the more important of the specific instincts, and their relation to religion. In holding that there is no specific

religious instinct but that, at the root of both religion and science, there are to be found a number of the common instincts, the author is in agreement with the view now prevalent among psychologists. He might have generalized his statement and said that all human activities and institutions are expressions of instincts and instinctive tendencies.

Woodburne is one of the many who, having been compelled to reject the doctrinal foundation of every religion that has ever existed, define religion in terms general and abstract enough to transcend the social institutions that go by that name. Religion is, for these persons, "an attitude," "an habitual disposition to seize upon the spiritual elements of the extra-human environment and to organize and conserve them in the interests of life." Or, more generally still, they call religious any effort at social betterment by non-mechanical means; they even find it sufficient to say that religion concerns itself with value, while science is concerned with existence. Thanks to their remoteness from the concrete facts of religion, the practical problems of the present are for them as non-existent. They find it possible, for instance, to set aside the undeniable fact that all the religions that now exist or have ever existed—I speak of religion, not of magic—revolve around gods regarded as in direct, personal communication with man. (The very slight and transitory success of Comtisme was proportional with the degree of success with which the disciples of the philosopher personified humanity as the *Grand Etre*.)

Generalizations of the sort instanced above have their place and do no harm when the sphere of their usefulness is understood; but they are like certain highly abstract economic theories that can have no direct application to our banking system, our trusts, our tariff, or any other existing economic institution.

JAMES H. LEUBA

BRYN MAWR COLLEGE

The Social Evolution of Religion. G. W. COOKE. Boston: Stratford Co., 1920. Pp. xxiv + 416.

This book will help bridge the gap that divides the leaders in the psychology and the philosophy of religion from the rank and file of the church goers. It is the outcome of a life of study and heart searchings by one bent upon discovering the real substance of religion. In successive chapters, the Communal, Tribal, Feudal, National, International, and Universal Religions are set forth as

an ascending social development. Although it makes no claim to deep professional scholarship, the book is well informed, and is pervaded by a spirit of earnestness and hopefulness that carries the reader forward without effort.

The last chapter is a brief survey of some of the most significant recent literature on religion. To those who look for signs of the times, it may be the most interesting chapter. These signs all point, according to the author, towards a religion free from the classical supernaturalism. Mr. Cooke is one more witness to the strength of the growing movement towards a less metaphysical and more pragmatic religion: "Religions are true to those who accept them as true, and to the extent to which they give meaning to the life of the group or the individual" (p. xix). Although the opinion expressed in this quotation is becoming very popular, it is hardly the last word that is to be said regarding the "truth of religion."

JAMES H. LEUBA

BRYN MAWR COLLEGE

Religion and Culture: A Critical Survey of Methods of Approach to Religious Phenomena. F. SCHLEITER. New York: Columbia University Press, 1919. Pp. 206.

The subtitle of this book would describe it more accurately if the term "magical" was added to "religious." There is much analytical keenness in this vigorous and well informed arraignment of every one of the methods and of the concepts in use in the study of these topics. The main criticisms fall upon the intensive study of a limited geographical area, the comparative method, the use of ethnographical analoga, of the concepts of animism, spirit, mana, and causality.

A marked iconoclastic tendency remains obvious in spite of the "softening" which, we are told in the preface, was undergone by the text at the instigation of friendly guides. But inasmuch as the criticisms are, on the whole, sound, we cannot regard with disfavor the author's iconoclasm. We shall rather look forward with hopefulness and some eagerness to the constructive work that should be forthcoming, it seems, from one equipped with so wide a background of information, so keen an intelligence, and so deep an interest in ethnographical and anthropological studies.

Few students working in the field covered by this essay could fail to be the gainer for reading these pages. This we say despite

the obviousness of the only positive conclusion offered by the author, namely that the methods and concepts which he has so mercilessly criticised "should be applied with much more critical caution than is customary." This advice, given in the last paragraph of the book with direct reference to the concept of causality, is the logical if unwritten, practical conclusion of every section of the book.

JAMES H. LEUBA

BRYN MAWR COLLEGE

Animism or Thought Currents of Primitive Peoples. G. W. GILMORE.
Boston: Marshall Jones Co., 1919. Pp. xii + 250.

Anything which helps us to understand the origin and development of society is of practical value. This small, well-written book describes a stage of early culture which has come to be recognized as a substratum of all civilization. In sixteen brief chapters, that which is known or conjectured about the origin of the beliefs in human and other souls and in spirits, about the nature of these souls and spirits and their relation to the bodies which they animate and to other bodies and souls, are set forth and abundantly illustrated. The treatment of these topics is sufficiently thorough for all except the specialist.

JAMES H. LEUBA

BRYN MAWR COLLEGE

The Science of Power. BENJAMIN KIDD. New York: Putnam, 1918. Pp. viii + 318. \$2.00.

In social theory this book represents the climax of that anti-intellectualism which had its birth in James's *Principles of Psychology* and which in philosophy has been sponsored by such writers as Bergson and F. C. S. Schiller. It is characterized by the same penetrating intuitions and the same exasperating extravagances as the author's first book, *Social Evolution*. If one is looking for careful, scientific analysis the book will be a disappointment; but if one values prophetic insight, even in spite of scientific obscurities and inconsistencies, the book will be found most stimulating.

The thesis of the book is that "Civilization has its origin, has its existence, and has the cause of its progress in the emotion of the ideal." "It is his capacity for emotion of the ideal," Mr. Kidd informs us, "and not his reasoning mind which constitutes Man, the God-like, and which separates him from the brutes" (p. 132). "The great secret of the coming age of the world is that civilization rests not on Reason but on Emotion" (p. 124). "It is through

emotion only that the present can be subordinated to the future and the organized will of civilization transmitted from one generation to the next through the young" (p. 202). Hence "the science of creating and transmitting public opinion under the influence of collective emotion is about to become the principal science of civilization" (p. 130). It is the "science of power."

All this, Mr. Kidd argues, is sufficiently proved by Germany. Germany's efficiency and power were due not so much to her knowledge of physical science, as to her ability to organize collective emotion. Only in Germany this new "science of power" was used in a barbarous way and for a pagan end. But Germany proves what might be done if collective emotion were directed to a right end in the interest of a social utopia.

Thus the author reinstates and defends again the thesis of his first book, *Social Evolution*; namely, that "there is no rational sanction for the conditions of progress" (p. 190). "The individual dies that the world may live," he tells us, "cannot really be expressed in any term of the individual's reason" (p. 205); for "reason is the highest form of the sum of the Self-Regarding emotions" (p. 197)! Reason must, therefore be controlled by "the emotion of the ideal," which the author defines as "the highest form of the sum of the Other-Regarding emotions" (p. 198).

Such an astonishingly narrow conception of the "rational," together with confusing definitions, lends some plausibility to the author's emotional theory of society and civilization. But as Professor Giddings, who contributes a critical introduction to the book, says: "The mechanism through which power is controlled, regulated, and applied is a product of intellect, and Mr. Kidd arrives at an amazing conclusion when, under-valuing the intellectual factor, he propounds as theoretically and practically true the dogma 'the emotion of the ideal is the supreme principle of efficiency in the collective struggle of the world.'"

CHARLES A. ELLWOOD

UNIVERSITY OF MISSOURI

Cultural Reality. FLORIAN ZNANIECKI. Chicago: University of Chicago Press, 1919. Pp. xv+ 359. \$2.50 net.

The development of social knowledge is bound to react upon the philosophical disciplines. Abundant evidence of this is already beginning to show itself in philosophical literature, and this book should be welcomed as opening up new philosophical horizons.

The author, who is a lecturer in the University of Chicago, attempts to formulate and justify a conception of reality which will be more helpful in the social sciences than traditional conceptions. He opposes what he terms "culturalism" to both idealism and naturalism. He points out that the only theory of "mind" based upon empirical data which we have is a theory that takes mind as a product of culture. But it is equally true that man is absolutely unable to perceive or to conceive any other "nature" than the one he sees through the *prisma* of culture, absolutely unable to act upon nature otherwise than in culturally determined ways. Our whole world, Dr. Znaniecki points out, is permeated with culture, and we can no more imagine what was the world of our pre-human ancestors, than we can imagine the fourth dimension. "There is no way out of culture." Hence, both naturalism and idealism must be replaced by "culturalism."

Upon this basis Dr. Znaniecki discusses experience and reflection, the concrete, empirical object, and historical reality, the practical organization of reality, and the theoretic orders of reality.

The book is a contribution of merit to the philosophy of the social sciences as well as a contribution to a new and promising line of development in philosophical thinking. CHARLES A. ELLWOOD

Outlines of Social Philosophy. J. S. MACKENZIE. London: George Allen and Unwin, 1918. Pp. 280.

Professor Mackenzie has furnished us with one more eminently useful textbook. The general position is that of the English neo-Hegelian tradition, as represented by Bosanquet. But the author is much more of a moderate than Bosanquet, and stands in a more independent relation to the Hegelian theory of the state. He holds, for example, that Hegel's teachings tended "to discredit attempts to secure any larger mode of unity, and, on the whole, to represent war as being necessarily a permanent institution." And he adds that though Bosanquet "does not follow him entirely in this, . . . he appears to do so to a considerable extent"—which, from the mild-mannered Professor Mackenzie, is severe criticism indeed.

An interesting feature of the volume is its repeated utilization of Plato's *Republic* as a point of departure for its discussions. Incidentally, some excellent comment is made upon those features of the ideal state that are most apt to be misunderstood by beginners—sometimes even by the learned. THEODORE DE LAGUNA

BRYN MAWR COLLEGE

Crime and Criminals, being the Jurisprudence of Crime, Medical, Biological, and Psychological. C. MERCIER. New York: Henry Holt, 1919. Pp. vi + 290.

The main topics of the book are the factors of crime (a psychological analysis of causation), the nature and kinds of crime, the definition of the criminal, and the treatment of crime. The method of the author is deductive. All conduct—and crime is a kind of conduct—depends on two classes of factors: those of internal and those of external origin. The author criticizes former theories of crime for their exaggerated emphasis on one or the other of these classes of factors. The internal factor depends, as far as we know, on instinct and intelligence. The external factor is made up of both circumstances of the present and circumstances of the past. Among the latter, the most important are those that have modified instinct.

In a discussion of the kinds of crime, principles of classification are expounded. Goring's classification is criticized and the author offers his own, based on the principle of incidence of injury to society. This classification embraces, (1) internal crimes against the principle of society itself, (2) public crimes against an individual state, (3) private crimes against the individual in his private capacity. The discussions of so-called ecclesiastic offenses and of suicide are of special interest. The analysis of family and racial offenses is remarkably systematic.

Criminality is dealt with from the point of view of the almost imperceptible line separating the criminal from the law-abiding citizen, and of the various types of criminals. A discussion of seven theories of crime is concluded by a criticism of Goring's theory because it rests upon only those 15 per cent. of offenders who are convicted for major offenses, a selected group within a special group. The author's theory rests on the interplay of the two variable factors of instinct and circumstance. In the total absence of either, no crime will be committed. "Crime . . . is due to temptation . . . acting upon the predisposition of the offender. . . . For crime as for madness every man has his breaking strain." This leads back to the doctrine of Goring that the criminal is a normal man differing quantitatively not qualitatively from the righteous. The sentences quoted express the main thesis of the book.

The kinds of criminals are differentiated according to the height of the breaking point and the kind of temptation most

effective. The high breaking point marks the occasional criminal, and the low the habitual. The moral imbecile is the extreme type of the habitual criminal.

The book concludes with a brief outline of ten factors upon which depends the degree of turpitude of the criminal.

RUTH WOODRUFF

BRYN MAWR COLLEGE

BOOKS RECEIVED

WATSON, J. B. *Psychology from the Standpoint of a Behaviorist*. Philadelphia: Lippincott, 1919. Pp. ix + 429.

LEIGHTON, J. A. *The Field of Philosophy*. (2d rev. ed.) Columbus: R. G. Adams & Co., 1919. Pp. xii + 485. \$2.00.

SEASHORE, C. E. *The Psychology of Musical Talent*. New York: Silver, Burdett, 1919. Pp. xvi + 288. \$2.40.

WARREN, H. C. *Human Psychology*. Boston: Houghton Mifflin, 1919. Pp. xx + 460. \$2.75.

MORDELL, A. *The Erotic Motive in Literature*. New York: Boni & Liveright, 1919. Pp. 250. \$1.75.

BENEDICT, F. G., MILES, W. R., ROTH, P., & SMITH, H. M. *Human Vitality and Efficiency under Prolonged Restricted Diet*. Washington: Carnegie Institution, 1919. Pp. xi + 701.

DESSOIR, M. *Vom Jenseits der Seele*. Stuttgart: Ferdinand Enke, 1919. Pp. xvi + 354.

CUNNINGHAM, H. E. *An Introduction to Philosophy*. Boston: Badger, 1920. Pp. 257. \$1.75.

BERGUER, G. *Quelques Traits de la Vie de Jésus au Point de Vue Psychologique et Psychanalytique*. Paris: Edition Atar, 1920. Pp. cviii + 263. Fr. 15.

FRÖBES, S. J. *Lehrbuch der experimentellen Psychologie*. Freiburg: Herdersche Verlagshandlung, 1917. Pp. xxvi + 605.

PIKLER, J. *Schriften zur Anpassungstheorie des Empfindungsganges*. Leipzig: Johann Ambrosius Barth, 1919. Erstes Heft, *Hypothesenfreie Theorie der Gegenfarben*. Pp. viii + 104. Zweites Heft, *Theorie der Konsonanz und Dissonanz*. Pp. 34.

LIPMANN, OTTO. *Psychologie für Lehrer*. Leipzig: Barth, 1920. Pp. vii + 196.

- KOFFKA, K. *Beiträge zur Psychologie der Gestalt*. Leipzig: Barth, 1919. Pp. v + 323.
- COHEN-KYSER, ADOLF. *Rückläufige Differenzierung und Entwicklung*. Leipzig: Barth, 1918. Pp. 85.
- MARTENS, H. A. *Psychologie und Verkehrswesen*. Leipzig: Barth, 1919. Pp. 14.
- LIPMAN, O. *Die psychische Eignung der Funkentelegraphisten*. Leipzig: Barth, 1919. Pp. 40.
- DITTLER, R. *Stereoskopisches Sehen und Messen*. Leipzig: Barth, 1919. Pp. 36.

NOTES AND NEWS

THE following items have been taken from the press:

DR. T. R. GARTH, of the West Texas State Normal College, has been appointed adjunct professor of psychology at the University of Texas.

LIEUT. COL. C. S. MYERS, F.R.S., of the University of Cambridge, has been elected to a fellowship in Gonville and Caius College, Cambridge.

DR. R. T. WILTBANK, of the University of Washington, has been appointed assistant professor of psychology in the University of Chicago.

DR. W. R. AMES has been appointed assistant professor of education and psychology in the University of Montana.

A FUND for research in neurology has been given to the Neurological Society of Paris as a memorial to the late Professor Dejerine.

At the annual meeting of the New York Academy of Sciences, Dr. E. L. Thorndike was elected President and Dr. R. S. Woodworth was elected one of the vice presidents.

DR. R. P. ANGIER, professor of psychology at Yale University, has been appointed dean of the common freshman year.

THE
PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

CUTANEOUS AND KINESTHETIC SENSES

BY JOHN T. METCALF

Depart. of Public Welfare, State of Illinois

In the field of cutaneous sensation the literature of the past three years includes one study of pressure sensations, one of heat, and one of pain. The first, that of Schulte (17), has to do with the effect upon one pressure sensation of another aroused at the same time. Three mechanically applied and electrically controlled stimuli were used. They were applied to the backs of the index and middle fingers of the subject's right hand. One, the standard stimulus, was constant in intensity at 125 g., and in its duration of 0.5 sec. A second, the inducing stimulus, was taken at three intensities, 25 g., 100 g., and 175 g. A third, the comparison stimulus, was varied in intensity until it appeared equal to the standard. It was always 0.5 sec. in duration, and followed the standard with an interval of 0.5 sec. between the removal of the latter and its own application. The moment of application of the inducing stimulus was varied from 2.0 sec. before the application of the standard to simultaneous application with it. It was not removed until after the subject's judgment had been made. The effect of the inducing stimulus was found to be nearly always one of summation, and this effect was progressively greater with greater intensities of the inducing stimulus. It was greatest when the inducing stimulus was applied simultaneously with the standard, and decreased when the application of the inducing stimulus came sooner than that of the standard. Attention to the inducing stimulus increased its effect. In a theoretical discussion the author purposely leaves aside physiological concepts of summation and interprets his results on the basis of apperceptive complexes.

Cutolo (8) attacks the problem of whether or not heat is aroused by a simultaneous stimulation of warm and cold spots. His experiments consist of two series. In the first the Zimmermann thermesthesiometer was used to stimulate simultaneously with their appropriate stimuli a cold spot and a warm. The distance between the stimulated spots varied from 2 mm. to 9.3 mm., and the period of stimulation was usually 5 sec. The resulting experience was found to be very complex. Heat is reported in the majority of observations, and it is described by such terms as "sting" and "smack." In the second series of experiments a grill was used consisting of eight small glass tubes laid closely side by side. Warm water was run through the even and cold water through the odd numbered tubes. The subject laid his forearm or hand on the grill, the warm water was turned on until warmth was reported, and then the cold water was turned on. The apparatus is found to demonstrate clearly the arousal of heat sensations by the simultaneous application of warm and cold stimuli. The author also finds that heat may mix with other qualities. The question of whether or not heat may appear without the quality of pain he regards as still unsettled.

Adaptation to superficial pain is studied by Strauss and Uhlmann (18). Localized pain spots on the volar surface of the forearm were stimulated with hairs and bristles and by a needle fastened to the shaft of a Head algesimeter. Different intensities of stimulation were used. The stimulus was applied and held while the subject observed the course of the sensation. The writers served alternately as subject and experimenter. Adaptation to pain was found with great regularity. The results show large individual differences, but for both observers the time required for adaptation increases progressively with increase in the intensity of the stimulus.

Binnefeld (6) makes a study of kinesthetic sensations from the muscles of the eyes in the comparison of visual extents. Preliminary experiments were made in the light by comparing pairs of lines or unfilled spaces bounded by points. Further experiments were made in the dark-room with points of light. All experiments were made both monocularly and binocularly. Three arrangements were used. First, the subject followed a single moving point which traversed a given extent. Second, the subject fixated a stationary point while the moving point, starting from the stationary point, traversed a given extent as before. Third, the extents were presented by two points which lit up simultaneously. As measured by the difference threshold, the estimation of extent is of about the

same accuracy under all three of these conditions. This the writer takes to indicate a high degree of importance for kinesthetic sensations in the visual estimation of extents. It is also found that the accuracy of judgment of extent with the free-moving single point is not influenced by the duration of the movement. Goerrig (9) uses the Störriug kinematometer and records the time of horizontal active and passive arm movements with the Hipp chronoscope. He finds that the estimation of the extent of the movements is not immediately dependent upon the perception of their duration, and that with both great and small extents the influence of the duration upon the accuracy of judgement is very small. He finds also that the extents are usually overestimated, an effect which tends to disappear with practice.

An article by Lashley (14) seems to the reviewer to be of great significance for work in the field of kinesthesia. It is a report of a study of the accuracy of voluntary movement in a case in which, owing to an injury to the spinal cord, the structures involved in making the movement were completely anesthetic. Although the subject experienced no sensation from the moving limb, the accuracy with which it was moved a prescribed distance without the aid of vision was not significantly less than that found in a normal subject.

Burt (7) has made a careful study of the perception of slight changes of equilibrium. The subject sat in a chair on a platform so arranged that it could be tilted at a known rate to either side, forward, or backward. He was instructed to react with the appropriate one of two keys as soon as he perceived the direction in which he was being tilted. Two different rates were used, both relatively slow. Of 21 series 18 show a superiority in the detection of lateral over longitudinal movements, with an average superiority of 25 per cent. The apparatus was also arranged so that the platform could be lowered on one side 3 cm. in 150 σ with a negative acceleration. The results show an average difference of 10 per cent in favor of lateral movement. A further study is made of the comparative advantages of dep and stick controls. The standard controls were duplicated in the laboratory, and experiments were made in much the same manner as the foregoing, except that now the subject reacted to the tilt with the control instead of with a key. There seemed to be no advantage of one form of control over the other when the force necessary to move them was the same.

Aimé (1) describes a case of labyrinthine disturbance, the result

of a gun-shot wound, in which the patient was unable to make movements in the vertical direction. When he attempted to climb a ladder, for example, he experienced extreme bodily discomfort. In connection with his study of this case the author raises the question whether there is a special sense of height, concluding that there is no more reason to assume this than there is to assume that there is a special sense of space. The functions of the different structures of the internal ear are also discussed by Bard (2). He suggests that there exists a close similarity between the mediation of tones by the tympanic membrane and the mediation of rhythmic movements by the elastic membranes of the labyrinth. Rhythms, he suggests, like tones may be harmonious or discordant, and there is nothing absurd in supposing that they may be combined into a system quite analogous to music. He points out that just as there are certain reflex accommodations in vision and audition, so also are there reflex accommodations of the static senses. These reflexes, the purpose of which is to enable the sense organs to function as perfectly as possible, form the subject of another paper (3). The same author contributes also a study of the physiological conditions of caloric nystagmus (4). This phenomenon he interprets as a double reflex, in part cerebral and in part cerebellar. The interplay of the two components results in the oscillatory movements of the eyes. Prince (16) has made a study of the effects of rotation and of unilateral labyrinth extirpation in kittens ranging in age from six days to seven weeks. The reactions show progressive changes with increased age. Well-defined labyrinthine disturbance is not found until about the third week after birth.

Equilibrium and Vertigo, by I. H. Jones (10) is a comprehensive summary of the anatomy, physiology, and pathology of the internal ear. The book is intended primarily for the medical practitioner and it contains much clinical material. It takes up at some length the practical uses of a study of the static senses with chapters on aviation and on seasickness. Many constructive suggestions are offered on the use of tests of the internal ear in diagnosis.

Also of interest primarily to the clinician are two articles which have appeared on the so-called "vibratory sensation," i.e., the complex of sense qualities which is aroused when the foot of a vibrating tuning-fork is placed in contact with some subcutaneous bony prominence. Williamson (20) discusses the use of a stimulus of this sort in the diagnosis of certain affections of the spinal cord and peripheral nerves. Symns (19) describes a method of standardizing the examination of cases.

May and Larson (15) use Kalischer's training method with dogs for the purpose of studying the mediation of kinesthetic impulses in the cord. The dogs were trained to take meat only when the right hind leg was held rigidly extended backward. Then the cord was hemisected, at different levels in different dogs. It was found that the dogs' ability to react correctly to the posture tests was unimpaired. The experimenters therefore conclude that some of the fibers mediating kinesthetic impulses decussate within the cord.

Benussi (5) has published the report of an extensive continuation of his thorough work on apparent movement in the cutaneous sphere. The paper does not lend itself to summarization and reference must be made to the original for an appreciation of the many refinements of technique and of the numerous particular results. Tactual illusions are described in two brief notes by Krass (12, 13), and Kollarits (11) gives an account of his observation of a combined tactual and auditory one.

REFERENCES

1. AIMÉ, H. Y a-t-il un sens de la hauteur? *Rev. phil.*, 1918, 86, 136-141.
2. BARD, L. De la perception des mouvements et de leurs formes par le sens de la gyration. *J. de Physiol. et de Pathol. Gen.*, 1919, 18, 70-82.
3. BARD, L. Des réflexes gyratifs. (Réflexes d'adaptation et d'accommodation du sens de la gyration.) *J. de Physiol. et de Pathol. Gen.*, 1919, 18, 83-94.
4. BARD, L. Du rôle des centres nerveux dans la production du nystagmus thermique. *J. de Physiol. et de Pathol. Gen.*, 1918, 17, 788-806.
5. BENUSSI, V. Versuche zur Analyse taktil erweckter Scheinbewegungen (kinematohaptischer Erscheinungen) nach ihren äusseren Bedingungen und ihren Beziehungen zu den parallelen optischen Phänomenen. *Arch. f. d. ges. Psychol.*, 1917, 36, 59-135.
6. BINNEFELD, M. Experimentelle Untersuchungen über die Bedeutung der Bewegungsempfindungen des Auges bei Vergleichung von Streckengrössen im Hellen und im Dunkeln. *Arch. f. d. ges. Psychol.*, 1918, 37, 129-232.
7. BURTT, H. E. The Perception of Slight Changes of Equilibrium, with Especial Reference to Problems of Aviation. *J. of Appl. Psychol.*, 1918, 2, 101-115.
8. CUTOLO, F. A Preliminary Study of the Psychology of Heat. *Amer. J. of Psychol.*, 1918, 29, 442-448.
9. GOERRIG, M. A. Über den Einfluss der Zeitdauer auf die Grössenschätzung von Armbewegungen. *Arch. f. d. ges. Psychol.*, 1917, 36, 293-358.
10. JONES, I. H. *Equilibrium and Vertigo*. Philadelphia: Lippincott, 1918. Pp. xv + 444.
11. KOLLARITS, J. Über eine taktile und akustische Täuschung. *Arch. f. d. ges. Psychol.*, 1918, 37, 403.
12. KRASS. Über eine neue Tasttäuschung. *Arch. f. d. ges. Psychol.*, 1918, 37, 300.
13. KRASS. Über eine neue Tasttäuschung. *Arch. f. d. ges. Psychol.*, 1918, 37, 402.

14. LASHLEY, K. S. The Accuracy of Movement in the Absence of Excitation from the Moving Organ. *Amer. J. of Physiol.*, 1917, 43, 169-194.
15. MAY, E. S. & LARSON, J. A. Posture-sense Conduction Paths in the Spinal Cord. *Amer. J. of Physiol.*, 1919, 50, 204-207.
16. PRINCE, A. L. The Effect of Rotation and of Unilateral Removal of the Otic Labyrinth on the Equilibrium and Ocular Reactions in Kittens. *Amer. J. of Physiol.*, 1917, 42, 308-317.
17. SCHULTE, R. W. Die gegenseitige Beeinflussung von Druckempfindungen. *Psychol. Stud.*, 1917, 10, 339-380.
18. STRAUSS, H. H. & UHLMANN, R. F. Adaptation of Superficial Pain. *Amer. J. of Psychol.*, 1919, 30, 422-424.
19. SYMNS, J. L. M. A Method of Estimating the Vibratory Sensation. *Lancet*, 1918, 194, 217-218.
20. WILLIAMSON, R. T. The Vibrating Sensation in the Differential Diagnosis of Affections of the Spinal Cord and Peripheral Nerves. *Lancet*, 1918, 194, 216-217.

AFFECTIVE PHENOMENA—DESCRIPTIVE AND THEORETICAL

BY H. N. GARDINER

Smith College

Distinguishing pleasure and the consciousness of pleasure Wallis (16, 17), in the interest of ethics, seeks an objective criterion to determine its true nature. He finds this in the definition of pleasure as the doing of a thing for its own sake. True pleasure, then, is that pleasure which is included in the fulfilment of life purposes. Drake (2) criticizes the "behavioristic" definition as a twisting of terms, contends that pleasure, as quality, is just what it is experienced as being, and finds the new meaning ethically valueless. Curiously neither writer refers to Plato's classical discussion of this subject. That the doctrine of pleasure as feeling varying only in intensity does not justify hedonism, is clearly shown by Ward (18). Rogers (12), accepting the view that pleasure is a sign that the demands of our nature are being met and also that pleasure is the reason why the end of an action is judged good, finds, nevertheless, that for ethical judgment the satisfaction of the moment must be brought into relation with the reflective idea of the satisfaction of life as a whole.

On the general subject of emotion the article by Languier des Bancelles (7) is serviceable for orientation. Defining emotions as affective commotions and instincts as species of adapted acts, he divides emotions into those that merely accompany and translate the instinct in terms of consciousness and those that are either

general, like grief and joy, or special, like anger and fear. The latter, though based on instinct, express its frustration; but, as there are all sorts of transitions between an instinct that succeeds and one that fails, there is no discontinuity between instinct and emotion. Carver (1) relates emotion and instinct more precisely. Emotion is defined as "the subjective experience which develops when gratification of the instinctive impulse is held in check by higher level control." It reinforces the "interest" of the instinct. If satisfaction is checked, tension arises and the affective element is experienced as emotion; if satisfaction is persistently thwarted, the condition becomes psychoneurotic. Illustrations are found in war neuroses. One important conclusion is that the energy of an instinctive process can find outlet along psychically equivalent paths, the problem being to find and inculcate useful psychical equivalents. T. A. Williams (23) and F. E. Williams (22) also treat of war neuroses, the former discursively, laying general emphasis on methods of psychotherapy, the latter explaining more particularly that anxiety and fear arise from "conflict," the complete or partial disability to adapt to the complex conditions of modern life. Spaulding (14) refers to "conflict" three cases of larceny, "conflict" here apparently meaning emotional repression, or the failure of unfulfilled desire.

An able article, full of matter, from the behavioristic standpoint, is contributed by Watson (21), who defines emotion as "an hereditary pattern-reaction involving profound changes of the bodily mechanism," particularly visceral and glandular. By "pattern-reaction" is meant a response the details of which appear with some constancy, regularity and order of succession each time the exciting stimulus is presented. Emotional reaction is distinguished from instinctive by the initial disturbance aroused by the shock of the stimulus; but the distinction is not absolute. Environmental conditions have probably brought about the partial inhibition of the more primitive types of emotion, while the glandular and smooth muscle sides remain; this would explain changes in level, the reinforcement or inhibition of emotions in progress and the finding of new outlets. The only primitive emotions which the author discovered in his experimental observation of young children were fear, rage and love, the last in approximately the Freudian sense of sex. The explicit portions of the reaction in emotion being usually the least important, he proceeds to consider the various methods for detecting the implicit. They include the controlled

association word reaction, the free association method, dream study and analysis (surely not wholly without introspection!), and several others in which he finds value, while he attaches little or no value at present to "expressive" methods and the so-called psychogalvanic reflex. He further discusses substitution of stimulus, attachments and detachments, emotional outlets, diffusion: "when emotional expression is blocked in any one region, outlet seems to take place somewhere else;" there is no conclusive evidence that the phenomena belong to the realm of the conditioned reflex. He also discusses consolidation among emotion, instinct and habit, the development of attitudes and the results of the physiological study of the emotions. The apparent conflict between the conception of emotion with its initial shock and chaos, paralysis and death-feint and the results of physiological observation which indicate "adaptive" processes is reconciled by the hypothesis that the better physiological state is due to the drug-like action of the autacoid substances; if small in amount, they are serviceable, if large, paralyzing. Moreover, the physiologists have overemphasized the adaptive character in all the major emotions. The immediate effect of an exciting stimulus is disruptive; there is a post-emotional state which may be mal-adaptive, but which may, on occasion, enhance the vital function. Sometimes, under a great tension, all part reactions hang together and mutually reinforce one another.

The James-Lange theory is still discussed and opinion is still divided. Larguier (7) expounds and defends James's view as a truthful introspective account of the content of emotion; Carver (1) rejects it on the ground of Sherrington's experiments, but is unable to decide between the alternatives that the corporeal concomitants are aroused along with the psychical excitement by the same stimulus, or that they are secondary to it; Ward (18) pronounces the theory to be "psychologically and biologically absurd"; Pillsbury (9) commits himself no farther than to say that "the vividness and life of the emotion depends upon the bodily expression" and that "the deep-seated motor response is an integral part of the emotion." His new chapter contains a good summary of recent work on the adrenals. Myerson (8), without knowing of the famous case reported years ago by Revault d'Allonnes, reports a similar one, but reaches no positive conclusion.

Warren (19, 20) makes a bold and original attempt at a classification of human reflexes, instincts and emotional phenomena on a purely empirical basis. The article was written preparatory to

the text-book, which shows some modifications, particularly in the arrangement of the reflexes. There is a list of from 60 to 70 of these, grouped under five heads. The instincts are divided into nutritive, reproductive, defensive, aggressive and social organization, the total number being 26. From these are distinguished the six instinctive tendencies, imitation, play, curiosity, dextrality, esthetic expression and communication. Human emotions are classified as expressive, reproductive, defensive, aggressive, social, and those with temporal—prospective or retrospective—projection; and under these headings 37 emotions are listed. Human dispositions are grouped under the same six heads, except that for the last is substituted instinctive and sentimental; 40 dispositions are named, each referred to its corresponding emotion. Finally, in the book, we have a classification of the sentiments as reality feelings, beliefs, esthetic, dynamic and moral, each of which is referred to its source. There is, of course, no claim for finality in a classification thus empirically constructed, and the classification presented seems to suffer from a certain lack of precision in the terms. In the article, for instance, there is no definition of emotion, and in the book it is only roughly defined as “a combination of systemic and motor elements.” The author himself is of the opinion that no satisfactory catalogue of the emotions and dispositions will be reached until we are able to measure qualitatively and quantitatively the various secretory and metabolic changes which occur in the human system. Meanwhile it is something to have this patient and painstaking attempt at one.

The galvanometric indication of emotional phenomena is the subject of an experimental study by Waller (15). The best results were obtained on the palmar surfaces of hand and foot, suggesting a correlation with the presence of sweat glands. But neither atropin nor a rubber band rendering the limb pulseless and exsanguine appreciably affected the skin response. Disagreeably emotional ideas proved the most effective, more so even than the original experience; *e.g.*, the threat of a burn more than the burn itself.

A study of anger by Richardson (11) based on daily reports for three months of its casual occurrence in the experience of a number of persons, mostly students of psychology, though lacking in style, follows a sound method for the discovery of the pedagogical bearings of the emotion and contains some useful suggestions for the educator. The author points out the utility of anger in certain cases as well as the need and possibility of its control.

The account by Hoffmann (5), an air-plane pilot, of what went

on in his mind in the quarter of a minute or so in the descent of some 2,000 feet while guiding to safety his suddenly injured plane with a wing on fire, is a remarkable piece of introspective description. Besides the number and complexity of the ongoing processes perhaps the most striking feature of the experience was the calm supervening on and practically coincident with the initial fear and the immediate adjustment to the situation.

Portigliotti (10), examining the letters which passed between Abelard and Heloise thirteen years after the latter entered a convent and the former became a monk, attributes the coldness of Abelard as contrasted with the ardor of Heloise to his mutilation.

In a richly documented article, a chapter from a forthcoming book in three volumes, Janet (6), with accustomed finesse, analyzes the mental states and acts of neuropaths with special reference to their effects on the persons in the environment. The article is too long to summarize here, but the main contention is that certain persons, commonly considered odd or wicked rather than sick, exert an influence on those living with them which force the latter to maintain a higher degree of psychological tension than would otherwise be necessary and by inducing fatigue tend to propagate the nervous disorder. To prevent this it often suffices to detect which is the dangerous person and to separate him from the rest.

The masterly discussion by Shand (13) should prove of unique interest to students of the psychology of value. Starting with the assumption that external things have value only so far as they are in actual or potential relation to some mind or minds, and that other things have value only so far as they are constituents or qualities of such minds, the problem is to find a theory consistent with this assumption and also with the common belief that things have a "real" value. The conclusion reached after an analysis which leads to the formulation of no fewer than eleven "laws" is as follows: "Intrinsic value is not a simple, statical quality. . . . It is essentially dynamical. It presupposes always something on which it can act, with which it has affinity, and the power of acting on this thing in certain ways. Such value, therefore, cannot be wholly contained in or confined to the thing which possesses it. For a condition of intrinsic value is the power of propagating the same kind of value in the other thing with which it has affinity. . . . Fear, anger and hate have one kind of effect; joy, admiration and love have an opposite kind. The power of each depends on its own nature. The power which is a condition of intrinsic value is therefore also conditioned by it."

The three historical articles by Gardiner (3, 4), based on a study of the sources, give a fairly full account of the affective psychology of the Greeks. They seem to show that while much has been learned, much also has been forgotten, and they tend to temper the assurance of progress in this field so easy to young students ignorant of what has been accomplished in the past.

REFERENCES

1. CARVER, A. The Generation and Control of Emotion. *Brit. J. of Psychol.*, 1919, 10, 51-65.
2. DRAKE, D. Is Pleasure Objective? *J. of Phil., Psychol. and Sci. Methods*, 1919, 16, 665-668.
3. GARDINER, H. N. The Psychology of the Affections in Plato and Aristotle. *Phil. Rev.*, 1918, 27, 469-488; 1919, 28, 1-26.
4. GARDINER, H. N. Affective Psychology in Ancient Writers after Aristotle. *Psychol. Rev.*, 1919, 26, 204-229.
5. HOFFMANN, C. G. Ordeal by Fire. A Note on the Psychology of Fear. *Atlantic Monthly*, 1910, 125, 353-356.
6. JANET, P. Les fatigues sociales et l'antipathie. *Rev. phil.*, 1919, 87, 1-71.
7. LARGUIER DES BANCELS, J. Instinct, Émotion et Sentiment. *Arch. de Psychol.*, 1919, 17, 153-186.
8. MYERSON, A. A Case of Altered Emotions Bearing on the James-Lange Theory. *J. of Abn. Psychol.*, 1918, 13, 239-249.
9. PILLSBURY, W. B. *The Essentials of Psychology*. (Rev. Edit.) New York: Macmillan, 1920.
10. PORTIGLIOTTI, G. Organi, funzioni e sentimenti. *Riv. di psicol.*, 1918, 14, 167-185.
11. RICHARDSON, R. F. *The Psychology and Pedagogy of Anger*. Educational Psychology Monographs. Baltimore: Warwick & York, 1918. Pp. 100.
12. ROGERS, A. K. The Place of Pleasure in Ethical Theory. *Phil. Rev.*, 1919, 28, 27-46.
13. SHAND, A. F. Emotion and Value. *Proc. Arist. Soc.*, 1919, N. S., 19, 208-235.
14. SPAULDING, E. R. Three cases of larceny in which the antisocial conduct appeared to represent an effort to compensate for emotional repression. *Mental Hygiene*, 1920, 4, 82-102.
15. WALLER, A. D. The Galvanometric Measurement of "Emotive" Physiological Changes. *Proc. Royal Soc.*, 1918, 90 (Ser. B), 214-217.
16. WALLIS, W. D. The Objectivity of Pleasure. *J. of Phil., Psychol. and Sci. Methods*, 1919, 16, 324-327.
17. WALLIS, W. D. What is Real Pleasure? *Ibid.*, 384-386.
18. WARD, J. *Psychological Principles*. Cambridge: University Press, 1919.
19. WARREN, H. C. A Classification of Reflexes, Instincts and Emotional Phenomena. *Psychol. Rev.*, 1919, 26, 197-203.
20. WARREN, H. C. *Human Psychology*. Boston: Houghton Mifflin, 1919.
21. WATSON, J. B. A Schematic Outline of the Emotions. *Psychol. Rev.*, 1919, 26, 165-196.
22. WILLIAMS, F. E. Anxiety and Fear. *Mental Hygiene*, 1920, 4, 73-81.
23. WILLIAMS, T. A. The Emotions and their Mechanism in Warfare. *J. of Abn. Psychol.*, 1919, 14, 15-26.

SPECIAL REVIEWS

The Physiological Basis of Thirst. W. B. CANNON (Croonian Lecture). *Proc. Roy. Soc.*, Series B, 1918, 90, 283-301.

Professor Cannon shows that the "sensation" thirst is of local origin, depending necessarily upon stimulation of the nerves of the lining membrane of the mouth and pharynx. The immediate stimulus to thirst is the dryness of these membranes, and the psychology of such thirst would presumably be a perception of this dryness—at least Cannon sees no need to suppose that specialized nerves are involved and would therefore scarcely argue for a specific sensory quality. The usual cause of dryness of the mucosa of the mouth and pharynx is a lack of salivary flow, and, in the ordinary biological economy, the normal cause of decreased salivation is a diminution of the water-content of the body. The loss of water from the body by sweating may thus occasion thirst indirectly, since it decreases salivation and permits the mouth and pharynx partially to dry,—but the general bodily need of water is not the immediate stimulus to thirst. Conversely, an intravenous injection of water may quench thirst mediately by promoting salivation. Moreover the body may remain in need of water and thirst be abolished by a temporary moistening of the oral cavity; and the body may be well supplied with water, and thirst occur because of the drying of the lining membranes by continued passage of a stream of air through the mouth (prolonged talking or singing) or by the inhibition of salivation (anxiety or fright).

By the logic of this salivary mechanism Cannon is enabled to dispose of the theories that hold that thirst is a "sensation" of general bodily origin, and to avoid the implications of those experiments which show that thirst arises when the body has need of water and disappears when the need is satisfied even though no water is taken into the mouth. Normally a bodily need of water acts indirectly to cause dryness of the oral passages by decreasing the flow of saliva, but this need is not the immediate stimulus and is not associated with thirst if other means of moistening the mouth and pharynx are resorted to or if the mucosa of these passages is rendered insensitive by the use of a local anesthetic.

On the side of positive research Cannon contributes the results of experiments which show that thirst is usually associated with decreased salivation. He determined the amount of saliva secreted by chewing a tasteless gum at a uniform rate for five minutes, collecting and measuring all the saliva which flowed during this period. Thirst was induced both by deprivation of fluid food and by profuse sweating. Under both conditions salivary secretion was greatly decreased—from about three to one c.c. per min. in the case that is charted—and the onset of thirst coincided with the beginning of marked decrease. On taking water salivary secretion was soon restored to normal amount and thirst simultaneously abolished.

Cannon warns against the confusion of appetitive thirst with this sensory thirst. Both persons and animals drink from habit and association (appetite) when not thirsty, just they eat from appetite when no longer hungry. Crude behavior can not be taken as an index of sensory thirst.

Many problems of bodily state during thirst are admittedly left untouched. There is also, the reviewer notes, the question of why a dry cold so instantly relieves thirst. Presumably, since a dry cold is the stimulus to the perception of wetness, it creates, in the presence of a dry mucosa, the illusion of wetness, thus indicating that the essential datum is the perception of dryness or wetness, and not the actual physical dryness or wetness of the tissues. So often the physiologist dealing with mental material like thirst stops just short of the essential fact.

Finally Cannon notes the place of thirst in the biological scheme. The removal of vertebrate organisms from an aqueous environment would require the development of a special mechanism for supplying the bodily need of water. Such a device is to be found, so Cannon observes, in the salivary mechanism. When the buccal cavities tend to dry artificially (*e.g.* in talking) salivation is increased reflexly. When, however, the body lacks water, salivary secretion, which is 97 per cent. water, can not be increased and thirst ensues. Thus thirst becomes an index of the water-need of the body. What Cannon does not tell and what all psychologists would like to know is how a sensory thirst comes to be invariably unpleasant and to act as a motive for a "voluntary" quest of water. It is this resultant questing, which unfortunately for Cannon's careful distinction has many factors common to appetite, that is fundamental to the survival value of thirst.

It is, in fact, in such manner that the interesting physiology of

Cannon's paper becomes contaminated by an unconvincing biology. Cannon seeks to exhibit a parallel between the three biological mechanisms by means of which the body is supplied with water, food, and oxygen, but he fails to see that the major part of the account of those mechanisms will be psychological. The parallel, as far as he goes, is plain in the case of thirst and hunger; both these are sensory affairs of local origin that indicate definite bodily needs and initiate "voluntary" quests for water or food. Of how the kinesthetic perception of stomachic contractions or of drying mucosa becomes the motive to specific action he has nothing to say.

The mechanism that provides against oxygen deprivation he asserts to be the action of carbon dioxide upon the respiratory center; but surely to appeal to a constantly operating unconscious reflex is not to create a parallel to conscious thirst and hunger. In the case of the oxygen-need we must turn for a parallel to asphyxiation, the "sensation" of "smothering" and possibly of "stiffness." The conscious quest for oxygen arising upon a sensory perception of local bodily origin—the struggling of the smothered animal—is approximately parallel to the urges of hunger and thirst, but as little is known of this mechanism as has previously been known of the mechanism of thirst. This quest for oxygen is, moreover, as little like thirst as is the thirst of a fish on land. Cannon finds it "difficult to think of an animal living in water as experiencing thirst," yet seems ready to believe in an oxygen-thirst of the animal living in air. To the reviewer it seems that all these situations are biologically and psychologically comparable: the smothered man who perceives kinesthetically the distress of oxygen-deprivation, the hungry man who perceives kinesthetically his stomachic contractions, the thirsty man who perceives tactually the dryness of his buccal cavities, and the fish on land who perceives tactually the dryness of his tissues. All these perceptions mean something unpleasant and mean action, and the action is adequately adaptive according to the intelligence, experience, and habits of the subject. The fish out of water is thirsty, but less adequately so than the man out of drink. The biological problem is one of the psychology of action, and as such, we may note further, it includes the appetites as well as the "sensations."

EDWIN G. BORING

CLARK UNIVERSITY

Psychology of the Normal and Subnormal. H. H. GODDARD. New York: Dodd, Mead, 1919. Pp. xxiv + 341.

Dr. Goddard's new publication marks the end of ten years of service as Director of Research at the Vineland Training School. He describes his book as essentially a product of the Vineland laboratory. He believes that the presentation of the facts of mental processes as set forth is therefore in some respects different from that usually found, saying "We have been led to this point of view by the study of the feeble-minded; and have been confirmed in these views by the wide application they seem to have, not only to the feeble-minded but to many common phenomena of life."

The chapter headings do not depart strikingly from those of the standard text, but they are much reduced in number; and there is a consistent emphasis on the unity of mind. Although this unity has often been freely admitted, the present author, by cumulative argument and repetition, succeeds in driving the point home and in giving it significance. The very frequent and repetitive use of the neurone pattern as a means of describing and "explaining" the mental processes is partly inspired by his desire to emphasize the dynamic unity of the mind as a determining factor in human conduct. He also thinks it "highly desirable that the science of mind should be so formulated as to contribute to useful behavior." The neurone pattern plays a prominent part in Goddard's own formulations and gives the treatment a physiological, behavioristic turn. Herrick and James are the authors most freely quoted.

The chapters on the nervous system were carefully written and are unusually well illustrated. Several of the illustrations are not found in the standard texts. The autonomic nervous system is given much prominence. (Incidentally, attention may be called to an error in figure 16 which illustrates the possible length of various neurones. The cell body of the spinal sensory neurone is apparently represented as being the big toe.)

A second feature of the book is the treatment of the emotions. No new theory is advanced; but the importance of Mosso's and Cannon's views is shown. There are lengthy quotations from Cannon; and Mosso's address on "The Mechanism of the Emotions" at the Clark Decennial is reprinted in the Appendix. Is it altogether correct to say "that the James-Lange theory of emotions is true so far as it goes, but that it is only part of the story because it confines itself to the central nervous system and does not take into account the enormous part played by the sympathetic?"

(p. 138). James recognized not only the flood of sensations coming from the great body of muscles, but a long list of other bodily changes, involving the internal organs, and circulatory apparatus all controlled by the sympathetic system. Goddard, however, brings the contributions of various writers into relation; and provides a very useful discussion for the student. An original diagram illustrating McDougall's theory of the emotions is added (p. 142).

The subject of "Intelligence" receives considerable discussion. There are separate chapters on the relation of intelligence to will and to emotion. Intelligence is defined as "the summation of consciousness." "Conceived as an abstract mental process it is the sum total of all the related consciousnesses that one is able to bring to bear upon a particular occasion." There are some interesting reflections upon the relation of individual differences to Democracy and the sociological importance of recognizing various levels of intelligence. "The truest democracy is an institution for the feeble-minded, and it is an aristocracy,—a rule by the best."

The book does not attempt a systematic exposition of the psychology of the feeble-minded. There are chapters on Applications, The Determination of Mental Levels, Pedagogical Applications, Moral Training, etc., which deal directly with practical problems, with special reference to the subnormal; and the whole book is interspersed with concrete illustrations from life incidents among the feeble-minded; but there are no thorough-going psycho-clinical studies of either individuals or groups, and no effort to assemble such work from other investigators. The writer handles the psychology of normal and subnormal co-ordinately, illuminating the former by means of the latter. The aim is to aid the reader in the interpretation of human behavior, in general,—his own as well as that of others.

And the book fulfills its aim. Its chief merit is the very important one of *clearness*. The author has deliberately, by his consistent use of the neurone pattern concept, by means of summaries, illustrations, and lucid style, sought for clearness, "with the underlying thought that while there is no expectation that our formulation is the final truth, yet if we violate no known facts, our formulation will be helpful in proportion as it is clear." Dr. Goddard's book will be favorably judged by this criterion. It should be an illuminating introduction to the problems of human conduct, particularly to those for whom psychology has been too academic,

symbolistic, intangible. Whatever defects the neurone pattern concept may have, it helps to make the phenomena of human behavior tangible. For medical students, in particular, the book should be a good stepping stone.

Typographically, the volume is attractive, being set in large type, with a free use of section headings, italics, topical summaries, and illustrations. These features add to its effectiveness as a text. It is to be regretted that the book so completely annihilates the purchasing power of a five dollar bill.

ARNOLD GESELL

YALE UNIVERSITY

DISCUSSION

A NOTE ON THE SELECTIVENESS OF THE ACHROMATIC RESPONSE OF THE EYE TO WAVE-LENGTH AND ITS CHANGE WITH CHANGE OF INTENSITY OF LIGHT

BY C. E. FERREE AND G. RAND

Bryn Mawr College

In Dr. Troland's review of the article by us on this subject (PSYCHOL. BULL., 16, 121) errors of statement occur on two important points. (1) "Unfortunately the writers do not speak of the size of field employed, so that one can not feel certain that strictly foveal stimulation was secured." The sizes of the fields employed are given on pp. 283 and 284, and again on p. 304, of the article reviewed. (2) "Ferree and Rand have made careful measurements of visibility curves at a number of intensity levels and find that the form of the curve varies radically with intensity even for intensity levels similar to those utilized in previous elaborate investigations by others. . . . The changes in visibility for certain wave-lengths due to intensity amount to many hundred per cent." The form of our curves did not vary *radically* with intensity at the levels which have been used in recent determinations of standard visibility curves, meant to be independent of intensity. The differences at these intensities were significant but not radical. The radical differences were for much lower intensities 5 meter-candles and under. The impression certainly should not be left that the differences amount to many hundred per cent. at the higher intensities. It is doubtful if the Purkinje shift can be estimated in per cent from our data in the sense referred to by Troland. What was given in our tables was a comparison of the photometric and radiometric evaluations of our stimuli at the different intensities. The deviation of these from exact correspondence of ratio as the intensity was changed ranged for the different parts of the spectrum used from 10 to 21 per cent. for a change of 75 to 50 meter-candles; from 14 to 48 per cent. for 75 to 25 meter-candles; and from 16 to 50 per cent. for 75 to 12.5 meter-candles.

We are not aware of published results of "elaborate investigations of others" contradictory to our own. The recent belief that the Purkinje shift ceases at 25 meter-candles or thereabouts seems to refer back to statements made by Ives and Nutting. Ives claimed that at "approximately 25 meter-candles" (300 meter-candles falling on a pupillary aperture of 1 sq. mm.) the achromatic response is practically, if not entirely free from Purkinje effects; and Nutting, that an illumination of 350 meter-candles falling on a pupillary aperture of 1.465 sq. mm. is safely outside the range of the Purkinje effects. Neither man cites results in support of his claim. Moreover the photometric determinations in the work in which these statements occur were made by the flicker method; ours were made by the equality of brightness method, or as the eye normally sees its brightnesses. There are good physiological reasons, also experimental data, for not expecting agreement by the two methods. Helmholtz and others of the earlier writers (Chodin, *Sammlung phys. Abhandl. v. Preyer*, 1877, 1, p. 33, ff., Brücke, *Sitzungsber. der Wiener Akad., Math.-Natur. Klasse*, 1878, (3), p. 63; etc.) believed that the eye changes its selectiveness of response to wave-length of light at the higher as well as at the lower intensities. This conclusion is drawn from a statement made by them that beginning with a spectrum of fully saturated colors and increasing the intensity of light, all the colors tend towards white and in so doing change their luminosities at different rates.

The question with regard to the intensity at which the Purkinje shift ceases, if at all, should be carefully studied before still more effort is expended on determining visibility curves meant to be used at 25 meter-candles and over.

A REJOINDER TO DRS. FERREE AND RAND'S NOTE

BY L. T. TROLAND

Harvard University

I have noted the objections raised by Drs. Ferree and Rand to the manner in which their paper on "The Selectiveness of the Achromatic Response of the Eye"¹ was treated in my review of the literature on vision for 1918. It would be extremely distasteful

¹FERREE, C. E., and RAND, G. The Selectiveness of the Achromatic Response of the Eye to Wave-Length and Its Change with Change of Intensity of Light. *Studies in Psychology Contributed by Colleagues and Former Students of Edward Bradford Titchener*, Worcester, 1917, 280-307.

to me to have my yearly summary become the origin of any controversy, but it would seem that the authors above mentioned have decided upon an annual policy of reviewing my review, and it therefore appears necessary for me to reply in this particular case. It is my sincere purpose to make my reviews not only comprehensive but accurate, although the magnitude of the task involved in covering practically the entire literature on vision for any year is so great that I cannot hope to attain perfection in either of these regards. I also wish to state at the outset that I entertain a high degree of respect for the scientific ideals in the investigation of visual phenomena represented by the work of Drs. Ferree and Rand and certainly do not wish to disparage their researches. However, I cannot sympathize with their apparent feeling that their presentation of results is above criticism.

In their note these authors question the accuracy of my assertion that they neglected "to speak" of the size of the field which was employed in the work under consideration. A reëxamination of their original paper however, does not lead me to regard my criticism as an error. It is scarcely necessary for me to point out that the size of a visual stimulus field must be expressed either in terms of the angle subtended at the nodal point of the eye or in some linear measure of the image formed upon the retina. The investigations discussed in this paper were made with two quite different arrangements of apparatus, the arrangement for the first two series of measurements involving diffuse reflection of the spectral light, while that for the third series involved a concentration of the light from the spectrometer directly upon the eye of the subject. On pages 283 and 284 of the article the description of the conditions for the first *two* series includes a specification of the area of the surface thermopile which was employed and a statement that the photometric surface had the same area. This photometric surface, however, was placed normal to the beam of light falling upon it and therefore could not have been normal to the line of sight of the subject. Presumably it made an angle of 150 degrees with this line. It is not stated, however, whether any diaphragm was interposed between the photometric surface and the subject's eye or, if so, what the position of this diaphragm was. Furthermore, there is complete neglect to state the distance of the photometer head from the subject's eye. Without this latter data it is obviously impossible to calculate the size of the visual field involved, even on the basis of plausible assumptions.

The arrangement of apparatus for the *third* series of measurements is described on pages 303 to 305 of the original article *following* the presentation of the data obtained by its use, and consequently in a position where it is apt to be overlooked or misinterpreted by the reader. It is stated that "a screen, S, containing a stimulus opening 15 mm. in diameter" was employed, this screen being placed "20 cm. from the eye." Assuming the "stimulus opening" to be a circle, we can compute from these data the size of the stimulus field which I find to be 4.28 degrees in diameter. The experimental arrangement in this case, however, is not sufficiently simple to make it easy for one not well acquainted with the properties of optical systems to feel confident of the meaning of the various distances and sizes which are specified.

In the case of the second arrangement of apparatus, just discussed, Drs. Ferree and Rand may feel that I am laying undue stress on their failure to reduce the statement of the stimulus conditions to terms of visual angular dimensions. It is therefore necessary for me to enlarge somewhat upon the significance of this oversight on their part. The investigations under consideration are concerned with a change in form of the visibility or achromatic sensitivity curve of the eye, conditioned by changes in the intensity of the stimulus. It is a truism of visual psycho-physiology that two radically different curves of this sort are involved in the visual function, one representing the response of the visual system based upon the retinal cones and the other that of the system innervated by the retinal rods. It is also a truism that the rods are absent from a small area of the central retina but that in practically all other parts of the retina both rods and cones are present in varying proportions. The rod-free area is specified by Parsons² as being ordinarily 3 degrees and 3 minutes, or 3.05 degrees in diameter. The visual angular diameter of the field employed by Drs. Ferree and Rand in their second experimental arrangement was apparently 1.23 degrees greater in diameter than the rod-free area. They were therefore apparently dealing with a combination of rod and cone vision, and variations in the form of the resultant visibility curve were to be expected at intensities at which rod vision plays an appreciable rôle. The writers may disclaim an interest in the theoretical development or implications of their results, but it would seem that these results lose most of their significance because of the fortuitous combination of rod and cone vision which they

² PARSONS, J. H., *An Introduction to the Study of Colour Vision*, 1915. p. 10.

involve. As for the first two series of measurements, we are seemingly quite without means of determining the dimensions of the retinal area which was employed.

I find upon reexamining their paper that Drs. Ferree and Rand have not only neglected the question of the angular size of the visual stimulus field employed but have omitted to specify other conditions which are of great importance for any theoretical interpretation of their results. For example, they do not state what point of the field was fixated, or whether any attempt was made to maintain fixation constant. For the first two series of measurements they also fail to specify either in photometric or radiometric units the absolute intensities of the stimuli which were employed. They provide us with a value for the candle power of the lamp which was used but do not give the distances of this lamp from the photometric surface for any experimental setting. They also do not specify the efficiency (candles per watt) at which the lamp was burned, a condition which it is necessary to know to determine the integral color of the corresponding portion of the photometric field. For the second arrangement of apparatus the efficiency is specified, but in this case a different lamp was employed.

In addition to these omissions I find no reference to the conditions of adaptation of the subjects' eyes during the experiments. This is an item of great importance for the form of a rod-cone visibility curve, since it is a well known fact that the degree of participation of rod vision in the total visual response depends as much upon the state of adaptation of the rods relative to that of the cones as upon the level of intensity of the stimulus. I am also disappointed to find no statement of the number of subjects employed and whether they were known to have normal vision. The tables provide us with data often carried out to four, and sometimes five, significant figures but with no other method of determining the precision of the data. Judging from the smoothness of the curves a considerable number of measurements must have been made for each point.

Another omission which seems to me worth mentioning is the absence of a specification of the exact wave-length ranges of the spectral stimuli which were employed. The width of the analyzing slit is given in ten-thousandths of a millimeter, but that of the collimator slit is entirely omitted. The considerable width of the analyzing slit "0.5575 mm.," suggests that the wave-length ranges were by no means negligibly small, but we have no means of deter-

mining to what portion of these ranges the single wave-length values which are given refer. Presumably if they are values taken from a calibration plot they refer to one end of the ranges in question, and it is a matter of considerable significance for the interpretation of the results to know which end is actually represented.

A second statement in my review to which Drs. Ferree and Rand take exception is one in which I assert that according to their findings "the form of the [visibility] curve varies radically with intensity even for intensity levels similar to those utilized in previous elaborate investigations by others." They object to the use of the term "radically." An argument over this particular point would probably reduce itself to a philosophical debate concerning the meaning of the word "radical." "The elaborate investigations" which I had in mind were the visibility determinations made by Ives³ with 18 subjects, by Nutting⁴ with 21 subjects, and by Coblentz and Emerson⁵ with 130 subjects. As a reference to my reviews for 1917 and 1918 will show, a considerable number of investigators have recently determined average visibility curves, using a large number of subjects. The purpose has been in every case to ascertain the constant function connecting the luminosity response of the retinal *cones* with the wave-length of the stimulus. The intensity conditions employed by the three investigators mentioned above were as follows:

Investigator	Ives	Nutting	Coblentz & Emerson
Reflecting surface.....	MgO at 90°	MgO (?) at 63° (?)	MgO at 90°
Illumination (M. C.).....	25	350	50
Brightness (C/M ²).....	6.86	85.7	13.74
Pupil (sq. mm.).....	12 (nat.)	1.465 (art.)	1.368 (art.)
Photon value.....	82.4	125.6	18.78
(Field Size).....	2°	?	2°

I have reduced the intensities to terms of my "pet" unit, the photon (brightness of the stimulus in candles per meter² multiplied by the area of the pupil in square millimeters), which is proportional to the illumination value of the retinal image, the actual visual stimulus. The intensities in question lie between approximately 20 and 125 photons.

³ IVES, H. E. Studies in the Photometry of Lights of Different Colors. V. The Spectral Luminosity Curve of the Average Eye. *Phil. Mag.*, 1912, 24, 853-863.

⁴ NUTTING, P. G. The Visibility of Radiation. *Phil. Mag.*, 1915, 29, 301-309.

⁵ COBLENTZ, W. W. and EMERSON, W. B. The Relative Sensibility of the Average Eye to Light of Different Colors and Some Practical Applications to Radiation Problems. *Bull. of the Bur. of Stand.*, 1918, 14, 167-237.

In order to reduce the intensities employed by Drs. Ferree and Rand to the same terms it is necessary to know the sizes of the natural pupil for the stimulus conditions which they used. Nutting, Blanchard and others give normal pupil areas at various brightnesses for large stimulus fields but not for small fields. However, I have found the problem sufficiently interesting to warrant a determination of the pupil sizes for my own eye under conditions of field size and brightnesses exactly similar to those utilized by Drs. Ferree and Rand. My results for the 75 and 12.5 M.C. cases were 13.4 and 13.2 sq. mm. with complete daylight adaptation, and 15.6 and 25.3 sq. mm. respectively after 12 minutes complete dark adaptation. Assuming the conditions of Ferree and Rand's work to correspond roughly with the latter pair of figures, we find their highest and lowest intensities to be 321.5 and 87.0 photons respectively. The lower value is practically the same as that which obtained in Ives' work.

Now all three of the investigators whose results I am comparing with those of Drs. Ferree and Rand assume, and indeed assert, that the intensities which they employed were safely above the range of the Purkinje effect. Ives found "comparative fixity" in the form of the curve from "70 I.U." (= 19.2 photons) up.⁶ Nutting tried intensities 1/2, 1/4, 1/16 of his standard value without detecting any Purkinje shift at these intensities. Coblentz and Emerson satisfied themselves by preliminary work between 25 and 780 M.C. (9.38 to 292.6 photons) that results obtained at 50 M.C. (18.78 photons) would be representative of daylight vision. Upon examining Table VIII of the paper by Drs. Ferree and Rand I note that between their limiting values of 75.0 and 12.5 M.C. (321.5 and 87.0 photons respectively) they found a change in "visibility" of the red stimulus (660 $\mu\mu$) relative to the yellow-green (560 $\mu\mu$) from 5.87 to 10.54. This is an increase of 79.5 per cent. Whether or not this is a "radical" change I must leave to the reader's judgment.

Drs. Ferree and Rand object to my statement that "the changes in visibility for certain wave-lengths due to intensity amount to many hundred per cent." Here, again, the validity of the statement depends upon the method of reasoning. A change estimated

⁶ Ives, H. E. Studies in the Photometry of Lights of Different Colors. I. Spectral Luminosity Curves Obtained by the Equality-of-Brightness Photometer and the Flicker Photometer Under Similar Conditions. *Phil. Mag.*, 1912, 24, 149-188. Especially pp. 170-172.

as in excess of 100 per cent., has obviously been treated as an increase and not as a decrease. The results in Table I in the article reviewed show a visibility value of the red stimulus relative to the yellow-green of $0.015/0.777 = .0193$ for the intensity, " $1/12 A$," while for the intensity, " A ," the same ratio is $0.98/4.02 = .244$. If regarded as a percentage increase with respect to the lower value this is a change of 1164 per cent. I do not feel that my original statement implies that changes as great as this occurred at "intensity levels similar to those utilized in previous elaborate investigations by others."

If it were not for the fact that the field employed by Drs. Ferree and Rand was considerably larger than those used by the other investigators there would certainly appear to be a contradiction between the results of the former and of the latter. I do not believe that the appeal of the first-mentioned investigators to the difference between the flicker and the equality-of-brightness methods helps their case very much. Ives used both methods, and Purkinje effects (reverse effects) appear in the former method under the same conditions which produce them in the method of direct photometric comparison. In this connection it is worth noting that Drs. Ferree and Rand have neglected to criticize my review at one point where my remarks can correctly be accused of inadequacy, *viz.*, my statement that the change in the form of the visibility curve indicated by their results is of the familiar Purkinje type. This holds good of the first two series of measurements, but not of the third, the series which we have just been discussing. The results in this series indicate a *reverse* Purkinje effect, since there is an increase in the visibility of the red stimulus relative to the blue. The reverse effect, as indicated by the values which are given, is a strong one. This is a very surprising finding, and one which is certainly contradictory not only to the quantitative work of Ives and others but also to a multitude of qualitative demonstrations of the manner in which the distribution of luminosity in the spectrum alters with decrease in intensity.

It occurs to me that the explanation of this anomalous finding may possibly lie in the nature of the *pupillary* conditions which obtained for the third series of measurements reported by Drs. Ferree and Rand. These conditions were such as to make the luminous flux reaching the retina from the "white" comparison field dependent upon the area of the natural pupil, while that from the spectral field was not thus affected, since the latter was con-

centrated wholly within the natural pupil in the form of an image of the spectrometer slit. Alterations in the size of the subject's pupil would therefore alter the relative apparent brightnesses of the two fields independently of any other causes. (I have often used this principle as a convenient method of determining pupillary areas.) Progressive changes in the area of the natural pupil are to be expected in the course of a series of measurements, unless considerable care is taken to insure equilibrium conditions of adaptation. Moreover, the pupillo-motor values of equally bright lights at low intensities and in large fields are probably not equal, since the work of Hess and others⁷ indicates that control of the pupil is based mainly upon cone response. This would entail a relatively smaller pupil for the red end of the spectrum, as compared with the blue end, at the lower intensities. It would have the effect, under the conditions of Drs. Ferree and Rand's measurements, of decreasing the physical intensity of the red stimulus required to match the "white" comparison stimulus, more rapidly—with a general decrease in intensity level—than that required for the blue. Although this expectation corresponds with the results which they obtained, I do not insist that my explanation is the correct one.

⁷ See, e.g. ENGELKING, E. Der Schwellenwert der Pupillenreaktion und seine Beziehungen zum Problem der pupillomotorischen Aufnahmeorgane. *Zeitsch f. Sinnesphysiol.*, 1919, 50, 319-337.

COMMUNICATION

PSYCHOLOGICAL TERMINOLOGY

The Committee on Terminology of the American Psychological Association is taking up for examination terms in the fields of Sensation and Cognition. Psychologists interested in the precise use of terms are invited to assist the Committee in its work by calling the chairman's attention to—

- (1) Psychological terms used with two or more different meanings (whether distinguished or not), and terms used indefinitely or ambiguously in contemporary writings.
- (2) Pairs or groups of terms which lead to confusion when used interchangeably.
- (3) Foreign terms needing definition or translation.
- (4) Books and articles containing systematic lists of cognate terms, or discussions of ambiguous terms. (Full references desired.)

It is a matter of prime importance in any science to clear up double meanings and imperfect synonyms. The word *feeling* is used in standard psychological works with several different meanings. The words *intellect* and *intelligence* are used by some writers interchangeably, while others draw a sharp distinction between them. There are many instances in the literature of both kinds of confusion.

The Committee wishes to include a large number of such terms in its next report, either defining and distinguishing them or citing discussions in easily accessible sources. This list will not be confined to sensation and cognition, but will cover the entire field of psychology. Will readers of this magazine assist the Committee to make the list fairly complete?

HOWARD C. WARREN, CHAIRMAN,
Princeton University

PRINCETON, N. J.,
February 9, 1920

BOOKS RECEIVED

- EVANS, E. *The Problem of the Nervous Child*. New York: Dodd, Mead, 1920. Pp. viii + 299. \$2.50.
- DUNLAP, K. *Personal Beauty and Racial Betterment*. St. Louis: Mosby, 1920. Pp. 95. \$1.00.
- VAUGHAN, V. C. *Sex Attraction*. St. Louis: Mosby, 1920. Pp. 44. \$.50.
- School and Home*. New York: Parents and Teachers Association, Ethical Culture School, 1920. Pp. 33.
- PARTLOW, W. D. & HAINES, T. H. *Mental Rating of Juvenile Dependents and Delinquents in Alabama*. Jackson; Miss.: Nat. Comm. for Mental Hygiene. Pp. 292-309.
- Journal of Educational Research*. Urbana, Univ. of Illinois: B. R. Buckingham, Editor. \$3.00.

THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

THE PHYSIOLOGY OF NERVE AND MUSCLE

BY EDWIN B. HOLT

Glenmere, Maine

Two topics are prominent in the papers published in 1918; firstly, the physiology of the "involuntary" or autonomic nervous system, and secondly, the question as to two kinds of innervation (clonic and tonic) of striated and unstriated muscle and as to the nature of tonus. Piéron (36) and von Brücke (7) summarize present views on the latter topic in a comprehensive way, and both papers deserve to be read by anyone desiring a good general idea of the twofold neuro-muscular process. (Piéron's paper, now rather inaccessible, might well be translated.) Higier's monograph (20) on *Vegetative Neurology* is the most comprehensive and readable introduction to the autonomic nervous system that the reviewer has yet seen, containing just about what the psychologist needs to know so far as this knowledge is to be had at present. The monograph by Kempf (25) on *The Autonomic Functions and the Personality* contains little about the physiology of the autonomic system, but is an interesting and important essay in psychology.

Of the still more general papers, Rijnberk's (39) on the "Rôle and Organization of the Nervous System," elementary but up-to-date, comprehensive and capably arranged, might well be given verbatim in one or two lectures to a class in physiological psychology. The author believes that the heart and the alimentary tract with its glandular appendages possess a considerable degree of sensorimotor autonomy. Adrian (1) gives a clear and compact summary of the work of Keith Lucas and Adrian on nerve-conduction: it is practically a condensation of Lucas's book, *The Conduction of the Nervous Impulse*, with important additional remarks. Adrian

inclines to attribute to the synapse as a region of decrement the functions of inhibition and summation. "The presence of a region of decrement in peripheral nerve is the only condition necessary for the production of peripheral inhibition and summation and these effects depend simply on the normal course of recovery, according to which an impulse set up in the earlier stages of recovery [from a previous impulse] has an intensity less than normal and an impulse set up in the later stages has an intensity greater than normal." The theory of inhibition as due to interference between two series of periodic impulses meeting on a final common path is interestingly discussed (pp. 43-5): and it is worth noting that Adrian and the other investigators of nerve-conduction seldom if ever mention the "inhibitory nerves" and "inhibitory nerve-impulses" which anatomists and neurologists (for example, Gaskell) are apt to postulate. Of course the nerve-impulse as studied by Adrian and Lucas is periodic, an "absolute refractory phase" intervening between any two, unit, "all-or-none" impulses. This presents, doubtless, the "clonic" form of muscular innervation. Whereas the second or "tonic" innervation, while we have as yet almost no direct experimental data on it, is thought by many to result from a non-fluctuating form of nerve-impulse. Of this latter Adrian says: "The evidence is too complicated and, as yet, too inconclusive to be discussed in detail, but it shows that we must face the possibility that there may be some way of producing a continuous activity in certain neurones and certain parts of the muscle, an activity quite unlike the intermittent discharges which form the usual type of nervous impulse." Head's presidential address, "Some Principles of Neurology" (18), is more especially of interest to clinicians than to psychologists. Some diagnostic cautions are urged, with handsome acknowledgements to Hughlings-Jackson, regarding the positive as well as the negative symptoms which may be due to a destructive lesion; as when—"Injury to the pyramidal system was shown, negatively, in the loss of the finer voluntary movements; but the activity of the lower centres, released from control, was evident in the spastic rigidity of the paralyzed parts." (One observes, by-the-way, that throughout the literature, the "control" exercised by the cerebral over the cerebellar, and by both over the spinal, neural levels is still referred to in a way that half insinuates a Cartesian homunculus resident in the higher centres. The indisposition to treat this "control" as deriving likewise from afferent or sensory sources certainly evidences limitations in our present understanding

of the nervous system.) In peroration, Head states that three processes "form the main features of the physiological functions of the central nervous system . . . which lead to integration. . . . First of all those impulses potentially of a like sensory quality, are gathered together. Secondly, all impulses capable of exciting sensations of a different quality are rejected by the receptors, which guard each functional level. The third method is manifested in the phenomena of adaptation. . . . No stimulus acting over a long period can remain continuously at the same level of efficiency; it leads to a state increasingly favourable to the appearance of the opposite phase of activity . . . the tendency to biphasic reaction so characteristic of the central nervous system." The passage is pre-Sherringtonian.

The increasing interest of physiologists in the autonomic nervous system is providing new data of which the psychologist will need to take account. The autonomic is not a separate nervous system, since it appears to consist exclusively of motor neurones and it receives its nerve-impulses from the central nervous system (spinal cord or mid-brain). In many cases afferent fibers are located in the same tracts with the efferent autonomic fibers, but these afferent fibers, uninterrupted, enter the spinal cord *via* the posterior roots (where their cell-bodies are found) and their topographical association with the autonomic nerves seems to be merely an anatomical accident: they are simply afferent spinal nerves. The afferent fibers from the viscera all go to the central nervous system, and sometimes do and sometimes do not take their course along (within) autonomic nerve-trunks. "General visceral afferent fibers are found in the IX and X cranial nerves and in the spinal nerves. Their cells of origin are located in the cerebrospinal ganglia. . . . There is no satisfactory evidence that any afferent neurones have their cell-bodies located in the sympathetic ganglia" (Ranson, 37, pp. 311-2). Nor are all the efferent neurones of the autonomic system unmedullated neurones: the motor neurones from the central nervous system that supply all the innervation of the autonomic, go to that system as medullated fibres, and sometimes travel in the autonomic tracts, uninterrupted and still medullated, to the near vicinity of the organ which they innervate (Higier, 20, p. 9). It is true, however, that all motor neurones are relayed into non-medullated ("post-ganglionic" or autonomic in the strict sense) neurones at some point before they reach any non-striated muscle. Nor are all the organs which are innervated by the auton-

omic system "visceral," in the familiar sense of that word: the sweat glands, for instance, the erector muscles of the hairs of the skin, and the dilator muscle of the pupil of the eye, are all innervated from the autonomic system. Again, the local sensori-motor functions (such as peristalsis of the intestine *via* Auerbach's plexus, or as, possibly, the heart-beat) are hardly to be classified under either the autonomic or the central nervous system. And, lastly, the distinction between the "two systems" as being respectively voluntary and involuntary can by no means be maintained; as in the case, for one very obvious example, of the sphincter muscle of the bladder.

Such are some of the reasons why the autonomic cannot be accounted a separate nervous system, and why, therefore, it is of interest to such psychologists as care to take into account at all our neuro-muscular organization. Furthermore, it is intimately connected, no doubt, with the emotions. Higier's monograph (20) gives an astonishingly compact and yet clear introductory picture of the anatomy, embryology, histology, physiology, pharmacology, and pathology of the autonomic system. Kempf (25) devotes one not very long chapter to the autonomic system itself. Ranson (37) writes a brief sketch introductory to six further studies by Ranson, P. R. Billingsley, and S. E. Johnson: these are clear and apparently very careful researches into the more minute topography of the autonomic tracts and into the histology of autonomic ganglia, glomeruli, etc. Johnson (23) for example, by means of transection and degeneration experiments, shows that the only nerve terminations existing in the autonomic system are of (motor) nerves which have come from the spinal cord or bulb; they terminate, and their impulses are relayed along non-medullated post-ganglionic fibers. There are no commissural autonomic neurones; nor do any sensory neurones running in autonomic nerve-trunks terminate in autonomic ganglia, but all go, uninterrupted, into the central nervous system. Ranson states that "In the anatomical and histological texts we find no hint that the sympathetic nervous system is made up of definite functional groups and chains of neurones as distinct and sharply limited as are any of the conduction systems of the brain and spinal cord. Nevertheless, such is the case; it is even probable that the functional groups and chains of neurones are more sharply limited in the sympathetic than in the central nervous system. The latter is provided with a mechanism for the widest possible diffusion of incoming impulses, while such diffusion does not occur in the former" (37, p. 305). These seven papers are all in one issue

of the *Journal of Comparative Neurology*. Orr and Rows (35) conclude, from a rather ingenious study of the degenerative lesions produced by toxic infection of the central nervous system through the lymph as compared with those produced by infection through the blood, that "in the sympathetic ganglionic chain there is no true reflex arc, or in other words that it cannot subserve reflex action without the intervention of the cerebro-spinal axis." And, again, "the consensus of opinion seems to be that the [autonomic] ganglia merely act as reinforcing centers for stimuli from the central axis." More than one-half of Spadolini's contribution (42) is devoted to a critical review of earlier work on autonomic innervation (inhibitory and augmentatory). The author regards sympathetic innervation as preëminently tonic.

It should be mentioned, perhaps, that the motor neurones which emerge from the central to go to the autonomic nervous system form three groups: the cranial (or cranio-bulbar), the thoracico-lumbar (or sympathetic), and the sacral, outflows. Many organs are innervated from two of these divisions—the cranial and thoracico-lumbar, or the thoracico-lumbar and sacral. When such is the case the functions of these two systems are invariably antagonistic to each other. Thus the bulbar innervation to the heart is inhibitory, the sympathetic innervation is acceleratory. It is unfortunate that the nomenclature is still not uniform: some authors, as Ranson (37) and Johnson (23), still use the term "sympathetic" as including all three divisions.

The recent developments in regard to the two varieties of neuro-muscular process (the clonic and the tonic) have further tended to obliterate the demarcation between the central and autonomic nervous systems. The classic doctrine taught that the central nervous system carried but one kind of nervous impulse, that this was conducted to striped muscles, and there produced one kind of contraction, the clonic (rapid muscular twitch). Non-striated muscles were innervated by the "sympathetic" nervous system, their contractions seemed to be slow and maintained or tonic, and the "sympathetic" nervous impulse might (or might not) be different in nature from the impulses of the central nervous system. Now it appears that striped muscles exhibit tonic contractions as well as unstriped (although the latter, apparently, do not show clonic contractions), and that the tonic contractions of unstriped muscles are set up by impulses that are sent out from the central nervous system. Beyond the points so far noted, the views regarding the varieties of neuro-muscular process, and of tonus, diverge.

It appears to be now rather widely admitted (after the researches of A. Perroncito, 1902; A. Mosso, 1904; and especially of de Boer, 1913) that there is a tonic (or postural) innervation of even the striped skeletal muscles by unmyelinated fibers from the autonomic system: although the reviewer finds no mention of such an innervation of skeletal muscle in Higier (20) or in Gaskell's *The Involuntary Nervous Systems*. Piéron (36, p. 89), Rijnberk (40), Mansfeld (32), Lukács, and apparently Bottazzi (6) hold this opinion: Dusser de Barenne (2) argues against it, and Cobb (9) from the fact that unilateral division of the abdominal sympathetic chain did not affect the onset of decerebrate rigidity on the operated side, rather disbelieves in the view that the autonomic system affects (postural) tonus. Von Brücke (7) believes that there is some histological evidence for this twofold innervation of skeletal muscle, but that the functional evidence therefor is still inconclusive. It is generally conceded, whether the autonomic system sends fibers to the skeletal muscles or does not, that the motor nerves from the central nervous system send out two kinds of innervation, a clonic and a tonic, to the skeletal muscles (Piéron, 36; v. Brücke, 7; de Boer; Mansfeld, 32; Hunt, 22, pp. 329-30; Betchov, 4, p. 15). Piéron and von Brücke hold that "tonus of rest" is governed by the autonomic, but "tonus of action" by the cerebro-spinal system. Piéron says (p. 88): "The tonic and clonic processes in skeletal muscles are not—energetically—subject to the same laws; do not involve—chemically—a metabolism of the same substances; do not depend—histologically—on the same elements; nor are they—physiologically—set off by the same nervous mechanisms."

Regarding the nature, and the number of kinds of tonus (including contracture), one finds the following views. Piéron (36) holds that the clonic function of striated muscle involves distinct twitches which may occur singly or "fused in a tetanus as typified by the voluntary contraction." It is a property of the myofibril and its carbohydrate metabolism. Tonic shortening of muscle, of which contracture is a pronounced case, is a function of the sarcoplasm of muscle and involves a nitrogen metabolism with production of creatine: it is very economical of energy, and leads to little or no fatigue. The contracted muscle, instead of warming up, grows cool; and a fall of temperature favors tonic contraction. Piéron hints that the tonic nerve-impulse may be "galvanic" rather than "faradic" in type. Von Brücke (7) believes that not only striped but also unstriped muscle manifests both tonus of action and tonus

of rest. He thinks it probable that action tonus involves active innervation (comparable to a mild tetanus) and active muscular metabolism; but deems it undecided whether rest tonus does or does not involve muscular metabolism. He seems to incline to the view that there is a nervously controlled change of length and maintenance thereof without expenditure of energy. As to a *change* of length on such terms the physicists would have something to say. Von Brücke admits the "lock" mechanism of Langelaan to be demonstrated, but the reviewer does not make out whether he accounts it the same as the energyless maintenance of length just mentioned (*cf.* 7, p. 123). Rijnberk, in a very judicious paper (40) stimulates autonomic fibers going to unstriated and (*via* the gray rami) to striped muscles. In some cases he could (tongue, lip) and in others could not (diaphragm, ankle) obtain contraction or even tonic shortening of the muscles. But, he says, these results may not be significant, for if the autonomic fiber subserves only "plastic tonus," "it may well be that its function is exclusively to maintain muscles at a given length, that is to preserve an existing condition, but that it is incapable of bringing about a change." Rijnberk's experiments, though somewhat complicated and involving hypotheses, seem to show that autonomic innervation alone is not sufficient to produce decerebrate rigidity, and he confirms the results of Cobb (9) that the elimination of autonomic innervation has no effect on decerebrate rigidity (p. 737). But he does not conclude with Cobb that therefore the autonomic system does not govern postural tonus; for decerebrate rigidity, he says, is doubtless a spinal tonus. The data are somewhat conflicting, but on the whole Rijnberk coincides with the view of Langelaan that "contractile tonus" is due to impulses from the spinal cord, and "plastic tonus" to impulses from the autonomic system. "Contractile" and "plastic" (tonus), as here used, are probably equivalent to "tonus of action" and "tonus of rest" as used by the authors mentioned above.

Fröhlich and Pick (13) describe a tonic contracture observed in skeletal and the heart muscle, which is induced by poisoning of the peripheral motor nerves at their point of origin, and which seems to involve no metabolism. The toxic application (strophanthin, etc.) has no visible effect, but produces a "*Kontrakturbereitschaft*" of the motor center, which when this center is otherwise stimulated and the corresponding muscles contracted, prevents them from relaxing again. They remain contracted and apparently

at rest (locked). In this state no electrical or metabolic changes can be detected in either the muscles or the nerves involved. Tetanus toxine will produce this contracture-preparedness at the anterior spinal roots, in cold- and warm-blooded animals: strophanthin and calcium will produce it in heart muscle. De Boer and Fröhlich (5) find that contracted heart muscle of the frog (not produced toxically) shows no action-current. But this was under diphasic connection with the string-galvanometer, and they suggest that monophasic connection might give a different result, inasmuch as de Boer has previously found in veratrine contracture of the gastrocnemius of frog, with monophasic conduction, action currents "*von langsamem Verlaufe*." (Fröhlich and Meyer found no action-current in catatonia induced by suggestion.) Mansfeld (32) contends for a "chemical muscle tonus" maintained by the sympathetic system in addition to the "mechanical muscle tonus" demonstrated by de Boer: the "chemical" tonus, it appears, involves expenditure of physiological energy. This paper is written in reply to a somewhat labored argument by Dusser de Barenne (2) that Mansfeld's experimental evidence for "chemical" tonus is inconclusive (and it is in fact rather indirect evidence). Schmiedeberg (41) finds that an injection of cocaine or novocaine suffices to relax the contracture produced by strophanthus. He believes that the cocaine acts directly on the elasticity of the heart muscle fibers, and that therefore the contracture resides in the muscle fibers themselves and is not (*contra* Fröhlich, Pick, and de Boer) due to any nervous influence. Similarly, tetanus contracture is due to a change in muscle fibers. Schmiedeberg holds that the lock-muscle of Pecten and other molluscs holds the two shells together by its own "elasticity," and that the nervous impulse operates only to relax the muscle. Bottazzi (6) registers his claim to have originated the "duality view of the contraction mechanism of muscle" (myofibril the basis of clonic contraction, sarcoplasm of tonic). He holds that any clonic contraction of striped muscle is followed by a sustained increment of tonus.

Betchov (4) writes on tendon reflexes, tonus and contracture without reference to a possible autonomic innervation. The paper deals mainly with the phenomena of hyperexcitability of reflex centers accompanied by muscular hypotonia, and the reverse. The author argues that hyperexcitability of spinal reflex centers, as found in cases of cerebral and cerebellar lesions, is due not to the absence of any "inhibitory control" normally exercised by the

higher centers, but to the absence of the normal tonic impulses from these centers (hence the hypotonia), in consequence of which the spinal centers, working at lower tension so to speak, are more susceptible to small increments of stimulation (hence the hyperexcitability). The author makes explicit reference to the Weber-Fechner law. Thus hypotonia and hyperreflexia would necessarily be found together; and for the same reason hypertonia and hyporeflexia (as in Parkinson's disease). There occur, however, changes in the elasticity of muscle fibers themselves, and such variations of tonus are of course independent of reflex hyper- or hypoexcitability. The search for "inhibitory" nerve-fibers has been utterly fruitless. Hunt (22) disputes Sherrington's principle of the "final common path," contending that the skeletal muscles are innervated by two "physiologically and anatomically" distinct systems of motor nerves, the "paleo-kinetic system" and the "neo-kinetic system." "The paleo-kinetic function represents a more primitive and more diffuse form of movement, which is under the control of the corpus striatum and is subserved by a strio-spino-neural system" (p. 305). This has nothing to do with the autonomic innervation of skeletal muscles previously referred to: although on page 324 the paleo-kinetic innervation is referred to as "sarcoplasmic." The neo-kinetic system is "for the isolated synergic movements of cortical origin." The author finds a "certain harmony" between Head's conception of protopathic and epicritic sensory systems and his own notion of paleo-kinetic and neo-kinetic motor systems. Various clinical illustrations and interpretations follow. To the reviewer this theory seems to be merely fanciful and ambitious. Jordan (24) describes a plastic tonus to be found in the body musculature of animals with essentially hollow or tubular bodies (Coelenterates, Holothurians, etc.). The body wall retains for a time any size or shape (within limits) impressed on it (by the body contents, etc.).

An important and interesting paper by Riddoch (38) describes the reflex functions of the completely divided spinal cord in man. In this condition, reflex movements which are normally distinct from one another and locally restricted become diffusely combined. A stimulus adequate for some particular reflex sets up a general response compounded of many effects that were originally appropriate each to one particular reflex alone: that is, reflex local signature is abolished. Riddoch calls this a "mass-reflex." There is evidence that in cases of partial translesion the mass-reflex is more apt to be elicited by stimulating the afferents on the more

transsected side. "The influence then exerted on a reflex arc by portions of the nervous system with which it is still connected is one of inhibition or control." The mass-reflex is mainly flexor, a quality which the author inclines to identify with protective or noci-ceptive. "In all cases of spinal injury in which this extensive motor discharge can be evoked, postural activity [which is largely extensor] is abolished and flexion of the lower extremity can be obtained as a protective reflex only. Primary extension reflexes are absent and diphasic movements of flexion and extension of the lower limbs, resembling those of locomotion, are never observed" (p. 354). This last fact is puzzling, since reciprocal innervation of antagonistic muscles is supposed to depend only on the spinal levels immediately involved. Reflex contraction of the external sphincters of the bladder and rectum are the most persistent reflexes of all. The "excessive and violent character" of the protective reflexes becomes "the terror and despair of the sufferer." "It would seem that the increasing degree of depression of postural activity from 'spinal shock' as the animal scale is ascended from dog to monkey and from monkey to man, indicates a progressive pre-spinal [cerebral or cerebellar] dominance in the series, and that it bears a close relation with the assumption of the upright position" (p. 347).

Hoffmann (21) describes the relation of tendon reflexes to voluntary contractions. In order to obtain the "tendon reflex," however, he employs, instead of a mechanical stimulus on the tendon, an electric stimulation of the nerve (electrodes placed on the skin), and records the action-current in the muscle by means of a string-galvanometer. This arrangement gives two distinct action-currents; one that of the direct nerve-muscle stimulation, the other that of a spinal reflex, the electrical stimulus having reached afferent fibers in the nerve-trunk. Yet so far as the mechanical movement of the muscle goes, the two contractions look like only one. This phenomenon is best gotten from the extensor muscles of the foot. If the muscle is at the outset relaxed, the first action-current is stronger than the second (that of the spinal reflex). If the muscle is voluntarily innervated, the second action-current is reinforced, and when the stimuli are feeble becomes stronger than the first. (It seems odd that the voluntary innervation does not reinforce both action-currents alike.) If the antagonist muscle is voluntarily innervated the second action-current (reflex) cannot be elicited. Increased reflex irritability goes with voluntary innervation. With

the patient voluntarily rising on his toes, the action-current of the extensor of the foot can be varied from 40 to 120 fluctuations per second by varying the frequency of faradic stimulation. "Very energetic contraction succeeds in attaining a synchronism between the action-currents and the stimulation when the latter is 150 per second; and this is probably not the upper limit. The nearer one approaches to this the more irregularities and halvings of the rhythm one finds in the resulting curve": showing "a certain inhibition." The author believes that ordinary skeletal muscular contraction and tonus are only quantitatively, but not qualitatively, different. Dreyer and Sherrington (11), working with the isometric myograph, find that reflex contraction is often stronger than the contraction following a similar single break-shock applied to the motor nerve directly. "A single momentary stimulus of moderate intensity, *e.g.*, a break-shock, even though not far above threshold value of stimulation, applied to the afferent nerve of a spinal reflex center, evokes from that center not uncommonly a brief repetitive series of volleys of motor impulses." The frequency of discharge of the reflex center goes to beyond 75 discharges per sec. and "there is nothing to show" that it does not go to 150 per sec. "At frequency-rates up to somewhat above 55 per second, the rhythmic discharge of the reflex center follows the full frequency-rate of the afferent nerve stimulation, the center emitting successive volleys of centrifugal impulses at the same rate as those evoked in and transmitted to it by the afferent nerve." The refractory phase of the spinal reflex (cat) cannot ordinarily be greater than 12 σ . Lutz (29), comparing the threshold values of spinal reflex (knee, flexion, and apparently ipsilateral) and nerve-muscle response (foot, extension), finds that the threshold for the former is about twice that for the latter. This, he concludes, supports the view that the synapse is a point of resistance in the conduction path of a reflex arc. In (30) the same author finds that decrease of temperature raises the threshold for both reflex and nerve-muscle response; and increase of temperature does the reverse. The reflex threshold is the more variable with given changes of temperature. At lower temperatures probably fewer neurones respond to the same strength of stimulus, and fewer synapses are able to transmit impulses. Vészi (44) objects, for no visible reason, to Sherrington's "hypothetical mechanism" of resistance and fatigue in the synapse, and argues that ganglion-cells are the points of resistance in reflex paths. He speaks of a refractory state of motor ganglion-cells.

Langley and Hashimoto (27) devote a considerable part of a paper on muscular atrophy to a critical and experimental study of the sources and limits of error in experiments on the atrophy of muscle by the "bilateral denervation method." The "disuse theory" of atrophy has gained wide acceptance, and an alternative theory "that the atrophy is due to the absence of a trophic influence of the nerves, has as yet no definite meaning." The present experiments were made with an eye to the theory recently suggested by Langley, "that the atrophy is due to the continuous fibrillation which occurs in denervated muscle." Fibrillation being the steady play of tremulous contractions in the fibers of a muscle, this theory should seem to imply that the muscle "atrophies" by being worn out. The authors do not pronounce definitively upon this theory, but they conclude from their rather extensive experiments, "that none of the methods of treatment of denervated muscle now in use—passage of galvanic current, production of contraction, passive movements and massage—can have more than a slight effect in delaying muscle atrophy." MacWilliam, in his study of fibrillation in the mammalian heart (31), states that, "Instead of travelling uniformly right through the mass of muscle . . . , as under normal conditions, the excitation wave in fibrillation travels most easily along the complexly arranged fasciculi there being an impairment or failure of propagation at most of the inter-fascicular connections. . . . Fascicular dissociation is an essential feature of fibrillation, which is, strictly speaking, a condition of 'fasciculation' rather than 'fibrillation.' . . . The state of fibrillation is rendered persistent by a disturbance in the normal relations of conduction time and refractory period in the cardiac musculature, resulting in the establishment of a mechanism of circulating excitations." Stevens (43) finds, in agreement with Langley's theory, that the wasting of muscle after nerve section "is not due to the cutting off of a superstitious influence, but rather it is due to an incessant fibrillar activity of the muscles, which begins from three to six days after nerve section and persists until the regeneration of the nerve." He disbelieves in either trophic nerve-fibers or trophic nerve-impulses, and favors "the hypothesis that muscular atrophy is due to fatigue caused by fibrillar contractions." The rate of fibrillar rhythm is from 10 to 20 per second. "There seems to be an exact parallelism between the appearance of the contractions and the wasting of the muscle, and between the disappearance of the contractions and the return of voluntary control."

The observations of Berblinger (3) will, if confirmed, modify our present views on the regeneration of peripheral nerves. Immediately after injury, the cells of Schwann are seen actively reconstructing a line of communication between the cut ends of the nerve-fibers: this activity proceeds from both the central and peripheral cut ends of the nerve, but mainly from the former. Any return of nerve function depends upon this line of communication being established before too much scar tissue is laid down. When nerve-trunks are partially but not severely injured, regenerative activity is observed (in young men) all along the peripheral portion of the axis-cylinders. Edinger (12) finds that the nerve-fiber, in regenerating, is assisted in some way by the cells of Schwann, without which it could not regenerate nor, indeed, effect its original growth. Doi (10) finds that regenerating nerve-fibrils do not readily grow except into the sheaths of old degenerated fibers. Marui (33) has a histological study (serial sections) of Mauthner's giant cells as found in the brains of two varieties of fish. He finds that neurofibrils merely pass through the "net" of Golgi; which latter is not a nerve structure but is of glial nature. The neuraxones form an "axone cap" surrounding the Golgi net: this axone cap is a "plexus" of terminal fibers, with ramifications, but not a true net-work. "The contact theory [of neuron connection] is a histological impossibility." Parts of Marui's description are difficult to follow.

Von Kries (26) has a semi-popular discussion of three theories of muscular contraction; Engelmann's imbibition theory (*Quellungstheorie*), Bernstein's surface-tension theory, and A. V. Hill's two-process conception. The author is eminently friendly towards Hill, and lays his emphasis on Hill's observations. The latter has shown that muscular contraction involves two processes; a non-oxidative contraction process (which yields lactic acid), and an oxidative recovery process. On the second process, like the resetting of a bow-gun, Weizsäcker has built a *Zweimaschinen-theorie*. The recovery process, apparently, stores energy for the next contraction, but whether in chemical form, or in a form congruent with the imbibition or the surface-tension theory, is not yet made out. Gunzberg (17) applied faradic stimulation every two seconds to the sciatic nerve of frog, the gastrocnemius muscle being immersed in Ringer's solution. Oxygen bubbled through the perfusing solution, he finds, retards the rise of the "staircase"; CO₂ accelerates it. Now oxygen retards the formation of lactic acid, and CO₂ accelerates it. Therefore the staircase effect may be the result of a metabolic

process necessary for securing a sufficient concentration of this acid. Galletti (14) finds that the least polarizing current which, applied to a nerve, will produce electrotonus at all, will produce both an- and catelectrotonus. Therefore excitation and inhibition are closely related processes. The paper is mainly devoted to a study of the influence of various drugs on electrotonus. Gruber and Fellows (15) find that adrenalin affects muscles undergoing death-changes as it affects fatigued muscles, heightening irritability. Gruber and Kretschmer (16) find that adrenalin counteracts the fatigue induced by the perfusion of fatigue substances (such as sarcolactic acid, lactic acid, and acid potassium phosphate) through the muscle, in identically the same way as it counteracts the fatigue produced normally in active muscles. Langley (28), in a study of the effects of curari, strychnine and other drugs on pre- and post-ganglionic nerve tracts, states that there is "a presumption that curari, strychnine and brucine paralysed the pre-ganglionic nerves by a direct action on the nerve cells." "Recently Burns and Watson . . . speak of guanidin as poisoning synapses like nicotine, and of atropine as paralysing terminal ganglia. The change in nomenclature seems to me unnecessarily confusing. . . . The facts are expressed most simply by saying that nicotine paralyses pre-ganglionic fibers, and atropine paralyses post-ganglionic fibers." This contention against the synapse seems to the reviewer to be unsupported.

Moral (34) ascribes the stronger action of "indifferent" narcotics (alcohol, ether, etc.) at high temperatures, and of the "basic" narcotics (novocaine, salicylamid, etc.) at low temperatures, to the fact that their *Teilungskoeffizienten* (ratio of solubility in lipid to solubility in water) are higher for high and low temperatures respectively. Burge, Neill and Ashman (8), from experiments with narcotics of widely different constitution, advance the theory "that narcosis is due to the direct destruction of catalase by the narcotic, with resulting decrease in oxidation, while recovery from anesthesia is brought about by an increase in catalase due to the increased output from the liver, with resulting increase in oxidation." The Meyer-Overton theory of narcotics as lipid solvents could in any case apply to the methane series alone. Vészi (45) advances the view that narcotics retard both non-oxidative and oxidative processes in cells by being adsorbed by the lipoids at the surface of the cell and thus lowering the tension between the cell surface and the surrounding medium. This retards the entry of food substances

and the passage out of waste products, and thus slows down the internal processes of the cell. Herzfeld and Klinger (19) believe that there is no free water in living cells, and that diffusion of substances into cells is possible only by the former becoming chemically united to the colloids of the cell. Therefore there is no need of looking for any "physiological permeability" in living tissue.

REFERENCES

1. ADRIAN, E. D. Conduction in Peripheral Nerve and in the Central Nervous System. *Brain*, 1918, 41, 23-47.
2. BARENNE, J. G. D. DE. Sur l'innervation et le tonus des muscles striés. *Arch. néerl. de Physiol.*, 1917, 2, 177-181.
3. BERBLINGER, W. Über die Regeneration der Achsenzylinder in resezierten Schlussnarben [Schussnarben] peripherer Nerven. *Beitr. zu pathol. Anat. u. allgem. Pathol.*, 1918, 64, 226-277.
4. BETCHOV, N. Recherches cliniques sur le tonus musculaire, les réflexes tendineux et les contractures, spécialement au point de vue de leur indépendance réciproque *Schweizer Arch. für Neurol. u. Psychiat.*, 1918, 2, 3-20.
5. BOER, S. DE, & FRÖHLICH, A. Die elektrischen Erscheinungen während der Kontraktur des Froschherzens. *Arch. f. exper. Pathol. u. Pharmacol.*, 1918, 84, 273-281.
6. BOTTAZZI, F. Nouvelles recherches sur les muscles striés et sur les muscles lisses d'animaux homéothermes. *Arch. ital. de Biol.*, 1916, 65, 17-62.
7. BRÜCKE, E. TH. VON. Neue Anschauungen über den Muskeltonus. *Deutsch. med. Wochens.*, 1918, 44', 121-124, 152-154.
8. BURGE, W. E., NEILL, A. J., & ASHMAN, R. The Mechanism of the Action of Anæsthetics. *Amer. J. of Physiol.*, 1918, 45, 388-395.
9. COBB, S. A Note on the Supposed Relation of the Sympathetic Nerves to Decerebrate Rigidity, Muscle Tone and Tendon Reflexes. *Amer. J. of Physiol.*, 1918, 46, 478-482.
10. DOI, T. Über die direkte Einpflanzung des Nerven in den Muskel. *Acta Schol. Med.*, (Kyoto), 1918, 2, 125-141.
11. DREYER, N. B. & SHERRINGTON, C. S. Brevity, Frequency of Rhythm, and Amount of Reflex Nervous Discharge, as Indicated by Reflex Contractions. *Proc. Roy. Soc.*, 1918, 90, B, 270-282.
12. EDINGER, L. Untersuchungen über die Neubildung des durchtrennten Nerven. *Deutsch. Zsch. f. Nervenheilkunde*, 1918, 58, 1-32.
13. FRÖHLICH, A. & PICK, E. P. Über Kontraktur des Froschherzens. *Zentbl. f. Physiol.*, 33, 225-228.
14. GALLETTI, H. R. Studien über antagonistischen Nerven. XIV. Untersuchungen über die elektrotonischen Erscheinungen des Nerven nach Aufenthalt in verschieden zusammengesetzten Salzlösungen. *Zsch. f. Biol.*, 1917, 68, 1-30.
15. GRUBER, C. M. & FELLOWS, A. P. VII. The Effect of Adrenalin on the Irritability and Contractility of Mammalian Nerve-Muscle Preparations after Death. *Amer. J. of Physiol.*, 1918, 46, 472-477.
16. GRUBER, C. M. & KRETSCHMER, O. S. VIII. The Effect of Adrenalin upon the Fatigue Produced by the Injection of the Fatigue Products, Lactic Acid and Acid Potassium Phosphate. *Amer. J. of Physiol.*, 1918, 47, 178-184.

17. GUNZBERG, I. À propos de 'l'escalier' dans les courbes du travail musculaire. *Arch. néerl. de Physiol.*, 1918, 2, 664-668.
18. HEAD, H. Some Principles of Neurology. *Brain*, 1918, 41, 344-354.
19. HERZFELD, E. & KLINGER, R. Chemische Studien zur Physiologie und Pathologie. V. Über 'lösliche und unlösliche' Kolloide; über echte und unechte Gallerten; das Protoplasma und das Problem der Zellpermeabilität. *Biochem. Zsch.*, 1918, 88, 232-282.
20. HIGIER, H. (Trans. by W. M. Kraus). *Vegetative Neurology*. New York & Washington: Nerv. & Ment. Dis. Pub. Co., 1919. Pp. vii + 144. \$2.00.
21. HOFFMANN, P. Über die Beziehungen der Sehnenreflexe zur willkürlichen Bewegung und zum Tonus. *Zsch. f. Biol.*, 1918, 68, 351-370.
22. HUNT, J. R. The Existence of Two Distinct Physiological Systems for the Transmission of Motor Impulses in Peripheral Nerves. *Brain*, 1918, 41, 302-331.
23. JOHNSON, S. E. On the Question of Commissural Neurones in the Sympathetic Ganglia. *J. of Comp. Neurol.*, 1918, 29, 385-403.
24. JORDAN, H. Über besondere Muskeln und Muskeleigenschaften bei Tieren mit echtem Hautmuskelschlauch. *Biol. Zentbl.*, 1917, 37, 578 (original not seen by reviewer).
25. KEMPF, E. J. *The Autonomic Functions and the Personality*. New York & Washington: Nerv. & Ment. Dis. Pub. Co., 1918. Pp. xiv + 156. \$2.00.
26. KRIES, J. VON. Neuere Untersuchungen zur Muskeltätigkeit. *Deutsch. med. Wochensh.*, 1918, 44', 201-203.
27. LANGLEY, J. N. & HASHIMOTO, M. Observations on the Atrophy of Denervated Muscle. *J. of Physiol.*, 1918, 52, 15-69.
28. LANGLEY, J. N. On the Stimulation and Paralysis of Nerve Cells and Nerve Endings. Part II. Paralysis by Curari, Strychnine and Brucine and its Antagonism by Nicotine. *J. of Physiol.*, 1918, 52, 247-266.
29. LUTZ, B. R. Threshold Values in the Spinal Frog. I. Comparison of the Flexion Reflex and the Nerve-Muscle Response. *Amer. J. of Physiol.*, 1918, 45, 507-514.
30. LUTZ, B. R. II. Variations with Change of Temperature. *Amer. J. of Physiol.*, 1918, 45, 515-527.
31. MACWILLIAM, J. A. The Mechanism and Control of Fibrillation in the Mammalian Heart. *Proc. Roy. Soc.*, 1918, 90, B, 302-323.
32. MANSFELD, G. Bemerkungen zur Arbeit Dusser de Barennes: "Über die Innervation und den Tonus der quergestreiften Muskeln." *Pflügers Arch. f. d. ges. Physiol.*, 1917, 168, 205 (original not seen by reviewer).
33. MARUI, K. On the Finer Structure of the Synapse of the Mauthner Cell with Especial Consideration of the "Golgi-Net" of Bethe, Nervous Terminal Feet and the "Nervous Pericellular Net" of Held. *J. of Comp. Neurol.*, 1918, 30, 127-167.
34. MORAL, H. Über die Wirkung von Narkoticis auf den Froschnerven unter den Einfluss von Temperaturänderungen. *Pflügers Arch. f. d. ges. Physiol.*, 1918, 171, 469-495.
35. ORR, D. & ROWS, R. G. The Interdependence of the Sympathetic and Central Nervous Systems. *Brain*, 1918, 41, 1-22.
36. PIÉRON, H. Du mécanisme physiologique du tonus musculaire comme introduction à la théorie des contractures. *Presse med.*, 1918, 88-91.
37. RANSON, S. W. An Introduction to a Series of Studies on the Sympathetic Nervous System. *J. of Comp. Neurol.*, 1918, 29, 305-312.

38. RIDDOCH, G. The Reflex Functions of the Completely Divided Spinal Cord in Man, Compared with those Associated with Less Severe Lesions. *Brain*, 1917, 40, 264-402.
39. RIJNBEEK, G. Van. Rôle et organisation du système nerveux. *Arch. néerl. de Physiol.*, 1916-1917, 1, 198-225.
40. RIJNBEEK, G. VAN. Recherches sur le tonus musculaire et son innervation. *Arch. néerl. de Physiol.*, 1916-1917, 1, 257-261, 262-270, 726-744.
41. SCHMIEDEBERG, O. Über elastische Verkürzung und aktive Erschlaffung lebender Muskeln. *Arch. f. exper. Pathol. u. Pharmakol.*, 1917, 82, 159-176.
42. SPADOLINI, I. Le azioni antagonistiche autonomi. *Arch. di Fisiol.*, 1917, 15, 1-167.
43. STEVENS, H. C. The Cause of Muscular Atrophy Following Nerve Section. *J. of the Amer. med. Assoc.*, 1918, 70, 835-836.
44. VÉSZI, J. Untersuchungen über die Erregungsleitung im Rückenmark. *Zsch. f. allgem. Physiol.* (Verworn's), 1918, 18, 58-92.
45. VÉSZI, J. Die physikalisch-chemische Theorie der Narkose. *Pflügers Arch. f. d. ges. Physiol.*, 1918, 170, 313-336.

SOME RECENT CONTRIBUTIONS TO THE PHYSIOLOGY OF THE AUTONOMIC NERVOUS SYSTEM

BY F. W. CARPENTER

Trinity College

Physiological Changes Associated with Certain Mental States.—Through the work of Cannon and his collaborators we have learned in recent years that emotional excitement brings about, through the autonomic nerves, an increased secretion by the adrenal glands. The substance liberated, epinephrin, is poured into the blood, carried by the circulation to various parts of the body, and here largely through its stimulating effect on the autonomic nervous system prepares the whole organism for vigorous muscular exertion. Among the resulting changes reported by investigators are inhibition of the movements of the alimentary canal, the shifting of blood from the abdominal viscera to the skeletal muscles, increased cardiac vigor, and the mobilization of energy-giving sugar in the circulation.

A somewhat analogous effect of the emotions of fear and rage in respect to the liver has lately been described by Burge and Burge (6). Presumably through the stimulation of the autonomic nervous mechanism during the emotional excitement there is formed in the liver an increased amount of catalase, a substance which, when released to the blood stream and carried to the skeletal muscles, appears to augment the oxidation of these muscles, acting possibly as an organic peroxide (comparable in structure to hydrogen

peroxide) liberating atomic oxygen. This physiological reaction is obviously of advantage to the organism in making available more energy for fighting or escaping from danger by flight, actions which, in nature, are often associated with the emotions of rage and fear.

The experiments which led to these conclusions were made on cats confined in a wire cage, and worried for a considerable period by a barking dog. A comparison of the catalase content of the livers of these "fighting" cats with that of the livers of "normal" or control cats (which had not been annoyed by the dog, but which otherwise had lived under the same environmental conditions) showed that the livers of the excited animals contained about ninety per cent. more catalase.

In a subsequent paper Burge (5) gives additional evidence along the same lines. During the early stages of the administration of ether for anesthetizing purposes cats and dogs exhibit marked mental excitement. By prolonging this period of excitement the catalase content of the blood can be appreciably increased. To show that nervous impulses passing to the liver bring about the production of catalase, the splanchnic nerves were stimulated electrically. As a result of the nervous excitation more catalase than before was found in the blood stream.

Stewart and Rogoff (20), as a result of their experiments with cats, call into question the assertion that hyperglycemia, or excess of sugar in the blood, is one of the conspicuous effects of emotional excitement, its production depending upon the secretory stimulation, through the autonomic system, of the adrenal glands. They doubt if so-called emotional hyperglycemia is a constant or even a common occurrence. If it does occur, they believe it is not dependent upon an augmented secretion of epinephrin by the adrenals. In normal cats frightened by a barking dog they were unable to detect any increase in epinephrin, nor could they find any essential difference in the sugar content of the blood after emotional excitement in normal animals as compared with other animals in which the output of epinephrin was prevented by an operation.

Changes in the cerebral circulation were found by Binet (4) to occur in men startled by the discharge of a revolver or the blast of a siren. The results, however, were curiously variable, ranging all the way from congestion to anemia.

Hyde and Scalapino (10) have published a preliminary report on a series of experiments undertaken to ascertain the effect of

different kinds of music upon the heart beat and blood pressure. Phonograph records were employed. In a subject fond of music the minor tones of Tschaikowsky's death symphony caused an increase in cardiac activity and a fall in blood pressure. These effects the experimenters regard as the probable result of "psychic or reflex inhibition of the vagus nerve and vasomotor center." The Toreador's stirring song from Carmen produced a different effect in that the blood pressure was increased, although the pulse was accelerated as before. The change is attributed to reflex action of the accelerator nerve or possibly inhibition of the vagus. A Sousa march, "The National Emblem," gave a still different result. The heart beat became slower with increased blood pressure. A stimulating effect upon the vagus is suggested. The authors refer in their discussion to the probable influence of music, through the autonomic system, also upon digestion, secretion, muscle tone, and respiration, and mention the possibility that the intelligent selection of music may be of benefit in the treatment of certain types of nervous disorders.

The Gastric Hunger Mechanism in Fasting and Fever.—Vigorous peristaltic contractions of the empty stomach are believed to initiate in the walls of that organ the nervous impulses which arouse in the central nervous system the sensation of hunger. These contractions appear to be occasioned by the local motor mechanisms in the gastric wall (myenteric plexus), but are subject to tonic and acceleratory influences through extrinsic parasympathetic fibers (vagus nerve) and inhibitory control by extrinsic sympathetic fibers (splanchnic nerves).

The hunger contractions of the stomach during prolonged fasting were kept under observation by Carlson (7) in a human subject who voluntarily abstained from eating for a period of fifteen days. Fasting men have usually declared that the sensation of hunger disappears after the first three days; but in Carlson's subject the gastric hunger contractions showed practically normal rhythm and intensity during the entire fasting period. The man reported as the "dominant element in consciousness throughout the fast, ideas or thoughts of food and eating," although the hunger contractions were less uncomfortable or painful than those experienced under normal conditions of food taking. The author is of the opinion that fasting men who say they feel no hunger do not recognize as such the sensation produced by the gastric hunger contractions, but regard it as pain or discomfort from gastrointestinal disorders.

The fasting subject reported, however, a loss of appetite or desire for food, a sensation which Carlson and other physiologists consider quite distinct from hunger. They apply the term appetite to a milder and pleasanter feeling, based in part on memory of agreeable gustatory or olfactory sensations. Appetite can be aroused experimentally by stimulating nerve endings other than those in the muscular coat of the stomach, which are associated with hunger contractions. Such endings are found for example in the lining of the mouth cavity and esophagus. Carlson accordingly attributes the loss of appetite by his subject to the condition of the latter's mouth, which became coated, and developed a disagreeable taste lasting throughout the fast. The unpleasant sensations originating thus are believed to have suppressed the physiological and psychic elements concerned in the pleasurable anticipation of food.

The absence of hunger and appetite in fever is a matter of common clinical experience. Experiments by Meyer and Carlson (14) on dogs show that during fever there is a depression of gastric hunger contractions. From results obtained through sectioning the vagus and splanchnic nerves, the conclusion was reached that this depression was probably due to the lowering of the vagus tone by the fever or the bacterial toxins associated with it; but the authors do not regard this as a complete explanation of the absence of hunger during a prolonged period of fever.

Anatomical and Histological Structure.—The introduction by Ranson (15) to a series of studies on the structure of the autonomic system by himself and his associates includes a good review of the terminology in present use by physiologists and anatomists, and very properly emphasizes the desirability of approaching the morphological study of the system from the functional point of view. The series of five papers by Ranson and Billingsley (2, 3, 16, 17, 18) has to do with the structural details of the cervical sympathetic trunk, the superior cervical ganglion and its branches, the thoracic sympathetic trunk, the rami communicantes, and the splanchnic nerves.

Langley's contention, based on physiological evidence, that all neurone terminations in autonomic ganglia are those of preganglionic fibers having a cerebrospinal origin, is borne out by the histological studies of Johnson (11). After an operation designed to bring about the degeneration of a group of preganglionic fibers, examination of the related sympathetic ganglia in frogs showed a

complete disappearance of the terminal spirals and pericellular networks normally in functional connection with the ganglion cells (cell-bodies of postganglionic neurones). These endings, which are the only types occurring in the frog's autonomic ganglia, appear therefore, to be exclusively those of fibers originating in the spinal cord. There is no evidence that commissural neurones, *i. e.*, intrinsic connector neurones confined to the sympathetic nerves and their ganglia, are present in the frog.

In agreement with recent work of physiologists indicating that the sensory nerves supplying the digestive tube are distributed largely to its muscular coat, nerve endings of sensory type have been found by means of methylene blue intravital staining in the outer (longitudinal) muscle layer of the stomach and intestine, and in the adjacent serous coat external to it (Carpenter, 8). These endings were not observed in other regions of the wall of either stomach or intestine. The terminal structures take the form of skeins and nets in the stomach of the cat, and of tuft-like endings in the small intestine of the dog. They are so placed that they would presumably be affected by vigorous peristaltic movements giving rise, in the stomach, to hunger pangs, or by severe distension or contraction of the muscle tunic in either organ producing pain. Their central connections have not been determined, although the sensory fibers in the intestine have been traced to the myenteric plexus.

General.—The monograph by Dr. Heinrich Higier (9), of Warsaw, entitled *Vegetative Neurology*, has been translated into English by Dr. W. M. Kraus, and published in this country. The volume deals with the anatomy, physiology, pharmacodynamics, and pathology of "the sympathetic and autonomic nervous systems." The unfortunate synonymity which exists in neurological nomenclature has led to the employment of terms by the author and translator somewhat confusing to the reader accustomed to the terminology now generally accepted by physiologists, that proposed by Langley. Higier follows the usage of many pharmacologists in applying the name, autonomic, not to the whole system, as is done by Langley, but to the cranial and sacral divisions (the parasympathetic of Langley). His expression for the entire mechanism is "vegetative nervous system." His "sympathetic" division, however, corresponds with that of Langley, since by that term he designates those components which are in functional connection with the thoracico-lumbar region of the spinal cord.

In those chapters devoted to anatomy and physiology the author bases his descriptions and discussions very largely on the work of a group of investigators whose publications have appeared in the German language. The account which he gives of the histology of the system is impaired by the omission of various details (such as those of the ganglionic synapses), the recognition of which is very helpful in understanding the system as a functional mechanism. Indeed, one or two of the figures designed to illustrate the structural relations of the neurones are not only misleading, but histologically incorrect. It is to be regretted that the translator, owing to his absence in the U. S. army medical service abroad, was unable to revise the proofs of the book and make final corrections.

The Autonomic Functions and the Personality by Dr. E. J. Kempf is another monograph appearing in the same series. The theory about which the book centers is thus expressed in the author's words:

"Whenever the autonomic or affective sensori-motor apparatus is disturbed or forced into a state of unrest, either through the necessities of metabolism, or endogenous, or exogenous stimuli, it compels the projicient sensori-motor apparatus to so adjust the receptors in the environment as to acquire stimuli having the capacity to produce adequate postural readjustments in the autonomic apparatus. In this manner, only, the disturbance of function may be neutralized. The constant tendency of the autonomic apparatus is to so organize the projicient apparatus into a means as to acquire a maximum of affective gratification with a minimum expenditure of energy or effort."

While it is beyond the scope of this review and the competency of the present reviewer to discuss either the validity or the value of this theory as a working hypothesis for the psychologist and psychiatrist, a few comments on one or two of the morphological and physiological considerations on which it is based may not be out of place. In support of his views the author lays stress on the Mosso-DeBoer theory that the skeletal muscles are supplied with sympathetic as well as cerebro-spinal fibers, and that it is through the sympathetic innervation that tonus in voluntary muscles is maintained. The anatomical basis for this theory is found in the observations of Botezat (*Zschr. f. wissen. Zool.*, 1906) and Boeke (*Ana. Anz.*, 1909; summary of his work in *Anat. Anz.*, 1913). These authors describe fine, non-medullated fibers ending in small motor end plates on certain striated muscles in various vertebrates.

It is held that the fibers are unconnected with the medullated cerebro-spinal fibers distributed to the muscles, the assumption being that they are autonomic elements. It cannot, however, be said that the view that the skeletal muscles throughout the body receive this double innervation has gained general recognition among neurologists.

On the physiological side the evidence appears to be conflicting as to the direct influence of the autonomic nervous system on the tonus of voluntary muscle. For example, the recent experimental work of de Barenne (1) and Lopez and v. Brücke (13) gave results opposed to such a view, while Riesser (19), on the other hand, obtained pharmacological evidence in its favor.

It may be added that the facts of vertebrate embryology do not, in the reviewer's opinion, bear out the author's conception of the priority in development of the autonomic apparatus over the cerebro-spinal ("projicient") apparatus. Nor can the inclusion of the diaphragm and its innervation in the autonomic mechanism (in support of the James theory of the origin of the emotions) be defended upon morphological grounds, however far the author may be justified in making such a classification for psychological reasons.

REFERENCES

1. BARENNE, D. DE. Ueber die Innervation und den Tonus der quergestreiften Muskeln. *Arch. f. ges. Physiol.*, 1916, 166, 145-168.
2. BILLINGLSEY, P. R. & RANSON, S. W. On the Number of Nerve Cells in the Ganglion Cervicale Superius and of Nerve Fibers in the Cephalic End of the Truncus Sympathicus in the Cat, and on the Numerical Relations of Preganglionic and Postganglionic Neurones. *J. of Comp. Neurol.*, 1918, 29, 359-366.
3. BILLINGLSEY, P. R. & RANSON, S. W. Branches of the Ganglion Cervicale Superius. *J. of Comp. Neurol.*, 1918, 29, 367-384.
4. BINET, L. Le pouls cérébral dans les émotions. *Comptes rendus*, 1918, 166, 505-508.
5. BURGE, W. E. The Effect of Ether Anaesthesia, the Emotions and Stimulation of the Splanchnics on the Catalase Content of the Blood. *Amer. J. of Physiol.*, 1917, 44, 290-297.
6. BURGE, W. E., & BURGE, E. L. The Effect of the Emotions on the Catalase Content of the Liver. *Amer. J. of Physiol.*, 1917, 44, 75-79.
7. CARLSON, A. J. Hunger, Appetite and Gastric Juice Secretion in Man During Prolonged Fasting (Fifteen Days). *Amer. J. of Physiol.*, 1918, 45, 120-146.
8. CARPENTER, F. W. Nerve Endings of Sensory Type in the Muscular Coat of the Stomach and Small Intestine. *J. of Comp. Neurol.*, 1918, 29, 553-560.
9. HIGIER, H. *Vegetative Neurology*. (Trans. by W. M. Kraus) New York & Washington: Nerv. & Ment. Dis. Pub. Co., 1919. Pp. vii + 144.
10. HYDE, I. H., & SCALAPINO, W. The Influence of Music upon Electro-cardiograms and Blood Pressure. *Amer. J. of Physiol.*, 1918, 46, 35-38.

11. JOHNSON, S. E. On the Question of Commissural Neurones in the Sympathetic Ganglia. *J. of Comp. Neurol.*, 1918, **29**, 385-404.
12. KEMPF, E. J. *The Autonomic Functions and the Personality*. New York & Washington: Nerv. & Ment. Dis. Publ. Co., 1918. Pp. xiv + 156.
13. LOPEZ, J. N. Y., & v. BRUCKE, E. T. Nach der Bedeutung des Sympathicus für den Tonus der Skelettmusculature. *Arch. f. ges. Physiol.*, 1916, **166**, 55-64.
14. MEYER, J., & CARLSON, A. J. Hunger and Appetite in Fever. *Amer. J. of Physiol.*, 1917, **44**, 222-233.
15. RANSON, S. W. An Introduction to a Series of Studies on the Sympathetic Nervous System. *J. of Comp. Neurol.*, 1918, **29**, 305-312.
16. RANSON, S. W., & BILLINGSLEY, P. R. The Superior Cervical Ganglion and the Cervical Portion of the Sympathetic Trunk. *J. of Comp. Neurol.*, 1918, **29**, 313-358.
17. RANSON, S. W., & BILLINGSLEY, P. R. The Thoracic Truncus Sympathicus, Rami Communicantes, and Splanchnic Nerves in the Cat. *J. of Comp. Neurol.*, 1918, **29**, 405-439.
18. RANSON, S. W., & BILLINGSLEY, P. R. An Experimental Analysis of the Sympathetic Trunk and Greater Splanchnic Nerve in the Cat. *J. of Comp. Neurol.*, 1918, **29**, 441-456.
19. RIESSER, O. Ueber Tonus und Kreatingehalt der Muskeln in ihren Beziehungen zu Wärmeregulation und Zentralsympathischen Erregungen. *Arch. exper. Path. Pharm.*, 1916, **80**, 183-230.
20. STEWART, G. N., & ROGOFF, J. M. The Alleged Relation of the Epinephrin Secretion of the Adrenals to Certain Experimental Hyperglycemias. *Amer. J. of Physiol.*, 1917, **44**, 543-580.

THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

TROPISMS AND INSTINCTIVE ACTIVITIES

BY WALLACE CRAIG

University of Maine

Comprehensive Studies.—Jones's book (14) is a popular, interesting account of the ancestors of man, who became arboreal probably early in the mammalian age, and of the influence of arboreal life upon every part of the organism, especially the nervous system.

Szymanski's long paper (42) consists of twelve distinct articles, grouped in three parts. 'I. Beobachtungen und Versuche über Angeborene Handlungen.' (1) The worm *Tubifex* (pp. 2-33). If all animals be divided into the optical, the osmotic and the tactile, this worm is an extreme example of the tactile: living with its head buried in its nutriment (mud), it has little use for distance-receptors. (2) In an insect larva (*Arge*, a saw-fly), arousal of the fear reaction, even amputation of a leg, has no effect upon the rate of heart-beat (pp. 33-37). (3) "Ueber Abwehrreflexe bei Raupen" (pp. 37-48). This is a study of the phylogeny of a reflex. It is traced back to "Probierbewegungen." Perhaps all reflexes, like voluntary acts, are secondary phenomena, having evolved by selection from varied movements (Jennings) which constitute the *Grundlage* of all behavior. (4) "Ueber Putzreflexe bei Insekten" (pp. 49-86). Each species of insect cleans especially that sense organ, whether eye, antenna, or mouth-part, which is most used by it. Insects make movements to clean the sense organs while awaking from a state of etherization; thus the deficiency of excitation caused by the action of ether on the nervous system is projected outward, by the law of "excentric localization" as if it came from

the sense organs. (5, 6, 7) (*v.i.*, under *Cycles*.) "II. Versuche über die Entstehung der rezeptorisch-motorischen Gewohnheiten." (1) (Pp. 127-157) Dogs failed to distinguish between a plain black wall and a black wall with a white pyramid drawn on it. (2) (Pp. 157-197) A study of the disappearance of habits. (3) (Pp. 197-220) A series of tests of rats learning a maze, leading to the conclusion that the reduction of errors to zero is not due to mere repetition but requires a "vital interest" such as hunger. "III. Allgemeine Betrachtungen über das Verhalten der Tiere. (1) Körperstellungen als Ausdruck innerer Zustände der Tiere" (pp. 220-237). The principal attitudes are sleep, rest and readiness, the last showing a few principal varieties. All can be grasped under the concept of attention. Attention must be given a biological definition. It is a setting of the organism for the reception of certain stimuli. Sleep is negative attention. In the sleeping attitude, each form protects its most important sense organ; *e.g.*, insects protect the antenna. (2) "Der Umfang der rezeptorischen und Aktionssphäre" (pp. 237-244). The author states (but the reviewer does not agree) that in most animals, perhaps in all, even including man, the "action sphere" is restricted to actions that are inborn, hence is narrowly limited, whereas the "receptory sphere" is comparatively unlimited.

Wheeler (49), from a survey of parasitism in wasps, bees and ants, concludes that in this group a parasitic species evolves from the host species itself. Some individuals within a species take to robbing others of the food destined for the larvæ. The parasitic habit thus started continues, by a "circular process." The parasite becomes a distinct species. In time, it exterminates its host. It gradually transfers its attentions to a new but related host.

Tropisms, Taxes.—Crozier and Arey (8) find that *Onchidium* in the laboratory is always photonegative. Yet in nature it is diurnal. Its heliotropism is, the authors think, of no use, and is, in the natural habitat, centrally inhibited by other stimulations. Piéron (28) finds that limpets, in homing, when on rough rocks, are guided mostly by the relief of the rock surface (tactile), less by the inclination toward the vertical (weight), least by the direction of light rays. On smooth rocks they rely on the last two factors. It is interesting to compare these two studies, on *Onchidium* and on the limpet.

Grave (10) finds that in the ascidian which he studied the free-swimming period is of short duration—ten minutes to two

hours. The larvæ are positively heliotropic for a brief interval at first. Becoming negatively heliotropic and probably positively geotropic, they descend and become attached.

Rabaud (29) finds that a myriapod (*Schizophyllum*) moves from lighted places into dark; but does this neither by a tropism nor by differential sensibility. It is phototactic, but not phototropic. It is "stenophote," living in the dark; whereas animals that flourish in the light are "euryphote."

Riley (31) studied the problem, What becomes of apterous water-striders if their pool of water dries up? Some of them, traveling overland, succeed in reaching other pools, but many die. Weese (48) finds that the horned lizard reacts more definitely to a gradient of soil temperature than to one of air temperature.

Small (36) finds that in a plant, *Vicia Faba*, geotropism of the root-tips obeys Weber's law, and does not require statoliths but is due to differential increase in the permeability of the protoplasm to ions, which is detected by increase in electrical conductivity. This change in the protoplasm resembles that in a contracting muscle.

Righting Reactions.—Szymanski (44) observed how beetles, when turned on their backs, regained the normal position. In sixty species he found twelve different methods. But in each beetle there are several variations of the method of turning over; they are tried in turn until one of them produces the end-effect.

Locomotion.—Copeland (5) gives convincing evidence that the locomotion of the mud snail *Alectrion* is due to ciliary movement. Stimulation of the tentacles induces movements of the pedal cilia, showing that the latter are, directly or indirectly, under control of the nervous system. Crozier (7) adds a new type of locomotion to those known among gastropods: in *Xenophora* the foot is advanced, is attached by suction, then draws the shell forward.

Müller (25) has made an extended study of a crustacean resembling *Branchipus*. The rate of movement of the swimming feet varies directly with temperature and light, and inversely as the viscosity of the medium; it decreases with age.

Stellwaag (39) studied the means by which insects steer during flight. Some investigators had claimed that they steer by shifting the center of gravity; as, by moving the abdomen. The author took shadow photographs of flying insects, and found that the abdomen does not move. He studied the wing movements, and saw that the two wings, though always synchronous, may move in different planes and with different amplitude.

Szymanski (47) points out that every rain which falls on a meadow isolates many insects on tiny "islands." Various insects escape from these islands by flying, jumping, swimming, running on the surface film, crawling under water. The swimming movements of ants are complex and highly adaptive.

Grave (10) finds that Ascidian behavior is not so similar to that of vertebrates as has been assumed. The free-swimming larva swims with constant rotation on its long axis.

By an examination of the mechanism of flying-fishes, Ahlborn (1) shows that they cannot fly, except by momentum.

Migration.—Baldwin (3) has inaugurated a new era in bird-banding by systematically trapping the birds. He has discovered that individuals winter in successive years in the same winter quarters; that yearlings return to the locality where they were hatched; that a pair of wrens, after rearing one brood, became "divorced," each finding a new mate and rearing a new brood.

The title of Bretscher's paper (4) may be misleading. His thesis is that bird migration occurs when the time has come, regardless of weather. He seems successful in proving that migration is independent of temperature as such. But Smith (37) finds that migration records (of all species massed together) show high correlation with barometric conditions and favorable winds

Cycles.—Szymanski continues his studies of the daily cycle: in earthworm, snail, crayfish, blow-fly, rabbit, cat, dog (46); in tree-frog, ringed snake, jackdaw (42, sections I, 5, 6 and 7); in white rat, dancing mouse (43); in the human infant (45). The ringed snake showed activity regularly at midday, which must have been due to inner factors, for it was not due to hunger nor temperature. Adult man is an "optical" animal, and as such is "monophasic," with one period of activity and one of rest in the nycthemeron. But the human infant, 1 to 10 days old, is "polyphasic," with 5 or 6 periods of activity; it is a "tactile," resembling the earthworm.

Rhythm.—Snyder and Snyder (38) have solved, at least in great part, the problem of the synchronous flashing of fireflies. Observing for several seasons, they saw on a few occasions that the fireflies did flash synchronously. They found that the rate of flashing increases as the temperature rises. At a given temperature the rates of many individuals are nearly identical. This gives a basis for synchronism. "On the other hand, as far as the individual beetle is concerned, the synchronous flashing would be purely accidental and utterly devoid of any relation to a higher

intelligence or to instinct or any community activity." These findings are similar to those of Shull on the synchronous chirping of crickets.

Swindle (41) tells us that he has "many pounds of kymograph records," and he gives a few samples, but he does not tell precisely what data these represent. He states that a cockatoo can be trained to beat simultaneously in four different rhythms, with 5 to 11 beats in the measure. This remarkable feat will excite the envy of our rag-time pianists and our jazz dancers.

Defense.—Crozier and Arey (9) find that the snail *Onchidium floridanum* exhibits two types of coloration which the authors think inexplicable either as concealing or as warning colors. This species has repugnatorial glands which, when the animal is touched, shoot their irritating contents with some accuracy toward the stimulating object.

Cowles (6) observed that hermit crabs, on changing to a larger shell, seized the sea-anemones which were on the old shell and transferred them to the new one.

Pantel and Sinéty (27) studied behavioristically the whole subject of pigmentation change in phasmids. Many facts in the rearing of the young favor the theory of color adaptation: the color harmonizes with that of the substratum, even when the substratum does not supply the nourishment. Adaptation is effected partly by the insect traveling to the substratum of its choice.

Siedlecki (35) reports field observations on the "terrifying" attitude.

Immobility.—Rabaud (30) finds that "death feigning" is only a special case of a reflex immobility which is found in some degree in all arthropods. The arousal from immobility is due to an antagonistic reflex. Both the immobilizing and the mobilizing stimuli are tactual. The chief zones of the former are on the cephalothorax. The chief zones of the latter are the soles of the tarsi and the tip of the abdomen. Thus an insect holding firmly to the substratum, with tip of abdomen touching the substratum, resists immobilization. The entire integument is replete with sense organs connected with motor-excitatory and -inhibitory centers, the latter being more at the anterior end, the former at the posterior. Reflex immobility is only an exaggeration of the normal functioning of these paths, an exaggeration of muscular tonus. Reflex immobility resembles sleep, differing chiefly in the greater muscular tension.

Szymanski (44) finds that in beetles the "hypnotized" con-

dition differs from death feigning in that the former is passively, the latter actively assumed. Death feigning in its highest development is accompanied by structural modifications, the insect drawing its legs, tortoise-like, into recesses in the trunk.

Fear.—Griffith (11) observed that white rats, on seeing, hearing and smelling a cat for the first time, showed extreme fear. This fear might have been due to the feline odor specifically, or merely to its unfamiliarity. Kunkel (20) observed that his white rats showed fear on first perceiving the odor of a cat, but not on first perceiving the odor of a rabbit, from which he concludes that the fear is aroused by the feline odor specifically.

Physiology.—Moore (23) finds that castrated rats with implanted ovary show typical maternal behavior; spayed females with implanted testis show typical male behavior.

Oltramare (26) reports that rabbits, guineapigs, cocks, pigeons, tortoises, frogs, tritons and fish have been kept in a dark room, some of them more than three months, with no profound effect on their vital condition. They show decrease of waste products and of muscular activity, and increase of stored nourishment, these physiological conditions being due to a reflex from the retina. Pantel and Sinéty (27) report that phasmid larvae which were experimentally blinded, by a non-traumatic method, showed an unfavorable physiological effect, indicated by change in the number of molts and in the rate of transformation.

Neurology.—Arey and Crozier (2), from a study of the behavior of *Chromodoris*, conclude that the gill crown and some other parts are controlled by a "nerve net."

Moral (24) finds that the effect of some anesthetics is greater at high temperature. This may be due to differential solubility: at high temperature these drugs are relatively more soluble in lipoids, hence pass into the nerves; at low temperature they are relatively more soluble in water, hence pass out of the nerves. Certain other anesthetics show the reverse phenomena.

Komine (18, 19) is using non-protein nitrogen in the brain as a measure of catabolism.

Riddle has a strain of ataxic pigeons descended from a female that was reproductively overworked. Hoshino (13) finds that the brain in these birds anatomically resembles that in hereditary ataxia in man. Koch and Riddle (16, 17) find that the ataxic brains are chemically underdeveloped. They have made out (17) an "age series" of normal pigeon brains, showing that chemical

differentiation follows the same course in the pigeon as in the rat and man.

Kuntz (21) finds that the sympathetic nerve fibers in the ovary and in the testis of the dog supply no cells nor tissues except the muscle fibers. Rogers (33, 34) shows that in the pigeon removal of the thalamus destroys the temperature-regulating mechanism. Wintrebert (50) observed that *Scyllium* commences automatic rhythmic movements at an early embryonic stage. These are independent of the nervous system. Control of muscle by nerve is established gradually.

Meltzer and Githens (22) were able to abolish "voluntary movements and the sensation of pain, without affecting reflexes" in dogs by a blow on the cranium. In such animals, nose-licking persists, indicating that it is a reflex. It may be induced by compression of the nasal septum, but the licking occurs only when the compression has ceased. Apparently the compression stimulates simultaneously two antagonistic sets of fibers, exciting and inhibiting, the former having an efficient after-effect.

Philosophy.—Hooker (12) presents the idea that organisms exhibit two fundamental processes: behavior and assimilation. In behaving, they react according to the theorem of Le Chatelier. In assimilating, they perpetuate themselves by autocatalysis. Kappers (15) points out interesting analogies and relations between the phenomena of growth and nervous and conscious action.

Sumner (40) shows reason to believe that the principle of trial and error can be given a still wider application than it has had. It will help us to explain the most difficult cases of adaptation and "organic purposefulness," including those of regeneration. "We may suppose the organism to be in a condition of 'unrest' until the end is achieved." Even the Lamarckian principle involves selection, because "modifications produced by the environment are in the nature of reactions to stimuli," and all reactions are selective.

Ritter (32) emphasizes the unity and continuity of the living organism. We should study the organism as a whole, not only in parts; in nature, not only in the laboratory. Both analysis and synthesis are needed. He emphasizes also individuality and specificity. He gives (vol. 2 pp. 246-274) a number of interesting descriptions of instinctive behavior.

REFERENCES

1. AHLBORN, F. Der Flugmechanismus der fliegenden Fische. *Zeitschr. f. wiss. Zool.*, 1916, 115, 368-381.

2. AREY, L. B. & CROZIER, W. J. The Nervous Organization of a Nudibranch. *Proc. Nat. Acad. Sci.*, 1919, 5, 498-500.
3. BALDWIN, S. P. Bird-Banding by Means of Systematic Trapping. *Proc. Linn. Soc. of New York*, 1919, No. 31, 23-56.
4. BRETSCHER, K. Die Abhängigkeit des Vogelzugs von der Witterung. *Biol. Zentbl.*, 1918, 38, 296-314.
5. COPELAND, M. Locomotion in Two Species of the Gastropod Genus *Alectrion* with Observations on the Behavior of Pedal Cilia. *Biol. Bull.*, 1919, 37, 126-138.
6. COWLES, R. P. The transplanting of Sea Anemones by Hermit Crabs. *Proc. Nat. Acad. Sci.*, 1920, 6, 40-42.
7. CROZIER, W. J. On the Use of the Foot in some Mollusks. *J. of Exp. Zool.*, 1919, 27, 359-366.
8. CROZIER, W. J., & AREY, L. B. The Heliotropism of *Onchidium*: a problem in the analysis of animal conduct. *J. of Gen. Physiol.*, 1919, 2, 107-112.
9. CROZIER, W. J., & AREY, L. B. *Onchidium* and the Question of Adaptive Coloration. *Amer. Natural.*, 1919, 53, 415-430.
10. GRAVE, C. *Amaroucium pellucidum* (Leidy) form *constellatum* (Verrill). I. The activities and reactions of the tadpole larva. *J. of Exp. Zool.*, 1920, 30, 238-257.
11. GRIFFITH, C. R. A Possible Case of Instinctive Behavior in the White Rat. *Science*, 1919, 50, 166-167.
12. HOOKER, H. D. Behavior and Assimilation. *Amer. Natural.*, 1919, 53, 506-514.
13. HOSHINO, T. A Study of Brains and Spinal Cords in a Family of Ataxic Pigeons. *J. of Comp. Neurol.*, 1919, 31, 111-161.
14. JONES, F. W. *Arboreal Man*. London & N. Y., 1916. Pp. 230.
15. KAPPERS, C. U. A. The Logetic Character of Growth. *J. of Comp. Neurol.*, 1919, 31, 51-67.
16. KOCH, M. L., & RIDDLE, O. The Chemical Composition of the Brain of Normal and Ataxic (?) Pigeons. *Amer. J. of Physiol.*, 1918, 47, 124-136.
17. KOCK, M. L., & RIDDLE, O. Further Studies on the Chemical Composition of the Brain of Normal and Ataxic Pigeons. *J. of Comp. Neurol.*, 1919, 31, 83-110.
18. KOMINE, S. Metabolic Activity of the Nervous System. III. On the amount of non-protein nitrogen in the brain of albino rats during twenty-four hours after feeding. *J. of Comp. Neurol.*, 1919, 30, 397-410.
19. KOMINE, S. Metabolic Activity of the Nervous System. IV. The content of non-protein nitrogen in the brain of the rats kept in a state of emotional and physical excitement for several hours. *J. of Comp. Neurol.*, 1919, 31, 69-82.
20. KUNKEL, B. W. Instinctive Behavior in the White Rat. *Science*, 1919, 50, 305-306.
21. KUNTZ, A. The Innervation of the Gonads in the Dog. *Anat. Record*, 1919, 17, 203-219.
22. MELTZER, S. J., & GITHENS, T. S. The Nose-Licking Reflex and Its Inhibition. *Amer. J. of Physiol.*, 1919, 50, 377-382.
23. MOORE, C. R. On the Physiological Properties of the Gonads as Controllers of Somatic and Psychological Characteristics. 1. The rat. *J. of Exp. Zool.*, 1919, 28, 137-160.
24. MORAL, H. Ueber die Wirkung von Narkoticis auf den Froschnerven unter dem Einfluss von Temperaturänderungen. *Pflüger's Arch.*, 1918, 171, 469-495.
25. MÜLLER, R. T. Zur Biologie von *Tanyastix lacunae*, Guérin. (Vorläufige Mitteilung.) *Biol. Zentbl.*, 1918, 38, 257-268.

26. OLTRAMARE, J. H. Quelques réflexions a propos de l'action de l'obscurité sur les êtres vivantes. *C. r. Soc. de Biol.*, 1919, **82**, 190-191.
27. PANTEL, J., & DE SINÉTY, R. Réaction chromatique et non chromatique de quelques Phasmides aux excitations dépendant de la lumière. *Bull. biol.*, 1918, **52**, 177-283.
28. PIÉRON, H. De l'importance respective des divers facteurs sensoriels dans le sens du retour de la Patelle. *C. r. Soc. de Biol.*, 1919, **82**, 1227-1230.
29. RABAUD, E. La lumière et le comportement des organismes. *Bull. biol.*, 1919, **52**, 325-343.
30. RABAUD, E. L'immobilisation réflexe et l'activité normale des Arthropodes. *Bull. biol.*, 1919, **53**, 1-149.
31. RILEY, C. F. C. Some Habitat Responses of the Large Water-Strider, *Gerris remigis*, Say. *Amer. Natural.*, 1919, **53**, 394-414, 483-505; 1920, **54**, 68-83.
32. RITTER, W. E. *The Unity of the Organism: or The Organismal Conception of Life*. Boston: Badger, 1919. 2 vols., Pp. 398, 408.
33. ROGERS, F. T. Studies on the Brain Stem. I. Regulation of body temperature in the pigeon and its relation to certain cerebral lesions. *Amer. J. of Physiol.*, 1919, **49**, 271-283.
34. ROGERS, F. T. Experimental Studies on the Brain Stem. III. The effects on reflex activities of wide variations in body temperature caused by lesions of the thalamus. *J. of Comp. Neurol.*, 1919, **31**, 17-35.
35. SIEDLECKI, M. Quelques remarques à propos de ce qu'on appelle "position terrifiante" des animaux. *C. r. Soc. de Biol.*, 1919, **82**, 49-52.
36. SMALL, JAMES. Changes in Electrical Conductivity under Geotropic Stimulation. *Proc. Roy. Soc.*, 1918, *Series B*, **90**, 349-363.
37. SMITH, FRANK. The Correlation between the Migratory Flights of Birds and Certain Accompanying Meteorological Conditions. *Wilson Bull.*, 1917, **29**, 32-35.
38. SNYDER, C. D., & SNYDER, A. v. t. H. The Flashing Interval of Fireflies—Its Temperature Coefficient—An Explanation of Synchronous Flashing. *Amer. J. of Physiol.*, 1920, **51**, 536-542.
39. STELLWAAG, F. Wie steuern die Insekten während des Fluges? *Biol. Centbl.*, 1916, **36**, 30-44.
40. SUMNER, F. B. Adaptation and the Problem of "Organic Purposefulness." *Amer. Natural.*, 1919, **53**, 193-217, 338-369.
41. SWINDLE, P. F. The Peristaltic-like Nature of Organic Responses. *Amer. J. of Psychol.*, 1919, **30**, 187-210.
42. SZYMANSKI, J. S. Abhandlungen zum Aufbau der Lehre von den Handlungen der Tiere. *Pflüger's Arch.*, 1918, **170**, 1-244.
43. SZYMANSKI, J. S. Die Verteilung der Ruhe- und Aktivitätsperioden bei weissen Ratten und Tanzmäusen. *Pflüger's Arch.*, 1918, **171**, 324-347.
44. SZYMANSKI, J. S. Ueber Umdrehreflexe bei den Käfern. *Pflüger's Arch.*, 1918, **171**, 348-362.
45. SZYMANSKI, J. S. Versuche über Aktivität und Ruhe bei Säuglingen. *Pflüger's Arch.*, 1918, **172**, 424-429.
46. SZYMANSKI, J. S. Die Verteilung von Ruhe- und Aktivitätsperioden bei einigen Tierarten. *Pflüger's Arch.*, 1918, **172**, 430-448.
47. SZYMANSKI, J. S. Das Verhalten der Landinsekten dem Wasser gegenüber. *Biol. Zeitbl.*, 1918, **38**, 340-344.

48. WEESE, A. O. Environmental Reactions of *Phrynosoma*. *Amer. Natural.*, 1919, 53, 33-54.
49. WHEELER, W. M. The parasitic Aculeata, a study in evolution. *Proc. Amer. Philos. Soc.*, 1919, 58, 1-40.
50. WINTREBERT, P. L'apport du système nerveux à l'automatisme de l'appareil locomoteur, chez les embryons de Sélaciens. *C. r. Soc. de Biol.*, 1918, 81, 585-588.

SENSORY PHYSIOLOGY OF ANIMALS

BY K. S. LASHLEY

University of Minnesota

The literature for the year indicates some revival of interest in animal behavior after two years of short commons. As usual the bulk of material deals with photic sensitivity, but it is marked by a tendency to turn from type studies of tropisms to an analysis of pattern vision in invertebrates. Labyrinthine function occupies second place in number of studies, perhaps as a result of the general interest in problems of aviation.

In the bibliography a few papers which have not been available to the reviewer are included in order to bring the references up to date. These are marked by an asterisk.

General Studies.—Szymanski (60) distinguishes between dynamogenic (antreibenden) and effective stimuli in relation to animal learning. The former, as hunger, increase excitability; the latter direct the organism's reactions. The rate of learning varies with the character of the dynamogenic stimulus. Buddenbrock (8) also emphasizes the dynamogenic effect of sensory stimulation in a study of the function of the "balancers" of diptera. He tested the function of these organs in a variety of ways. Their importance varies in different species but, in general, their removal results in a reduction in speed and especially in the amplitude of the movements of the wings. Consequently flies deprived of balancers are either unable to rise or to continue flight; although they may steer and balance in a normal manner for short distances. In some species removal of both legs and balancers inhibits movements of the wings although insects with either legs or balancers can fly in a normal manner. Hence the author concludes that the vibrations of the balancers serve solely to excite afferent impulses which reinforce the innervation of the wings.

Arey and Crozier (2) give an extensive account of the natural history and sensory reactions of *Chiton*. The molluscs are sensitive

to contact, light, and chemicals and probably have separate receptors for these. Sensitivity to temperature is not established. They report a similar study of the nudibranch, *Chromodoris* (14). There is evidence that the nervous system of this mollusc consists of a peripheral nerve net and a central synaptic reflex system. Both papers contain too many details for adequate review here.

Sensitivity to Chemicals.—Shelford (57) found that fishes reacted positively to dilute solutions of various narcotics and would remain in them until death occurred.

By various training methods Frisch (22) determined the differential sensitivity of the bee to a number of odors. The insects are able to distinguish some odors which are indistinguishable for man, but in general there is a greater similarity in sensitivity than the great difference in sense organs would lead us to expect. The threshold of the bee is not lower than that of man. The paper is certainly the most important that has appeared on olfaction in invertebrates.

Schut (56) tested the reactions of a snail to a number of 'artificial' and 'natural' odors. The snails were negative to some and positive to other odors of all classes irrespective of the intensity of the odors for man.

Henning (29) considers the question raised by Binet and Passy as to whether the dog is able to smell plant odors. He trained the animals to select an odorous cloth from among a series or to avoid a room permeated by a given odor. Untrained animals gave no detectable reaction to odors without biological significance but they could be trained to react to any type of odor that is detectable by man. Reaction to cues other than odor does not seem to have been ruled out.

Static and Auditory Sensitivity.—Jordan (36) denies the sensory function of Reissner's fiber in fishes, giving embryological and experimental evidence that it does not control the curvature of the body. Ruth (54) suggests that an increased secretion of the calcium glands which are normally concerned with the formation of otoliths in the lizard may result in increased activity during pregnancy, at which time the secretion is increased. Moore (47) describes the righting reaction in the starfish as due to a series of direct reflexes called out by stimulation of the arms and tube-feet.

Tracy's paper (61) on the anatomy of the labyrinth and its connection with the swimbladder in fishes contains suggestive speculations concerning the function of the latter. Maxwell

(42, 43) finds that the utriculus of the dogfish is capable of mediating all of the animal's reactions to gravity if the semicircular canals and sacculus are destroyed. Similarly, the semicircular canals show both static and dynamic function when the vestibule is destroyed.

Muller (49) describes the behavior of guinea pigs after unilateral and bilateral destruction of the labyrinth and cerebellum in various combinations. Destruction of labyrinth and cerebellum on the same side reduces the symptoms of destruction of either alone, on opposite sides it exaggerates the symptoms. From experiments on amphibia, reptiles, birds, and mammals, Ivy (35) concludes that the quick component of labyrinthine nystagmus is a subcortical reflex over which the cerebrum has an inhibitory influence. Prince (50) finds that in cats the symptoms following labyrinthine destruction disappear after 48 hours. Decerebration then results in a renewal of the symptoms.

Reed (51) compares the condition of the columella and operculum in different salamanders.

By trapping all frogs coming to a pond for breeding and keeping records of croaking at the pond Cummins (15) found that there is no relation between periods of loud croaking and migration to the pond. The croaking does not attract migrating frogs.

Hunter (34) reports a variety of experiments supporting his earlier view that the white rat is insensitive to periodic sounds although it reacts readily to noises.

Sensitivity to Light.—Hecht has contributed four papers bearing upon his theory of the chemical nature of photic stimulation. In brief, the theory assumes that the photic response may be divided into two phases. A certain length of exposure is necessary to produce a reaction (sensitization period). After exposure to light a varying interval preceeds the reaction, which may occur after cessation of the photic stimulus (latent period). The sensitization process is shown to be a simple photochemical reaction (28) since it is very rapid, is little affected by temperature, and follows the Bunson-Roscoe law for exposure time and intensity. For the clam, *Mya*, 5.62 meter candle seconds are required to produce a reaction. The theory assumes that the sensitization process involves the breaking down of a photosensitive substance into two "precursors." under the action of light. These recombine spontaneously in darkness. When *Mya* is kept in darkness its reaction time to light is reduced and the rate of reduction follows the law of a bimolecular reaction. At each stage in adaptation to light a

balance is reached between the amount of precursors and of photochemical substance (25). The precursors act upon a second substance to excite a response, and the latent time is due to the slowness of this process. Below 21 degrees the latent time is affected by temperature as a simple chemical reaction (27). The length of the latent time is a linear function of the exposure time and this, with other evidence, makes it probable that the precursors catalyze the reaction of the second substance (26).

Snyder and Snyder (58) find that the rate of flashing in fireflies, when freed from chance inhibiting agents, varies with the temperature.

Laurens and Hooker (39, 40) determined the relative stimulating value of spectral lights for *Volvox* by the minimum exposure time necessary to initiate orientation. They used lights of known intensity and equated each spectral light with a standard white light. This gave the region of greatest stimulating value at $\lambda = 494 \mu\mu$. They then compared the rate of movement in spectral lights of equal energy. The greatest rate appeared also at $\lambda = 494 \mu\mu$.

Crozier (11, 12) found that shading normally induces contraction of the gills in *Chromodoris* but high temperature, direct sunlight or low alkalinity of the sea water inhibit the response. The movement of the gills seems primarily controlled by the necessity for eliminating carbon dioxide. Crozier and Arey (13) report that although the mollusc, *Onchidium*, is definitely negative to light under laboratory conditions, in the vicinity of its "nest" it is undirected by light. Removed from the nest environment, it becomes heliotropic. The phototropic response has no adaptive value.

Schut (55) finds that land snails (*Helix aspersa*) are negative to direct sunlight, probably on account of the heat rays. They do not give any reaction to shading. In diffuse light the snails see and avoid small objects 2 mm. from the eye-bearing tentacles. Franz (20) studied *Helix variabilis*, which is positive to light. In diffuse daylight the eyes play little if any part in directing movement. Buddenbrock's "Lichtkompassbewegungen" (*v.i.*) could not be observed. Buddenbrock (6, 9) reports extensive studies of the reactions of a land snail to light. With strong contrasts of illumination the eyes control the tonus of the body muscles producing typical tropisms. When the environment does not contain strong contrasts the animals tend to maintain a constant orientation toward some object, irrespective of whether it is brighter or darker than the background (Lichtkompassbewegungen). They avoid

obstacles at a distance of more than 10 cm. irrespective of their luminosity.

Demoll (17) refutes Hess's theory of the mechanism of accommodation of the eye of *Alciopids* and ascribes it to the action of muscles controlling movements of the lens.

Blees (4) confined *Daphnias* in glass tubes so that they must move away from light in order to escape from the tubes. These crustacea are strongly positive to light, but after practice they showed improvement in ability to escape from the tubes against the attraction of the light. Hess (32) tested the differential sensitivity to wave length of ten different species of *Cladocera*. A variety of methods was used to test the relative stimulating effects of monochromatic light, the principle of most being the opposition of the monochromatic band to white light from a standard source and regulation of the intensity of the latter until the animals just orient to the monochromatic band. The relative stimulating effects were found to correspond to those for a totally colorblind man.

Lodge (41) reports that flies have no color preference and are attracted to baits by odor. Riedel (53), measuring the photo-electrical changes in the eye of the lobster, found a continued positive deviation in the light adapted eye, a steep positive initial deviation with quick falling off, in the dark adapted eye. The form of the curve varies with the temperature. Cajal (10) describes the structure and nervous connections of the ocelli of various insects.

Minnich (45) made many tests of orientation in the bee and gives evidence in support of the continuous action theory of photic stimulation. Active bees are always strongly positive to light (46) and swarming is due, not to an increase in phototropism but to a general increase in activity.

The Hess-Frisch controversy concerning color-vision of bees is continued with increased asperity in polemics by these investigators (30, 21). Each reviews his own methods and results, maintains that they form an adequate test of color-vision, and accuses the other of bad technique and worse logic. The controversy seems likely to continue until someone steps in and settles the question by the use of really scientific methods.

Hess (33) describes experiments on orientation to light in caterpillars from which he concludes that their reactions are not tropisms. The spectral region of maximum stimulating value for them is in the yellow-green to green: hence they are not like plants in their responses to light and resemble a totally color-blind man.

They are extremely sensitive to ultraviolet rays and this leads the author to extensive speculations on the function of compound eyes in reception of ultraviolet light.

Eltringham (19) finds that the visual field is reproduced accurately as a mosaic in the compound eye of butterflies, with good definition at distances of 3 cm. to 1 meter. He holds that butterflies distinguish colors.

Dolley (18) tested the relative stimulating effects of continuous and intermittent light of flash frequencies from 2 to 100 per second, as measured by the orientation of *Vanessa*. At flash frequencies of 5 or less per second the intermittent light is less effective than continuous. Between 20 and 30 per second it is more effective. At other rates its effects are equal to those of continuous light. The stimulating effect varies also with the ratio between the periods of light and darkness and this in turn varies with the flash-frequency. The reactions of the insects depend somewhat upon past experience, previous violent mechanical stimulation sometimes making them turn toward the weaker instead of the stronger of two lights.

Grave (23) describes the structure and behavior of the larva of an ascidian. When the tadpoles are first released from the parent colony they are strongly positive to light. They later become indifferent. They are at first negative to gravity but later seek the bottom. The method of attachment is described.

Hess (31) concludes from the facts that fish react promptly to food dropped on the water directly above them and that schools of minnows show flight reactions at movements in the air above them that the eye of the fish has a visual angle of about 180 degrees. He attempts to prove this by the construction of a rough model of the fish eye and by an analysis of the relation of the spherical lens to the retina and iris. The silvery sheen on the sides of many fish has value as protective coloration, since it increases the light reflected from the sides and makes the fish appear brighter when seen against the sky and darker when seen against the bottom. Under conditions not described he finds that in the water the light coming from above is more than nine times brighter than that coming from below. He describes a slight modification of his earlier method of studying color-vision and concludes, as usual from studies with this method, that fishes are totally color blind.

Reeves (52), with more accurate methods, finds that fish are sensitive to wave-length irrespective of intensity. Dace and sun-fishes failed to learn to discriminate between white lights of greatly

different brightness, or learned only with great difficulty. An attempt was made to determine the relative stimulating value of colored lights for the fish. They were then trained to discriminate colored lights (filters) and the association persisted during large variations in the intensity of the lights. The paper embodies the most careful work yet done by training methods upon color-vision of fishes. The tests on the brightness values of the colored lights for the fishes are not altogether convincing, however, and this of course is the crucial point in such studies.

Delage (16) points out that the supernumerary fovea in raptores may serve to determine the point from which the bird begins its swoop upon its prey, provided that the height of flight is regulated according to the speed. Bard's paper (3) contains some speculations on the function of pigments in the retinae of various animals, without experimental tests.

Meadows (44) reports that horses in the tropics suffer from night blindness as a result of sunlight glare. Hartridge (24) discusses the function of various forms of pupils. The vertical slit of the cat gives great illumination with little aberation for vertical contours, corresponding to the tree-dwelling habits of the felidæ. The horizontal pupil of the sheep sacrifices vertical for the sake of horizontal definition.

Szymanski (59) attempted to find out whether dogs could recognize pictures of objects, but he could not train the animals to distinguish any patterns, although they learned to distinguish between illuminated and dark passages.

REFERENCES

1. AREY, L. B. A Retinal Mechanism of Efficient Vision. *J. of Comp. Neurol.*, 1919, 30, 343-554.
2. AREY, L. B., & CROZIER, W. J. The Sensory Responses of Chiton. *J. of Exp. Zool.*, 1919, 29, 157-260.
3. BARD, L. Du rôle des batonnets et des pigments retiniens dans la perception des formes et des couleurs. *Jour. d. physiol. et d. pathol. gen.*, 1919, 18, 276-294.
4. BLEES, G. H. J. Phototropisme et expérience chez la Daphnie. *Arch. néerl. de physiol.*, 1919, 3, 279-306.
5. *BROMAN, I. Om Jacobsonska Organets konstruktion om funktion. *Lunds Univ. Årsskrift. N. F.*, 1918, Avd. 2, 14, 1-40.
6. BUDDENBROCK, W. Einige Bemerkungen über den Lichtsinn der Pulmonaten. *Sitz. d. Heidelb. Akad. d. Wiss., Abt. B.*, 1916, 1.
7. *BUDDENBROCK, W. Die Lichtkompassbewegungen bei Insekten, insbesondere den Schmetterlingsraupen. *Sitz. d. Heidelb. Akad. d. Wiss., Abt. B.*, 1917.
8. BUDDENBROCK, W. Die vermutliche Lösung der Halternfrage. *Arch. f. d. ges. physiol.*, 1919, 175, 125-164.

9. BUDDENBROCK, W. Versuch einer Analyse der Lichtreaktionen der Heliciden. *Zool. Jahrb., Abt. f. Zool. u. Physiol.*, 1920, **37**, 313-360.
10. CAJÁL, S. R. Observaciones sobre la estructura de los ocelos y vias nerviosas oculaires de algunos insectos. *Trabajos del lab. de invest. biol.*, Madrid, 1918, 16, 109-139.
11. CROZIER, W. J. The Control of the Response to Shading in the Gill-pulmes of *Chromodoris*. *Amer. J. of Physiol.*, 1919, **49**, 147.
12. CROZIER, W. J. On the Control of the Responses to Shading in the Branchiæ of *Chromodoris*. *J. of Gen. Physiol.*, 1919, **1**, 585-591.
13. CROZIER, W. J., & AREY, L. B. The Heliotropism of *Onchidium*. *J. of Gen. Physiol.*, 1919, **2**, 107-112.
14. CROZIER, W. J., & AREY, L. B. Sensory Reactions of *Chromodoris zebra*. *J. of Exp. Zool.*, 1919, **29**, 261-310.
15. CUMMINS, H. The Rôle of Voice and Coloration in Spring Migration and Sex Recognition of Frogs. *J. of Exp. Zool.*, 1920, **30**, 325-343.
16. DELAGE, Y. Suggestion sur la raison d'être de la double fovea des rapaces diurnes. *C. r. d. Acad. sci.*, 1920, **170**, 425-431.
17. DEMOLL, R. Die Akkommodation des Alciopidesauges. *Arch. f. d. ges. Physiol.*, 1919, **176**, 113-122.
18. DOLLEY, W. L. The Relative Stimulating Efficiency of Continuous and Intermittent Light in *Vanessa antiopa*. *Psychobiology*, 1920, **2**, 137-176.
19. ELTRINGHAM, H. Butterfly Vision. *Trans. Ent. Soc. London*, 1919, 1-49.
20. FRANZ, V. Lichtsinnversuche an Schnecken. *Biol. Zentralb.*, 1919, **39**, 540-543.
21. FRISCH, K. Zur Streiffrage nach dem Farbensinn der Bienen. *Biol. Zentralb.*, 1919, **39**, 122-139.
22. FRISCH, K. Ueber den Geruchsinn der Biene und seine blüten-biologische Bedeutung. *Zool. Jahrb., Abt. f. Zool. u. Physiol.*, 1919, **37**, 1-238.
23. GRAVE, C. *Amaroucium pellucidum* (Leidy) form *Constellatum*. 1. The activities and reactions of the tadpole larva. *J. of Exp. Zool.*, 1920, **30**, 239-257.
24. HARTRIDGE, H. The Shape of the Pupil in Various Animals. *J. of Physiol.*, 1919, **53**, vi-viii.
25. HECHT, S. Sensory Reactions, Equilibrium, and Dark Adaptation in *Mya arenaria*. *J. of Gen. Physiol.*, 1919, **1**, 545-558.
26. HECHT, S. The Nature of the Latent Period in the Photic Response of *Mya arenaria*. *J. of Gen. Physiol.*, 1919, **1**, 657-666.
27. HECHT, S. The Effect of Temperature on the Latent Period in the Photic Response of *Mya arenaria*. *J. of Gen. Physiol.*, 1919, **1**, 667-685.
28. HECHT, S. The Photochemical Nature of the Photosensory Process. *J. of Gen. Physiol.*, 1920, **2**, 229-246.
29. HENNING, H. Geruchversuche am Hund. *Zeitschr. f. Biol.*, 1919, **70**, 1-8.
30. HESS, C. Beiträge zur Frage nach einem Farbensinne bei Bienen. *Arch. f. d. ges. Physiol.*, 1918, **170**, 337-366.
31. HESS, C. Ueber Gesichtsfeld, Silberglanz und Sehqualitäten der Fische und über die Lichtverteilung im Wasser. *Zeitschr. f. Biol.*, 1919, **70**, 9-40.
32. HESS, C. Der Lichtsinn der Krebse. *Arch. f. d. ges. Physiol.*, 1919, **174**, 245-281.
33. HESS, C. Ueber Lichtreaktionen bei Raupen und die Lehre von den tierischen Tropismen. *Arch. f. d. ges. Physiol.*, 1919, **177**, 57-109.
34. HUNTER, W. S. Some Notes on the Auditory Sensitivity of the White Rat *Psychobiol.*, 1918, **1**, 339-352.

35. IVY, A. C. Relation of the Cerebral Cortex to Labyrinthine Nystagmus. *Amer. J. of Physiol.*, 1919, 48, 141-142.
36. JORDAN, H. Concerning Reissner's Fiber in Teleosts. *J. of Comp. Neurol.*, 1919, 30, 217-225.
37. *KINZIG, HELENE. Ueber den Bau der Statocysten einiger dekapoder Crustaceen. *Verh. Naturh. Ver. Heidelb.*, 1919, N. F., 14, 12-45.
38. *KÖRNER, O. Vermittelt das Labyrinth des Fische Gehörs wahrnehmungen? *Die Naturwissenschaften*, 1919, 7, 378-381.
39. LAURENS, H., & HOOKER, H. D. The Relative Sensitivity of *Volvox* to Spectral Lights of Equal Radiant Energy. *Anat. Rec.*, 1918, 14, 97-98.
40. LAURENS, H., & HOOKER, H. D. Studies on the Relative Physiological Value of Spectral Lights. II. The Sensibility of *Volvox* to Wave-lengths of Equal Energy Content. *J. of Exp. Zool.*, 1920, 30, 345-368.
41. LODGE, OLIVE C. Sense Reactions of Flies. *Bull. Ent. Res. London*, 1918, 9, 141-152.
42. MAXWELL, S. S. Labyrinth and Equilibrium. I. A comparison of the effect of removal of the otolith organ and the semicircular canals. *J. of Gen. Physiol.*, 1920, 2, 123-132.
43. MAXWELL, S. S. Labyrinth and Equilibrium. II. The Mechanism of the Dynamic Function of the Labyrinth. *J. of Gen. Physiol.*, 1920, 2, 349-355.
44. MEADOWS, D. Nyctalopia in Horses. *Veterin. Jour.*, 1919, 75, 140-141.
45. MINNICH, D. E. The Photic Reactions of the Honey Bee, *Apis mellifera* L. *J. of Exp. Zool.*, 1919, 29, 343-425.
46. MINNICH, D. E. The Relation of Phototropism to Swarming in the Honey Bee, *Apis mellifera* L. *Psychobiology*, 1920, 2, 177-180.
47. MOORE, A. R. Stereotropism as a Function of Neuromuscular Organization. *J. of Gen. Physiol.*, 1920, 2, 319-324.
48. *MOTTRAM, J. C., & EDRIDGE-GREEN F. W. Some Aspects of Animal Coloration from the Point of View of Color Vision. *Science Progress*, 1918, 12, 65-85, 253-264.
49. MÜLLER, MAX. Untersuchungen über Kleinhirn und Labyrinth des Meerschweinchens. *Zeitschr. f. Biol.*, 1919, 70, 287-332.
50. PRINCE, A. L. On the Compensation of Ocular and Equilibrium Disturbances which follow Unilateral Removal of the Otic Labyrinth. *Amer. J. of Physiol.*, 1919, 49, 130-131.
51. REED, H. D. The Sound-transmitting Apparatus in Caudate Amphibia. *J. of Morph.*, 1920, 33, 325-387.
52. REEVES, CORA D. Discrimination of Light of Different Wave-Lengths by Fish. *Behav. Monog.*, 1919, 4, (No. 19) iv + 106.
53. RIEDEL, A. H. Ein Beitrag zur Kenntnis der Photoelektrischen Reaktion des Hummerauges. *Zeitschr. f. Biol.*, 1918, 69, 125-140.
54. RUTH, E. S. Calcium Glands in the Common Philippine House Lizard. *Philippine J. of Sci.*, 1918, 13, b, 311-315.
55. SCHUT, L. W. Recherches sur les fonctions des organes des sens chez un escargot terrestre (*Helix aspersa*). I. Les sens de la lumière et de la vue. *Arch. néerl. physiol.*, 1919, 4, 9-22.
56. SCHUT, L. W. Recherches sur les fonctions des organes des sens chez un escargot terrestre (*Helix aspersa*). II. Le sens de l'odorat. *Arch. néerl. physiol.*, 1919, 4, 23-30.

57. SHELFORD, V. E. The Reactions of Goldfish to Certain Habitforming Drugs. The use of the gradient tank. *J. Amer. Pharm. Assoc.*, 1918, 7, 597-603.
58. SNYDER, C. D., & SNYDER, A. H. The Flashing Interval of Fireflies—Its Temperature Coefficient—An Explanation of Synchronous Flashing. *Amer. J. of Physiol.*, 1920, 51.
59. SZYMANSKI, J. S. Abhandlungen zum Aufbau der Lehre von dem Handlungen der Tiere. *Arch. f. d. ges. Physiol.*, 1918, 170, 1-244.
60. SZYMANSKI, J. S. Ueber den Antrieb., *Biol. Zentralb.* 1919, 39, 257-265.
61. TRACY, H. C. The Membranous Labyrinth and its Relation to the Preccelomic Diverticulum of the Swimbladder in Clupeoids. *J. of Comp. Neurol.*, 1920, 31, 219-258.

HABIT FORMATION AND HIGHER MENTAL CAPACITIES IN ANIMALS

BY JOHN F. SHEPARD

University of Michigan

Last year we had two studies of transfer of training. This year there is a third from the same laboratory by Wiltbank (21). Like the work of Webb, it is concerned with maze learning, in fact uses similar mazes, though these are differently related to each other, and the two monographs should be studied together. Five mazes were learned, designated in order from *A* to *E*. One group of rats learned *A*, then *B*, etc., to *E*; a second group learned *B-C-D-E-A*; and so on to a fifth group, which learned *E-A-B-C-D*. A sixth group learned *E* and then *D*. Tabulating results on the basis of number of trials, total errors and total time, a greater or less positive transfer was found in all cases from the first learned to the second learned maze. In two cases the second learned maze had a section (quarter) identical with the corresponding section of the first. These cases showed the greatest positive transfers, but this was not due simply to greater savings in the identical parts, other parts showing still greater savings. Stating transfer in terms of percentages of savings, there were some indications that these were greater when transfer was from the more difficult to the less difficult maze rather than from the less to the more difficult; but the results were not consistent. Corresponding to this, with regard to the mazes *D* and *E*, he finds that, on the whole, there is an advantage in the total effort involved in learning both, if the harder maze is learned before the easier rather than the easier before the harder; the absolute amount saved is greater in the former case. All this seems to the reviewer extremely doubtful in view of ter-

fering factors, such as the peculiarity of the *D* maze. If we tabulate Webb's results to show the absolute amount saved with each pair of mazes in both orders of difficulty, and the total effort involved in learning each pair in both orders of difficulty, we find a decided tendency in favor of the order less difficult—more difficult. This corresponds with the point noted last year, that differences of the second mazes are more important for absolute saving than differences of the first.

In tracing the effects through a series of mazes learned, the transfer in any given case was found not to be a function of the adjacent mazes only, but of all preceding mazes learned. On the whole, the transfer effect is cumulative, tending to increase with the number of preceding mazes, but not invariably. Each group of animals relearned its first maze after the four other mazes had been mastered. Only one group showed definite evidence of retention of the specific habit.

Maze *E* was given two, four, eight or sixteen trials with different groups of rats, then *D* was learned, then *E* was mastered. Other groups went through similar experiments with the functions of the two mazes interchanged. Two, four or eight trials in one gave negative effects in the other measured in trials and errors, positive effects measured in time. Sixteen trials gave positive transfer. Considering the maze which was given the limited trials, and then, after the second maze, was finally mastered, we find in general a reduction of effort in learning (except in the case of sixteen preliminary trials) compared with the control group which learned without the interruption of the second maze; and especially was there a saving in errors and time in the trials following the second maze compared with the corresponding period in the learning of the control group. In several cases the performance in the trials immediately after the interruption was better than in those before—they had continued to learn the first maze while learning the second.

As the main factor contributing to negative transfer, Wiltbank gives kinaesthetic habits driving the animals into blind alleys; as factors giving positive transfer, he names overcoming the instinct of timidity, association of getting food with the maze situation, and "practise in error-elimination with its attendant resistance to the blind alleys once frequently entered" which "cannot but leave its impress upon the reactions of the organism in any similar situation."

In a second article (22) Wiltbank criticizes Peterson's "Com-

pleteness of response" theory, which he interprets as the sum-total of responses occurring in the maze which are present already in tendency when the animal enters the maze. A first objection which he raises is that Peterson would make the tendency to respond to the true path the force which draws the animal out of the blind and impels him along the true path, that this force might not be as strong when the animal leaves the blind as on entrance, and that the importance of the stimulus of the blind end is not recognized; all of which seems to the reviewer a misunderstanding of Peterson, at least in part. Other difficulties are to understand how the erroneous tendency is directed into the successful tendency when the animal leaves the blind and how the successful tendency is thereby strengthened, points which surely need more definite treatment from Peterson. Wiltbank refers to the experimental result above, that an animal may continue to learn a maze partially learned while learning another, and says this could not be if the rat in the second maze were developing "a set of tendencies constituting a complete response." He suggests that in running the maze the stimuli are serial, but before one has ceased, the next may become effective. Consequently in a blind, the association may, as it were, run ahead of the animal's legs, and lead him to turn before the end, while in a section of the true path, he cannot turn into the next section before he reaches it. He calls this the principle of "completeness of the single successful movement," with incompleteness of the unsuccessful.

Brockbank (3) used the Watson circular maze with camera lucida attachment to study retention of habit by the rat. Some groups of animals ran one trial per day, others ran three trials in immediate succession each day. Retention was tested in some cases after seventy days, in other cases after forty-five days, in still other cases after thirty days from completion of learning. The rats were given exercise equivalent to the maze running during the retention interval. It was found that persistent errors or points where establishment of the habit was difficult during the learning period, but which had finally disappeared, tended to reappear in the retention tests. Distances traveled in different alleys during learning had no relation to distances traveled in redintegration. The number of errors and the total trials made during learning was far greater with the three-trials-per-day groups than with the one-trial-per-day groups. The difference between the two methods was relatively small in the redintegration tests except in the time

required. One may suggest that it would add to the value at this point if some groups were run in which one trial per day only were used in the retention tests both for those which had used one-trial-per-day in learning and those which had used three-trials-per-day in learning. Learning a rope-ladder problem during the retention interval did not interfere with accuracy in reintegration. In general when one animal had better established the maze habit than another animal in a given learning period, the same animal showed the better results after the retention interval. Practise in learning other problems (inclined plane box, etc.) previous to the maze facilitated learning and consequent retention of the maze.

Dashiel (9) is concerned with the question whether, in learning two different habits which are similar in kind it is better to learn one completely and then learn the other completely, or to practise them alternately. He used rats learning two arrangements of the maze; children learning a maze (made of screens) in a forward direction and in the reverse direction; adults learning two pencil mazes, two card sorting habits with different sets of cards, and two methods of adding. In all cases, learning by the complete method was more economical than learning by the alternate method. Especially was the irregularity much greater with the alternate method. The number of trials was not clearly different in the case of the rats.

Two papers are concerned with the value of distribution of practise in maze learning. In Carr's experiments (6), adults learned the pencil maze. One group used distributed trials in the first part of the learning period, concentrated in the last part; the second group used the reverse arrangement. The results indicate that the extra value of distribution is mainly in the first part of the learning process. This is at least consistent with Lashley's results (14). Lashley used rats in a simple maze offering a single choice between a blind and an alley leading to the food. A first group of animals learned in the ordinary way. The variation with the second group was that they were allowed to explore the maze without food for twenty minutes the day before training began. A third group was not allowed to correct errors, but was returned to the starting point at once if they entered the blind. With a fourth group a dish of food covered with netting was placed in the blind, otherwise as the first group. One part of each group learned with two trials per day; a second part with ten trials per day. Differences between the groups were small with two trials per day; but ten trials per day were much less effective with all groups, and

also showed large differences between groups, especially the fourth group was much less efficient and the second distinctly more so than the first. The results indicate that the low value of concentrated practise is due to cumulative effects in the later trials of the exploratory instinct, and of such emotional excitement as that from being picked up in the food box, together with a greater tendency to repeat temporary errors, rather than any process of neurological fixation.

Carr (5) continues his work on the alternation problem. His apparatus is different from that formerly used. A four inch runway follows the sides of a large rectangle and a cross runway connects the middle of the two shorter sides of the rectangle. The food box, which is also a starting box, is placed near one end of this cross runway. The animal (rat) started from this box through the longer part of the cross runway and through the right or left side of the rectangle (either of which could be blocked) to the food. This arrangement prevented any distinctive orientations in the food box following the different trials. The habit of simple alternation was learned more or less well though more slowly than formerly, and the control of each choice was shown to be due to the stimuli from the preceding run. The association was formed when there was as much as thirty-five seconds of time between trials, consequently between stimuli and response; in fact, up to this limit at least, success had no definite relation to time interval. Carr decides that the connection between retained effects of stimuli from the preceding activity on the one hand and the response on the other hand was formed directly, without any survival that could be called memory bridging the interval.

Carr and Koch (8) used the same apparatus in a further variation of the alternation experiment. Two groups of animals were used. The first group learned the habit as usual. With the second group a door at the end of the cross runway blocked the entrance into one of the return alleys (alternately the right and left), so that free choice was impossible, there could be no errors. Eighty per cent. of the trials were done under this objective control; twenty per cent. consisted of series of free-choice tests interpolated at regular intervals to measure the acquired association. The results indicated that the controlled runs were of some value, but that they were less effective than those with free choice. Even with the motor impulse of active participation in the reaction, a controlled response is of low value. Fixation of a connection seems to be a combined process of selection and rejection.

The relation of time interval to the formation of associative connections is further studied by Carr and Freeman (7). A modified alternation apparatus was used. The return alleys were widened and were broken by partitions extending half-way across the alley alternately from its two sides. Electric buzzers were placed in each return alley. At the beginning of each trial both doors from return alleys to food box were closed. The rat was placed in the center path and entered one of the return alleys. In part of the cases the corresponding door was opened at once and the rat reached the food. In these cases the buzzers were not sounded. In the other cases the opposite door only was opened and the rat was compelled to turn at the closed door and go back and through the other alley to food. In these cases the buzzers were sounded. With one group the sound was made as the animal was turning at the closed door; with a second group it was made about one second before the closed door was reached; with a third group it was made about the same interval after the rat turned and started back. Formation of an association between the sound and turning was tested at regular intervals by giving the sound at various times before the door was reached and success was shown by the animal turning at once in response to the sound. Practically no connection was established in the third group, it was formed with fair rapidity in the first, and most rapidly in the second.

Hunter raises a very important question in connection with a modified alternation experiment (11). Two pieces of apparatus were required. The first was a maze presenting ten points of choice, each a T-shaped junction and the series so arranged that the order of correct turns formed a double alternation left-left-right-right-etc. This apparatus is spoken of as a spatial maze. The second consisted of a runway following the sides of a rectangle with a cross runway connecting two opposite sides of the rectangle. An animal starting at one end of the cross path and passing through it must return through either the right or the left side of the rectangle. A shutter could be used to close either of the return alleys at its first bend; and a block at the starting end of the cross-path could be shifted to close all three alleys at the junction, or either of the return alleys only. This apparatus is called a temporal maze, a name suggested by the method of operation. The block is set to close all alleys at one end of the cross-path, one return alley is stopped with the shutter, and an animal is placed at the end (next the starting block) of the cross path. When it has entered the open

return alley, the starting block is shifted to close the opposite return alley only. For simple alternation the shutter and block were shifted after the animal had completed his first circuit through the open return and had begun his second through the center path; and such shifts were made after each circuit, thus necessitating circuits alternately through the right and left sides of the rectangle. For double alternation the stops were shifted each time after two circuits had been made through the open side. In either case ten circuits constituted a day's test after which the animal was fed. In the spatial maze, one trip (with ten choices) was given each day with food at the end. The double alternation problem then presented the same order of choices as the spatial maze; but in the one case they were all in different spatial positions, in the other they occurred in temporal succession only (repeating the same spatial location). It may be added that except in one case, the analogous intermediate alleys in the spatial maze were identical as they should be. No rats learned the double alternation, one only learned the simple alternation in the temporal maze, all learned the spatial maze easily. This makes it very probable that the cues used in running the spatial maze cannot be a merely temporal succession of kinaesthetic stimuli; spatial location, in some terms, enters into the successive cues.

Szymanski, in a series of articles (15, 16, 17, 18, 19, 20) reported experiments on several animal forms and by various methods. He finds the dog unable to use a stationary visual stimulus as a control to determine discrimination of two compartments; likewise unable to use a moving as over against a stationary visual stimulus. Of two similar platforms on which food was placed, mice learned to avoid the one which gave an electric shock. For some time the association showed more or less frequent failures to work, then rather suddenly became apparently permanent. Fish were able to learn a simple maze with one choice, the stimulus being to get from shallow to deep water. Szymanski decides this is a kinaesthetic-motor association; but the apparatus faced the light in such a way that, so far as the reviewer can see, it might well have been visual control (turning to give light on the right or the left side). The association apparently did not last as long as one day. Frogs were able to learn a sort of one-choice maze.

Many of the experiments used rats in the maze. Szymanski found them to learn equally well during the active and quiet periods of the day cycle; those in the quiet period ran more slowly up to the

thirteenth trial, not thereafter. Rats which were not hungry were allowed to run the maze to enter their cage at the end, but never learned to run without errors; yet this experience in the maze under these conditions enabled them to learn to make perfect runs in a very short time when the need came to get their food in that way. In another experiment the blinds of a maze were stopped and the rats allowed to run the path but without food at the end. They were forced to go forward whenever they were not inclined to do so, but this was not often necessary. Yet after one hundred trips through this path, they did not learn the same maze with blinds open more easily than the control animals. Szymanski assigns as the reason the lack of vital interest such as hunger; but his method does not distinguish between this and objective control (see Carr and Koch above). Some rats which had learned to go through an elevated opening in a puzzle-box, generally used the same type of opening in passing through blocks in a maze.

Arlitt (1) studied the effects of alcohol given in doses of from $1/4$ c.c. to $2\frac{1}{4}$ c.c. in each days feeding and for different periods of time upon the health, fertility and learning ability of white rats and their offspring to the fourth generation. From ten to eighty-two per cent. of the acoholized animals died within six months, while none of the control groups died in the same period. Growth was retarded and this defect was inherited by the offspring. Complete sterility was caused in the males and females by the larger doses, partial sterility by the smaller doses. The drug interfered with the speed but not the accuracy of habits previously formed. The most intelligent animals, measured by the previous learning showed at least as much resistance and length of life as others. Learning ability is decreased, shown especially by decreased speed of running and increased number of trials required in the maze. These defects are transmitted to the second generation and possibly in an even greater degree to the third. They have disappeared by the fourth generation, apparently bred out through sterility.

Buytendijk (4) performed experiments with paramecium in a capillary tube. By moving the tube to keep the animal in a constant part of the field of the microscope, and recording such movements, a record of the animal's changes of position was obtained. He decides that the reversals made at the end of a column of water are not a matter of learning but are due to a flexibility which is at least partly of physico-chemical nature.

Cockroaches, according to the work of Eldering (10) can learn

to go to light rather than darkness, but can learn much more easily to go to the right or left in a double compartment box. When tested with small and large luminous surfaces of the same total luminosity, they showed some preference for the smaller surface. Associations were retained at least a month and were not destroyed by narcosis.

From a series of experiments in which puzzle-boxes are used with dogs, Jong (12) concludes that the dog learns only by trial and error and shows no evidence of reason, knowledge of end, etc. He may see food placed in the accustomed place after he has worked the release mechanism and may uselessly work it again. The fact that an object on which attention is suddenly concentrated acquires significance is not reason, but it is all the indication of reason there is and it is what one has in all trial and error.

Swindle (23) shows that "training which causes an organism to beat with a given bodily member a rhythm of a particular numerical value, trains it at the same time to beat with the same member, simultaneously or at different times, other rhythms of the same numerical value," and "all other members are at the same time trained to do numerically the same thing." He explains how the training may be had from the normal life activities of the animal, as in tearing flesh by carnivorous birds, and carried over to other acts, as in cleaning the beak.

Bawden (2) discusses the evolution of behavior, which is supposed to take a large step forward in man because of the substitution of the hand for the muzzle in the manipulation of food with consequent liberation of the mouth and development of speech. The argument then proceeds on the text that "a gesture is an arrested act. A word is a substitute for a gesture. A thought is an incipient word." The discussion of this subject has not evolved much during these many years.

Lashley (13) continues the excellent work in which he and Franz have been engaged on determination of the functions of various parts of the cerebrum in learning, using the rat as subject. In the new work, two types of problem were used for learning. The first was a double platform box in which the animal had to go directly and press a platform on one side of the food box, then pass to and operate one on the other side of the box, then go to the opened door. The platforms were low enough that a rat was not at a disadvantage because of some paresis or weakness. The second problem was one of simple visual discrimination choosing a lighted compartment

rather than a darkened one. Animals with frontal or frontal and parietal lesions were more active than normal. Other operations had little effect on general activity. No disturbance of instinctive reactions resulted in any type of cases. In connection with learning the platform box, the following operations were more or less completely performed: one hemisphere removed, both occipital regions destroyed, both parietal regions, both frontal poles, frontal and parietal of both hemispheres. None of these groups showed loss of ability to learn the platform box compared with normals. Animals with frontal poles removed likewise learned visual discrimination normally. No single part of the cerebrum seems any more important for learning the platform box than any other part. Some part (any part) of the frontal probably functions most normally in this type of habit, but other regions may substitute. The visual discrimination habit, after its formation was not injured by destruction of either frontal or parietal. It was destroyed by occipital operation, but could be re-acquired in normal time. The other acquired acts in the discrimination box were not affected by the lesion, only the specific visual discrimination. The occipital lobes normally function in the visual habit, and probably by direct return motor path to lower centers. Lashley infers that they are not necessary for the visual habit, however. At this point, it seems to the reviewer that considerable portions of this region remained intact, some of which may be necessary. The part destroyed broke the normal connection and other (perhaps neighboring) parts could substitute, but there may be a limit to the portion that can substitute in this specific act, unless indeed, lower centers are doing greater or less part of the substituting in these habits. The point can only be determined by successive operations with learning tests between and covering possibly all of the cortex at once (as the final stage). Paresis seemed to depend upon lesion of both the stimulable cortex and the corpus striatum.

REFERENCES

1. ARLITT, A. H. The Effect of Alcohol on the Intelligent Behavior of the White Rat and Its Progeny. *Psychol. Monog.*, 1919, 26, No. 4, Pp. 50.
2. BAWDEN, H. H. The Evolution of Behavior. *Psychol. Rev.*, 1919, 26, 247-276.
3. BROCKBANK, T. W. Redintegration in the Albino Rat. *Behav. Monog.*, 1919, 4, No. 2. Pp. 65.
4. BUYTENDIJK, F. J. J. Acquisition d'habitudes par des êtres unicellulaires. *Arch. Néer. d. physiol.*, 1919, 3, 455-468.
5. CARR, H. Length of Time Interval in Successive Association. *Psychol. Rev.*, 1919, 26, 335-353.

6. CARR, H. Distribution of Effort. *Psychol. Bull.*, 1919, 16, 26-28.
7. CARR, H. A., & FREEMAN, A. S. Time Relationships in the Formation of Associations. *Psychol. Rev.*, 1919, 26, 465-473.
8. CARR, H. A., & KOCH, H. The Influence of Extraneous Controls in the Learning Process. *Psychol. Rev.*, 1919, 26, 287-293.
9. DASHIELL, J. F. A Comparison of Complete versus Alternate Methods of Learning Two Habits. *Psychol. Rev.*, 1920, 27, 112-135.
10. ELDERING, F. J. Acquisition d'habitudes par des insectes. *Arch. Néer. d. physiol.*, 1919, 3, 469-490.
11. HUNTER, W. S. The Temporal Maze and Kinesthetic Sensory Processes in the White Rat. *Psychobiol.*, 1920, 2, 1-17.
12. JONG, H. DE. Recherches sur la formation d'idées chez le chien. *Arch. Néer. d. physiol.*, 1919, 3, 491-527.
13. LASHLEY, K. S. Studies of Cerebral Function in Learning. *Psychobiol.*, 1920, 2, 55-135.
14. LASHLEY, K. S. A Simple Maze: with Data on the Relation of the Distribution of Practice to the Rate of Learning. *Psychobiol.*, 1918, 1, 353-367.
15. SZYMANSKI, J. S. Untersuchungen über den biologisch richtigen Verlauf des Lernvorganges bei weissen Mäusen. *Pflüger's Arch. f. d. ges. Physiol.*, 1917, 169, 537-550.
16. SZYMANSKI, J. S. Versuche über die Entstehung der rezeptorisch-motorischen Gewohnheiten. *Pflüger's Arch. f. d. ges. Physiol.*, 1918, 170, 157-220.
17. SZYMANSKI, J. S. Versuche über den Lernvorgang bei den weissen Ratten während der Ruhe-bzw. Aktivitätsperioden. *Pflüger's Arch. f. d. ges. Physiol.*, 1918, 171, 311-316.
18. SZYMANSKI, J. S. Versuche über die Fähigkeit der Hunde zur Bildung von optischen Association. *Pflüger's Arch. f. d. ges. Physiol.*, 1918, 171, 317-324.
19. SZYMANSKI, J. S. Versuche über die Wirkung der Faktoren, die als Antrieb zum Erlernen einer Handlung dienen können. *Pflüger's Arch. f. d. ges. Physiol.*, 1918, 171, 374-385.
20. SZYMANSKI, J. S. Beiträge zur Lehre der Entstehung neuer Gewohnheiten bei den Tieren. *Pflüger's Arch. f. d. ges. Physiol.*, 1918, 173, 125-151.
21. WILTBANK, R. T. Transfer of Training in White Rats upon Various Series of Mazes. *Behav. Monog.*, 1919, 4, No. 1. Pp. 65.
22. WILTBANK, R. T. The Principles of Serial and Complete Response as Applied to Learning. *Psychol. Rev.*, 1919, 26, 277-286.
23. SWINDLE, P. F. Some forms of Natural Training to Which Certain Birds Are Subjected. *Amer. J. of Psychol.*, 1919, 30, 165-172.

SPECIAL REVIEWS

The Unity of the Organism. WILLIAM E. RITTER. Boston: Badger, 1919. 2 vols. Pp. xxix + 398, xv + 408.

The present volumes by one of the foremost philosophical biologists deserve careful reading by all students of organic structures and behavior. The author brings to his task a long preparation in zoology and a wide acquaintance with cognate subjects, including speculative philosophy. The discussion throughout concerns the relative merits, explanatory and descriptive, of the organic and the elementistic points of view. Ritter has marshalled an exceedingly wide range of fact and argument in favor of his "organismal" point of view, a standpoint which may be presented by the two following quotations: "*The organism in its totality is as essential to an explanation of its elements as its elements are to an explanation of the organism*" (vol. I, p. 24). "Obviously, . . . 'the organism as a whole' if taken strictly, could mean nothing less than the organism and all of its parts. The whole would not be the whole if some of its parts were omitted; so even from this standpoint one might contend that the 'organism as a whole' must mean the organism taken wholly, that is through and through, no part being neglected, and that consequently instead of connotating the organism analyzed, in reality it connotes just the opposite and thus indicates the only starting point for *complete* analysis of the organism. But 'organismal integrity' not only carries all the other phrase implies so far as mere totality is concerned, but it does more in that *integrity* and its etymological kindred point definitely not only to the parts, but to them as interdependent" (vol. I, p. 26).

The author considers in much detail the possibility of accounting for biological data in terms of germ layers, cells, protoplasm, and chromosomes, everywhere adducing evidence indicating the significant rôle played by the organism in shaping the final product. Turing from the series of destructive criticisms of the elementist position, the organismal conception is elaborated in terms of the integrations presented by growth, internal secretions, nervous action, and consciousness. The work accomplished by Cannon, Sherrington, and Jennings is utilized extensively, while Loeb's views on

the nervous system and tropisms are vigorously criticized. Psychic integration is indicated most clearly in the Wundtian apperception, which Ritter follows Royce in relating to the tropisms of Loeb. The chief psychologists whose views are utilized are Wundt, James, and Royce.

Ritter's organismal point of view is tremendously important, although, as a psychologist, I believe that other biological fields than psychology are more in danger of the elementist's one-sided views. It is unfortunate that the author chose the chief structural psychologist, Wundt, in order to drive home psychic integration as superior to elementalism, when the functional psychologists have more consistently approached their problem from the organic point of view. (No reference is made to functional and behavioristic psychology.) Yet in spite of the limitations besetting the psychological side of the work, and in spite of the lack of new material in the elucidation of chemical, neural and conscious integration, psychologists will profit by this comprehensive treatment of "the organism as a whole"—and to some it may carry a needed moral.

WALTER S. HUNTER

UNIVERSITY OF KANSAS

Pitch Discrimination in the Dog. G. V. ANREP. *J. of Physiol.*, 1920, 53, 367-385.

The author, under Pavlov's direction, retested the sensitivity of dogs to tonal stimuli by the conditioned salivary reflex method in order to meet the theoretical and experimental criticisms advanced in 1913 by H. M. Johnson. The latter's work is in turn criticized for utilizing a defective apparatus for the production of pure tone and for including many stimuli other than sound (stimuli from release, from punishment, and from the availability of food with either tone) which would serve to inhibit or obscure the strictly auditory consequences of stimulation. Anrep controlled his work carefully, using mechanical devices for the presentation of food and stimuli, he himself being in another room. A special apparatus for the production of pure tone was constructed based upon the use of a sinusoidal current with a telephone as tone generator.

Discriminations were established in four dogs as follows: 637.5 vibs. from silence; 1,062.5 vibs. from silence; 637.5 vibs. from each of the following: 1,062.5, 850, 722.5, and 680 (one dog only on the last).

Although Anrep observed (through a periscope) gross food-seeking movements to tonal stimuli, the reviewer is inclined as yet to believe that the conditioned reflex method, as applied in Pavlov's laboratory, reveals a sensitivity too slight to condition the rise of gross body habits.

WALTER S. HUNTER

UNIVERSITY OF KANSAS

NOTES AND NEWS

THE following items have been taken from the press:

IN connection with the faculty of medicine of the University of Birmingham a course of ten weekly lectures on the "Principles of Psychotherapy" is to be given by Dr. W. McDougall, F.R.S.

PROFESSOR JAMES R. ANGELL, professor of psychology at the University of Chicago, and chairman of the National Research Council, has been elected president of the Carnegie Corporation.

DR. HARRY WOODBURN CHASE, formerly professor of psychology, was inaugurated president of the University of North Carolina on April 28.

DR. JAMES R. ANGELL has been elected a member of the National Academy of Sciences. The other members of the Academy who represent psychology are: Professors James McKeen Cattell, John Dewey, G. Stanley Hall, and Edward L. Thorndike.

PROFESSOR CHARLES E. SKINNER, head of the department of psychology at Mt. Union College, has accepted a position in the Indiana State Normal School, Indiana, Pa.

DR. CURT ROSENOW, of the Juvenile Psychopathic Institute, Chicago, has been appointed assistant professor of psychology at the University of Kansas.

WITH the completion of the 170th volume of *Pflüger's Archiv*. Max Verworn and B. Schöndorff relinquish the editorship to E. Abderhalden, A. Bethe and R. Höber.

THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

VISION—GENERAL PHENOMENA¹

BY LEONARD THOMPSON TROLAND

Harvard University

Not the least of the contributions to scientific knowledge due to the war is to be found in the firm establishment of Henschen's theory of the point for point representation of the retina upon the calcarine cortex. A very comprehensive article by Best (13) summarizes the results of studies upon disorders of the visual function due to war injuries of the central optical apparatus. He first contests Igerscheimer's doctrine that all injuries to the optic nerve tend to produce scotomas centering about the blind spot, and then reviews the evidence for the specific localization of various visual functions in the cortex. The calcarine fissure is the center of relative binocular localization, being responsible for the establishment of visual direction and the combination of disparate sensations. All the evidence is in favor of a point to point representation of the retina in this region, and hence is contrary to von Monakow's idea of a diffuse distribution of the optic connections. Psychologically higher visual functions, such as motion perception, contrast processes, visual recognition, perception and imagination, and certain aspects of color sensibility are dependent upon centers physiologically higher than the calcarine region. Destruction of this latter region has no more serious an effect upon the general visual consciousness than has destruction of the retina or optic

¹ A very large amount of foreign war-time literature not hitherto available but now at hand is necessarily neglected in the present summary on account of limitations of space. I have here confined myself strictly to articles dated for the year 1919. I hope to be able to summarize previously unreviewed literature, at least for the years 1917 and 1918, in a supplementary summary.

nerve. A careful study of this paper is recommended to anyone interested in a thorough analysis of the dependency of various visual functions upon the brain processes. Morax, Moreau, and Castelain (73) report results of a study of visual defects in 86 cases of wounds in the occipital region of the cortex, dividing these cases into seven characteristic groups. Among these cases there was only one in which complete blindness was caused by an occipital lesion, vision always tending to remain in the fovea except where both cerebral hemispheres were seriously damaged. Morax (72) continues with a theoretical discussion of the cerebral localization of macular vision, on the basis of the data accumulated by himself and his collaborators. He finds that the cortical center for macular vision is distinct from that of peripheral vision although contiguous with the latter, lying posterior to it in the calcarine fissure. The macula is divided into two halves, each of which is represented on one hemisphere only. The entire *fovea*, however, has a representation on both hemispheres, the centers for the fovea lying posterior to those for general macular vision on the edges of the calcarine fissure. Monbrun (71) summarizes results of studies upon war injuries to the visual cortex which confirm those of the investigators above considered. He finds the visual projection area to be limited to the lower portion of the cuneus and the upper portion of the lingual lobe within the calcarine fissure and strongly supports Henschen's theory of point to point retinal representation. A partial destruction of the cortex in this region produces a scotoma with definite limits within which there is absolutely no vision. Like Morax he finds the macula to be projected on the posterior surfaces and the periphery of the retina on the anterior ones. However, there are wide individual differences in the cortical representation of the macula. Although the perceptions of light, form and color may be differently affected in different stages of hemianopia the projection of these three functions upon the calcarine cortex appears to be identical. The probable paths of the optic fibres from retina to cortex are discussed in some detail. Wilson (99) reports 5 cases of local scotomas determined by wounds in different portions of the occipital lobe which present evidence in favor of Holmes' view that the vertical axes of the visual field are represented in dorsal and ventral margins of the visual projection areas.

Schweinitz (87) analyzes the visual disorders resulting from war psycho-neuroses. General loss of visual power and enfeebling

of color vision often occur, as well as disturbances of the motor functions of the eye. There may be a reduction of acuity, cloudiness of vision, or constriction of the visual field, but in practically every case the symptoms are characteristic of a psychological situation rather than of an anatomical injury and the patient usually behaves in such a manner as to avoid bodily injury although his visual consciousness is seriously curtailed. Disorders of this sort would appear to be determined by affections of visual processes in the association areas of the cortex rather than in the primary occipital region. Hoeve (52) contests Igerscheimer's view already referred to above regarding the results of injuries to the optic nerves or tracts. The arrangement of the fibers in the optic nerve is such that injuries to the latter should be expected to produce scotomas having a position in either the monocular or binocular visual fields roughly corresponding with the positions of the lesions in the nerve cross-section. Well known types of scotomas due to optic nerve injuries do not center in sector form about the blind spot, as claimed by Igerscheimer, whose views are neither theoretically nor clinically defensible. Spaulding (91) describes two interesting instances of scintillating scotoma, observed upon himself, which seem to be associated with abnormalities in refraction.

A considerable number of studies of the motor and refractive functions of the eye are reported. Stefanini (92) discusses the movements of the eyes in response to sounds produced on opposite sides of the head. He finds a reflex tendency of the eyes to follow the sound, even when the displacement of the latter is subjective and due to binaural beats. Lamb (64) notes that the only practical application of the mathematical "theory of finite rotations" is to the movements of the eye-ball. He presents a new mathematical analysis of these movements which is simpler in form than that of Helmholtz, with which it is critically compared. He concludes that "the cardinal advantage of the fact that the eye conforms to Listing's law . . . consists in this, that the test of superposition is fulfilled for straight lines which pass through the center of the field of view, in the primary position." Liddell (65) examines experimentally the validity of Ferree and Rand's theory that so-called fluctuations of visual attention are due to eye-movements. Photographic records of the eye-movements of seven subjects were secured during such fluctuations, and no correlation was found between the movements and the phases of visibility and invisibility of minimal visual stimuli. The results are deemed to refute the

views of Ferree and Rand, which were based upon less adequate data.

Weve (97) contests Behr's theory that stimulation of the nasal half of one retina tends to cause a *direct* pupillary reaction only, while stimulation of the temporal half tends more towards a *consensual* response. Observations upon twelve subjects show clearly that direct and consensual reactions are brought out to the same extent from both retinal regions. The literature dealing with the pupillomotor function is reviewed and various possible arrangements of the pupillomotor paths in the optic tract are outlined. Abelsdorff (1) describes a case of war injury to the optic nerve, resulting in a peripheral but no central scotoma, in which the pupillary response was destroyed. Since central vision was intact, he argues for the existence of special pupillomotor fibers, distinct from those responsible for sensation. Engelking (30) has determined the minimal brightness necessary to produce a noticeable pupillary reaction, using both photographic and entoptic methods of observation. After twenty minutes dark adaptation the first intimation of response appeared at an illumination of 0.001 meter candles, but a positive reaction was not obtained until 0.025-0.04 meter candles were reached. The latter value corresponds with the absolute threshold of cone vision. Engelking concludes that a slight, faltering, pupillary response is aroused by stimulation of the retinal rods, but that the function rests mainly upon the cones. A large stimulus field, 23.0 by 16.3 degrees, was employed. French (38) reviews the physiology of the eye, and then presents new data concerning the relation between pupillary area and the intensity of the stimulus. He finds the equation, $A = kI^{\frac{1}{2}}$ to hold for these two factors, k being a constant.

Hartridge (45) endeavors to explain the fact that the focal length of the crystalline lens is noticeably shorter than what would be expected from its form and refractive index, by pointing out that the increasing optical density of the lens towards its axis will bend the wave-front of the light by differential retardation, as it moves through the lens substance, this effect being added to the refraction which occurs at the surfaces. The same investigator (44) discusses aberrations of the ocular refractive system which affect peripheral vision. The curvature of the retina is found to compensate quite perfectly, up to 30 degrees (at least in the rabbit's eye) for that of the field of the lens, the size of an image being practically independent of angle, a necessity for stereoscopic vision. Lock-

wood (66) finds that with a pupil larger than four millimeters in diameter the spherical aberration of the eye appreciably influences distinctness of vision, and with a fully dilated pupil the difference in refracting power between the central and edge zones amounts to 6.6 diopters.

Bailliant and Magilot (6) outline a method for determining the blood pressure in the vessels of the retina, and find this ordinarily to lie between 15 and 30 millimeters of mercury. Osborne (75) has examined the aqueous humour of the ox's eye and finds it to be practically free from protein, although otherwise resembling blood serum in constitution. This freedom from protein increases transparency, but can only be explained on the assumption that the containing membranes are waterproof or are in a state of oedema. Descemet's membrane is probably waterproof, but the iris is not, and so the aqueous humor must penetrate the latter with a pressure of about 10 millimeters of mercury. Nordensson (74) finds that the transparency of the anterior boundary of the vitreous humour decreases progressively with the age of the subject, being practically constant for all individuals of the same age.

Sheard (89) and Raman (80) discuss, independently, the causes of the scattered light phenomena seen about small luminous areas in the dark; and arrive at strikingly similar conclusions. Raman first questions Helmholtz's view that these are mainly due to diffraction at the edge of the pupil, and shows by means of a square artificial pupil that the pupil effect, although present, is relatively small, the principal phenomena being independent of the pupil. The halos which are observed strikingly resemble those caused by the diffraction of light passing through a layer of irregularly placed small particles, such as lycopodium powder. In harmony with this interpretation, the use of monochromatic instead of white light brings about marked changes in the phenomena produced by the eye. The two halos which are visible indicate the operation of two sets of particles, of average diameters $13\ \mu$ and $7\ \mu$, respectively. Sheard's findings are in general agreement with the above: the first colored halo is attributable to the cells in epithelium of Descemet's membrane, the red component of this halo having an angular diameter of $3^\circ 40'$; the second halo, which is much fainter, has a diameter of 8° and is probably due to the epithelial cells of the cornea. The sizes of the particles theoretically required to produce the observed effects are calculated to be $10\ \mu$ and $25\ \mu$, respectively, and these sizes agree approximately with those of the epithelial cells.

In the field of *ocular hygiene*; Hartridge (42) finds the cause of eye-strain to be the attempt to dissociate the reflexes of accommodation and convergence. Eyestrain cannot be due to too great exertion of the accommodative mechanism alone, since it is as common in conjunction with myopia as with hypermetropia. Experiments, with accommodation accomplished by a spectacle lens but convergence still required, produce eyestrain—and to an extent proportional to the success with which the diplopia is overcome. Coblentz (21) presents the spectral transmission curves of various glasses designed to protect the eyes from injurious radiations, such as the ultra-violet and infra-red. Ferree and Rand (35) follow out previous investigations on the power of the eye to sustain clear and comfortable seeing with different illuminants. In the present paper they study the influence of various proportions of ceria and thoria in gas mantles, and find that in general the efficiency of the eye increases with increase in the per cent. of ceria. 3 per cent. of ceria, however, is somewhat better than 5 per cent., which was the highest amount tested. Mantles lacking in ceria produce a greener light than those containing it in some quantity. The results of the tests are presented in numerical and graphical form.

Ferree and Rand (34) also report measurements of the time required to change the adjustment of the eyes for clear seeing at a near point to one six meters away, and *vice versa*. Only the motor factors in the process are dealt with, since other work by the same authors shows that the lag of the sensory changes is relatively very small. For 18 normal observers, the times for passing from the near to far points varied from 0.50 to 1.16 seconds, and for the reverse adjustment between 0.39 and 0.82 seconds, 15 of the observers requiring more time for the first change. The modal time for the double excursion lies between 1.35 and 1.65 seconds. Two types of apparatus were employed and the results are tabulated in full. A small amount of astigmatism has a marked effect upon the efficiency of this function. Forsythe (37) has determined the minimal speed for telegraphic light signaling, as limited by the inertia of the eye. The best ratio for dot: dash: space is 1:4:3. At a distance of 2,700 yards, the minimal time for a four part signal is about 1.6 seconds, both in daylight and at night, although some observers do slightly better in daylight. A gas-filled ribbon filament tungsten lamp, turned on and off electrically is as effective for such signaling as a shutter. Prantl (78) has studied the speed of reading, with the type at various angles to the ocular

horizontal. His graph of the time required with respect to the angle shows two maxima, at 150 and 210 degrees, respectively, in these positions four times the normal time being demanded. At 180 degrees (with the type up-side-down) only 3.7 times the normal is needed. The various factors involved in reading speed are discussed.

Griffiths and Baumgartner (41) have investigated the relation between power to visualize, as tested by the ability to make geometrical constructions mentally, and fineness of brightness discrimination as determined by ability accurately to set a photometer, hoping to throw some light upon the basis of individual differences in image type. Data from 75 subjects however show only a very low correlation between the two traits, not enough to warrant the supposition of a causal linkage. There is no correlation at all between memory for letters and digits, or speed of multiplication, and brightness discrimination.

Wingender (100) describes experiments upon many classical geometrical optical illusions by an interesting method. The main lines of the figures were shown by reflected light, while the supplementary lines—inducing the illusion—were added at will by transmitted light. When this addition was made a motion of the main lines, such as to generate the illusion, could usually be seen. A rapid alternation of these two phases of the figures shows that there is a minimal period, about one fourth of a second, required for the illusion to develop; and this time is shown to be the same as that needed for the change from a monocularly conditioned to a binocular stereoscopic perception. It is clearly much greater than that needed for a purely sensory arousal. The general and special conditions for the generation of many well-known illusions, such as those of Muller-Lyer, Zöllner, Hering, etc., are carefully considered: sharp analysis of the figure, and complexity too great to be appreciated as a whole are detrimental to the illusory effects, and the position of the fixation point is of importance.

Henning (50) discusses at great length the reasons why the sun and moon appear larger at the horizon than at the zenith. Observations made by sixty observers in the open indicate that the principal cause of the apparent magnification lies in the red color assumed by the celestial orbs in rising or setting. Not only the sun, moon or stars, but all objects on the horizon which fall within the zone of the reddish glow are subject to the magnification, and the increase in the clearness of details is sometimes as great as

would result from use of a powerful telescope. The illusion is reduced or destroyed by observing through red-absorbing glasses. The mechanism of the effect is as follows. The preponderance of red rays, on account of their relatively slight absorption by smoke or vapor, reduces the "atmosphere" of the scene, thus making it appear stereoscopically nearer and sharpening its details. The principles involved in the Aubert-Förster and Köster phenomena demonstrate a linkage between acuity, apparent size and apparent brightness, such that increased acuity carries with it increased apparent size but decreased apparent brightness. The celestial magnification effects are instances of these phenomena; the augmented size of the sun and moon at the horizon is found to entail a diminished luminosity. Neither the size nor the luminosity changes are physical. Other principles which may be involved in the illusion are considered in detail, together with the basis of allied appearances, such as distortions of the sun or moon at the horizon, the apparent shape of the arch of the heavens, etc.

Wassenaar (94) finds that the vessels of the retina can be seen entoptically projected upon a rotating black and white disk, the color of the entoptic images varying with the speed of the rotation. It is sometimes purplish red and sometimes green. Streaming movements, attributed to the vessels of the choroid, can be observed by a similar method. The same investigator (95) discusses the colors which are generated by alternately covering and uncovering the closed eye.

Bard (9) is not satisfied with explanations which have been advanced hitherto for the invisibility of the blind-spot. He notes that at the *punctum cæcum* the layers of the retina do not stop suddenly but with undulations, and that corresponding distortions are observable in objects in the vicinity of the blind spot. The undulations of opposite sides are supposed to be dovetailed in their projection upon the cortex or visual field. The same writer discusses anew the mechanism of localization in visual space, finding the simple "geometrical" theory of private line conduction from the retina to the cortex to be inadequate because of poverty of conductors and lack of specificity in the functioning of individual conductors. He believes that each retinal receptor possesses mechanisms which are analytic for direction or position and which impress upon the optic nerve currents, characteristics utilized by the cortex in sorting the impulses spatially. This view is discussed in comparison with classical "local sign" doctrines. In another paper (8)

Bard considers the same general problems not only for vision but for audition and touch. Depth perception is not mainly a binocular function, as usually supposed, but depends upon the fact that the monocular retinal image has a thickness, positions within which are sensed by a mechanism which is "natural and immediate."

Eaton (28) analyzes the various monocular criteria of depth, and contends that since monocular vision gives the impression of solidity, it should be called stereoscopic. He finds that the fusion of disparate images is not essential to stereoscopic vision and that its deliverances are even capable of being overcome and reversed by other, and monocular, factors; as in the case of interchanged stereoscopic photographs of familiar objects. In securing a stereoscopic effect, monocularly, from a single photograph it is important that the perspectives of the eye and camera should coincide. The decrease of the sharpness of images with increasing distance is an important factor, as shown by the difficulty often experienced in correctly fusing stereoscopic X-ray photographs where this relationship is reversed. Previous experience is the most important of all determining influences. In general the combined power of so-called secondary criteria of depth (perspective vision) is greater than that of the "primary" binocular mechanism. In a second paper (29) Eaton analyzes some of these factors in greater detail. He adduces evidence to show that very seldom does our perception utilize simultaneously all parts of both retinal images, and that the determination of corresponding points is not hereditary but is fixed by experience. The principles involved in the fitting together of the two retinal images are discussed in considerable detail, and the functions attached to the separate eyes are found to remain independent until the very highest levels of synthesis are reached. Luster, binocular or monocular, is due to the presence of light in addition to that required for the adequate perception of an object by itself. Other suggestions, of interest to the close student of binocular functions, are offered. Barrie (10) disagrees with Eaton as to the effects obtained by various rearrangements of ordinary stereoscopic photographs, finding the binocular factor to be more powerful.

Kaila (61), in a lengthy article, endeavors to build up an empiricist theory of depth perception in which the disparation of binocular images acts as a "reproduction motive" entering into an association complex based upon experience and containing the final stereoscopic impression. Hering's theory, involving the

automatic fusion of two genetically determined depth sensations, is found to be inconsistent with the fact that equal amounts of diplopia may arouse quite different depth impressions if other factors in the general sensory constellation are permitted to vary. In the developed perception the diplopia is of course subconscious, but this does not prevent it from acting as an associative unit. The problem of the cerebral mechanism of this association is considered in some detail, together with the question as to the manner of co-representation in the cortex of corresponding retinal points. The position of the binocular fixation or convergence point, recorded by oculomotor impulses, must also enter into this associative system as a parameter. The theories of the Panum and of the Hering depth phenomena are considered very carefully, and there is an appendix containing a long critique of Jaensch's doctrine of space perception. Cohen (24) describes an apparatus designed to test stereoscopic vision at considerable distances (30 to 40 feet from the subject). It consists of a dark box displaying an arrangement of four, colored, letters at different distances, the observer being required to state their order.

Kuile (63) offers a mathematical analysis of the apparent motion generated by the binocular fusion of two synchronous, simple, harmonic motions independently presented to the two eyes. The motions occur symmetrically, parallel to a line joining the nodal points of the eyes. The stereoscopically generated motion has an elliptical, circular or hyperbolic path, according to the exact conditions selected. The relative velocities of the apparent motion at various points are calculated and a chart providing an empirical verification of the results is given. Koffka (62) also applies mathematical methods to problems of motion perception. Beginning with Korte's empirically established laws which express the relations between intensity, distance and time interval for the optimal motion impression in stroboscopic vision, he uses Wertheimer's theory of the neural "short-circuit" to develop equations for the brain process underlying such vision. The argument is very elaborate, and leads not only to a theoretical analysis of the brain mechanism but also to definite predictions regarding stroboscopic phenomena, which are compared with empirical findings.

Roelofs and Zeeman (84) have made an experimental study of factors controlling the periods during which disparate contours, in retinal rivalry, are visible. Conflicting vertical and horizontal, and other more complex contours were used. Greater acuity of

one eye as compared with the other, greater contrast with the background, greater intensity, and eye-movement parallel to the given contour tend to cause predominance. Rivalry is interpreted as a phenomenon of passive attention. The conflict is one of configurations, as such, and not of eye-fields.

Gibson (39) discusses further the similarity between color comparisons made by a normal subject in a "minus red" light and those made by the dichromatic color-blind in ordinary illumination. Because certain dyes employed to color wools are fluorescent it is necessary to place the "minus red" filter between the wools and the eye to produce exactly similar confusions. Cowdrick and Winfield (25) have determined the best conditions for the use of the Hering color-blindness apparatus, which were never specified by its inventor. They find that when artificial daylight is employed at a constant intensity it permits a reliable diagnosis of different types of color-blindness. Rich (81) finds that the commercial "daylight" lamp (Mazda C2) departs too much from actual daylight to warrant its use in establishing color-matches for careful research purposes, although it suffices for demonstration of the laws of color-mixture in laboratory courses. The marked deficiency of the artificial light in blue, as compared with daylight, makes itself felt when colors in the short wave end of the spectrum are combined with others.

Luckiesh (69) offers a general outline of the conditions for successful terrestrial, marine and aerial *camouflage*, in which he utilizes the principles of the psychology and physiology of vision. In a second more lengthy paper (68) he discusses the problem of the visibility of aeroplanes. This profusely illustrated article carefully analyses the problem on the basis of physiological and physical optical principles, and many actual measurements made from aeroplanes of the brightness and other visual values of various types of terrestrial surfaces, and also of sky and clouds. Jones (60) attacks the problem of camouflage in its application to the protection of vessels against submarines, considering in particular the "low visibility phase of protective coloration." He analyzes theoretically the various factors involved and develops a formula for expressing the visibility of an object in terms of the brightness of its background and of the veiling glare necessary to just make the object invisible. An instrument is described which measures visibility in accordance with this principle, which was used in elaborate experimental tests made with model ships variously

camouflaged. Photographs of the experimental "theater" employed in this work are published in another place (*Trans. of the Illum. Eng. Soc.*, 1919, 14, 232-233.) Results of these measurements are reported in detail and their analysis shows that broken colored systems the elements of which can be perceived increase visibility, while if they are too small to be seen they have no effect. Visibility depends entirely on the average hue, saturation, and brightness values of the object in contrast with its background. The best values of these several factors for characteristic weather conditions are specified. Gibson, Tyndall, and McNicholas (40) present graphs of the spectral transmissions of various filters which were used during the war to detect camouflage or to improve visibility.

In the field of *photometry* Ives (58) offers a specification of a standard photometric scale analogous to the thermometric scale employed in pyrometry. The various factors involved are (1) conditions of observation: a field brightness of 2.5 millilamberts, field size of 2° , and the flicker photometer, (2) the method of choosing observers based upon specified test filters, (3) the visibility curve, (4) the mechanical equivalent of light: 0.00156 watts per lumen, (5) standards of luminous intensity, and (6) standards of color. The specification of all of these factors is based upon the most recent data of the author and other investigators. Blondel (14) describes a system of physical photometry similar to that previously reported by Ives. He employs a spectroscope with a template, representing the visibility curve, in the plane of one of the slits and a thermopile to measure the intensity of the combined rays. He describes this arrangement as the "inverse" of that used by Ives.

Hyde, Forsythe and Cady (55, 57) find that Coblenz's energy distribution curve for the acetylene flame is such that a color match between it and a black body could not be made with an accuracy greater than 7 to 8 per cent. Measurements made by the present investigators and others, however, show that a close color match is actually obtainable, the corresponding black body temperature being 2360°K . Coblenz (22, 23) defends his work on this subject by pointing out that only very low precision of measurement is obtainable in the blue and violet end of the spectrum but that elsewhere his data correspond well with the above mentioned black body temperature. He offers a table of revised values. The importance of this question lies in the fact that practically all measurements of the visibility curve have been made with the acetylene flame.

Hyde, Forsythe and Cady (56) present a new experimental determination of the brightnesses of a black body at temperatures between 1700 and 2600° K. The empirically obtained values agree well with those computed from the visibility data previously published by the same investigators and based upon direct comparison rather than flicker photometry. The same data also provide the basis for a new estimation of the mechanical equivalent of light as 0.00150 watts per lumen. The value of 70 candles per sq. cm., or the brightness of a black body at 2077° K. (color match with a 4 w.p.c. standard carbon lamp), is proposed as an absolute standard of light.

A number of papers deal with practical tests of vision designed for the *selection of aviators* or other military recruits. Cantonnet (16, 18) lists seven visual requirements which the aviator should meet and describes tests for each of the visual functions involved. Novel tests for "quickness of acuity" and sensitivity to dazzling are outlined. Methods of testing night acuity and dark adaptation are also presented. The same author (17) describes a binocular vision test designed to measure any deviations from normal of the convergence of the eyes with fixation of objects at various distances. Howard (54) discusses the various factors involved in the visual judgment of distance. An apparatus is described which tests individual sensitivity to change in "binocular parallax" and in the size of the retinal image. Results are given for 106 subjects, 75 of whom were aviators. Binocular parallax is found to be twenty times more important than the size of the retinal image in judging distances under conditions which were used. The normal threshold for the detection of binocular parallax is 8.0", but 14 observers had an average threshold as low as 1.89". The reaction time for monocular judgments is much higher than for binocular ones, which latter are practically instantaneous. There is very little correlation between the parallax threshold and visual acuity. Spearman (90) and others discuss briefly various visual factors involved in the efficiency of the aviator.

Cobb (19, 20) reports quantitative studies of the process of dark adaptation with special reference to the problems of night flying. An apparatus was designed which permitted a determination of the absolute luminosity threshold at various times in the course of dark adaptation. After the subject had become completely dark adapted his eyes were dazzled for five minutes and later for fifteen seconds and the courses of the adaptation after each of these

exposures were studied. The absolute peripheral threshold at equilibrium dark adaptation was found to vary from 1.34 to 9.95 millionths of a candle per sq. cm., the mean value for 15 subjects being 4.97. The recovery of dark adaptation after the fifteen seconds exposure was three times as fast as after the five-minute exposure. There was little correlation between rate of adaptation and the final level attained, and no correlation was found between power to discriminate brightnesses and any adaptation factor. A statistical subdivision and classification of the individual results is presented. Plateaus in the adaptation curves suggest the existence of two factors in the process.

Downey (27) describes a new adaptometer and photometer which utilizes a luminous radium compound as a standard comparison stimulus. The device permits a systematic investigation of the course of dark adaptation, the proper procedure for which is outlined. Tests with this instrument lead to the following conclusions. Dark adaptation of one eye has no effect upon the other, although under similar conditions the rate of adaptation is the same for both eyes. There is no binocular summation of brightnesses in dark adaptation. Recovery from such adaptation is complete in about thirty seconds, after which the same time is required to reproduce the original adaptation as in the beginning, provided bright daylight is employed all over the retina, although when only a small field is used to reduce the adaptation to the daylight level recovery occurs in about a minute. There is a marked dark adaptation in the macula, and even in the rod-free area of the retina. Dark adaptation has relatively little effect upon the threshold for extremely small stimulus fields.

Buisson (15) offers a new account of his measurements on the minimal quantity of radiant energy which will produce vision.

Putter (79) continues the development of his general, mathematically formulated, theory of stimulation. In the present contribution he applies the principles previously deduced to the temporal relations of excitation in the human eye. The laws of fatigue or "*Umstimmung*," and of the growth and decay of visual sensation are derived theoretically and compared with empirical findings. Equations, tables and graphs are given showing the temporal course and limits of the fatigue process, the data of Von Kries and Schjelderup being employed in combination with the theoretical relationships. A similar treatment of the facts relating to the growth or "*Anklingen*" of the sensation is based upon the

results of Exner and of Martius. A further contribution, the final one of the series, deals with stimulation processes in general, but some particular visual phenomena are considered. These articles seem worthy of a more detailed study than the reviewer has yet been able to give them.

Filehne (36) discusses certain phenomena which are most readily observed under conditions of twilight vision. Among these are the vibrations of the atmosphere due to temperature differences and movements of thin clouds of vapor such as result from evaporation. Observations upon these phenomena indicate that the rate of decrease of the sensibility of the retinal rods within a circular central field, 2 to 5 degrees in diameter, with increasing brightness of the retinal image is greater than in the remainder of the retina. Experiments on the appearance of a sphere illuminated so as to exhibit a bright crescent and subtending a visual angle of about 3 degrees show that the crescent may cause the general illumination of the sphere to disappear, this being due to the reduced sensibility of the retina in the region concerned. This observation is applied to the appearance of the planet Venus, on which general faint illumination in the crescent stage cannot be seen against a completely dark sky but only in twilight. Bell (12) reports measurements on the visibility of bright lines and spots. Previous investigators disagree widely as to the smallest angular size of the single spot or line which is visible. In the case of a bright object on a dark background the threshold appears to depend only on intensity, stimuli subtending angles as small as $0.2''$ often being visible. The present investigator made tests with German silver wire against a dark background and found the minimal angles to vary from $2.3''$ to $0.46''$, depending on the nature of the reflection from the wire and that of the background. White thread against a background of black paper was distinctly visible in sunlight at $0.92''$, the lowest angle at which any portion could be distinguished being $0.46''$. The brightness contrast in this case was 16 to 1. This was less than $1/50$ the minimal angle for a single spot under similar contrast conditions.

Roelofs and Zeeman (85) discuss a possible interpretation of certain cases of night blindness. They estimate the intensity of starlight illumination at 0.0003 meter candles. The visual acuity at this and higher intensities was determined, a relatively slow increase of acuity with respect to illumination being found. Since refractive errors in the eye increase the intensity required for a

given acuity the illumination obtainable at night may for individuals with high refractive errors be insufficient to permit adequate seeing, especially with the large pupil which goes with night vision.

Allen (2) reports extremely interesting results of a continuation of his earlier studies on the effect of differential color fatigue upon critical flicker frequencies. His findings "appear absolutely to determine the number of fundamental color sensations." The eye was first fatigued for three minutes with a selected monochromatic radiation, after which—in separate experiments—the critical flicker frequencies for this and other spectral wave-lengths were determined so that curves representing the spectral distribution of these frequencies after fatigue by different monochromatic stimuli could be plotted. In general fatigue lowers the critical frequency, but not equally for all colors, and certain fatiguing stimuli produce no effect upon the spectral curve. There are four points in the spectrum yielding such stimuli, lying at 660, 570, 470 and 420 $\mu\mu$ respectively. The effect of fatigue by stimuli lying between these points in the spectrum may be either to decrease the critical flicker frequency in a single spectral region or in two such regions, as the case may be. For example, fatigue with yellow, 577 to 651 $\mu\mu$, causes a decrease in the frequency for red and also for green but little decrease for this yellow itself. The spectral regions from which fatiguing stimuli produce no effect upon the frequency curve are regarded as fundamental transition points, and a comparison of these regions with the color sensation curves of Abney, and König and Dieterici reveals a close correspondence with the ends or intersections of the component color curves in question. Fatiguing stimuli which produce only one depression in the frequency curve are regarded as mono-sensational. Data from color-blind eyes corroborate these interpretations and substantiate the three-color theory with its implication that yellow is a compound sensation.

In a second article (3) Allen presents new data bearing on the relation between critical flicker frequency and stimulus intensity. Spectral stimuli were employed, and the results confirm those of Haycraft, who found the critical frequency to be proportional to the logarithm of the brightness, with a shift in the constants of the equation at intensities corresponding with the threshold of cone vision. The relation of the results to the Purkinje effect is carefully considered. Piéron (76) discusses the law relating stimulus intensity, i , with the time, t , required to reach the maximal sensory intensity. The law of Bloch, $i t = \text{constant}$, holds only for short

times. That of Hoorweg-Weiss, first applied to the electrical excitation of the nerve but rediscovered by Blondel and Rey for visual sensation, is much more satisfactory and has the form $t = a/(i - b)$, a and b being constants, the interpretations of which are considered. Another fairly successful relationship is $t = a/i^n$, n having different values for different departments of sensation. The law of Hoorweg-Weiss is found to hold to within about 2 per cent for eight different kinds of sensory stimulation as well as for several objectively measured nerve processes. Woog (101, 102) reports experiments on the persistence of vision in different regions of the retina. He finds an increase in flicker towards the periphery, using a frequency of 15 to 25 per second, persistence therefore being greatest in the center of vision. His stimulus fields when gradually brought nearer to the eye began to flicker when they subtended an angle of about 9° . In answer to an objection that the greater sensitivity of the periphery to flicker may depend upon the exact level of intensity which was used, Woog states that the interposition of dark glasses between the eye and stimulus surface does not alter the relationship.

Ferree and Rand (32, 33) present new measurements of the chromatic thresholds of sensation from the center to the periphery of the retina and discuss the bearing of their results upon color theories. Supporters of the Hering theory have claimed that the sensitivities to red and green fall off in a constant ratio towards the periphery, the same being true for blue and yellow. The results of the present investigation do not confirm this view. Spectral red, yellow, green and blue stimuli were employed and the chromatic thresholds were measured in energy units at approximately twenty-five different visual angles, ranging from 0 to 92° in the temporal and nasal meridians. The observers had normal color vision and a neutral outlying field equal in brightness to the test field was employed. The results as tabulated and plotted reveal marked irregularities in the increases of the thresholds in passing from the center towards the periphery. There are regions of low yellow sensitivity where there is no correspondingly low blue sensitivity, and the same is true for red and green. In their theoretical discussion (33) Ferree and Rand criticise previous investigators for employing stimuli equated in "canceling power" and determining the points at which the chromatic effects of these stimuli disappear, instead of measuring the sensitivities and chromatic sensibilities for spectral stimuli at all points. Antagonistic colors may seem

to vanish at the same point when in reality there is a wide discrepancy between their thresholds, since a change in position of 2 or 3 degrees may cause a very large alteration in liminal value. They believe it to be impossible to find a red and green which do not vary in quality in passing from the center to the periphery, but it is not an essential of such a color theory as Hering's that such stable stimuli should exist. Although the ratios between the thresholds of antagonistic stimuli vary widely with position on the retina their "canceling powers" remain constant.

Houstoun (53) offers a restatement and amplification of his theory of color vision previously propounded. This theory is based upon the idea that monochromatic light falling upon the retina gives rise to a nerve current representative not of the frequency of this light alone but, to a lesser degree, of similar frequencies on either side of it in the spectrum, a result of the irregularities of molecular response in the photo-chemical process. The overlapping of such distribution curves for monochromatic red and green is thus able to produce practically the same distribution curve as that given by monochromatic yellow. A sufficient separation of two overlapping distributions, however, will produce two maxima with an accompanying effect of a complex sensation such as purple. The position of the summit of the curve, therefore, is representative of the hue, while its breadth stands for lack of saturation or resemblance to white. An important feature of this paper is a detailed analysis of the color sensation curves of Maxwell, Abney and König and Dieterici, which, for comparison, are reduced as far as possible to the same units. The data of Dieterici are adopted as most representative of the normal and a plot of these data on rectangular coördinates is employed as a basis for developing equations for the trichromatic color system, which are correlated with theoretical equations derived from the writer's hypotheses.

Barton and Browning (II) have investigated mathematically, and with the aid of models, the probable mechanism of the Young-Helmholtz theory of color vision. Three sample resonators of appropriate natural vibration periods were subjected to forced oscillation and their respective amplitudes of response were recorded photographically. The natural periods corresponded to 760, 550, and 400 $\mu\mu$ respectively, and the mathematical analysis showed that to produce the resonance curves required by the facts of color vision the vibrations must be very highly damped, this damping being so great that persistence of vision cannot

be explained as a result of the continued action of the vibrators after the removal of the stimulus. The theoretical resonance curves differ from those demanded by the facts in not having zero values for any wave-length and in that the red sensation curve shows no second maximum in the violet. The ratios of the responses of the three model vibrators to different impressed frequencies were found experimentally to correlate remarkably well with many facts of color vision, such as the results of mixing various monochromatic lights, fineness of color discrimination in various parts of the spectrum, etc. Lodge (67), Joly (59), and Allen (4) discuss the possibility that the response of the retina to light is photo-electric in nature. Lodge suggests that certain radio-active material which is contained in the pigment cells is set off by light, the resulting secondary rays stimulating the rods and cones electrically. Fatigue is attributed to exhaustion of the radio-active material. He suggests the experimental testing of this hypothesis. Joly reviews two previous investigations of his own on the bullock's eye along this same general line which failed to produce positive evidence. Allen refers to the proposal previously made by him (*Journal of the Röntgen Soc.*, April, 1919) that the response of the rods and cones is due to a photo-electric action at their surfaces, which produces a change in electrical potential and thus generates a nerve impulse. Pikler (77) has propounded an elaborate theory of the chromatic and achromatic colors, which the reviewer has already summarized in a previous issue of the BULLETIN.

Sheard and McPeck (88) report extremely interesting measurements on the rest and action currents of the dog's eye. The problem which they attack is that of the existence of antagonistic influences which may be exerted upon the currents of the eye by lights of different colors. Spectral stimuli and a very reliable and delicate galvanometric system were employed. The eyes which were used were always freshly enucleated and care was taken to rest the preparations between exposures to different colors. Constant stimulation produced fluctuations in the nerve current of about 12 seconds period combined with a progressive change in the potential of the nerve stump with respect to the cornea, this change consisting in an increase in the positive potential of the nerve for the warm colors of the spectrum and a decrease for the cold colors, the turning point lying at about $600 \mu\mu$. In the case of a yellow, $590 \mu\mu$, a conflict of these two opposing tendencies was observable. Complementaries tended to reverse or to neutralize

the potential changes produced by each other. When a given potential level has been established by a certain color its complementary produces the greatest obtainable departure from this level. A plot of the potential conditions produced by different wavelengths shows in certain of its characteristics, striking similarity to the classical Hering color curves. The fluctuations in potential which were observed were not explicable on the basis of any external causes, and may possibly be related to the fatigue or after-image oscillation processes of the eye. A discussion of the history and theory of the electrical action of light in the retina is included.

Bard (7) points out that in hemianopia, color vision disappears more readily than form vision, indicating that perception of form is independent of that of color. He propounds the idea that on account of their length in the direction of propagation of the light the retinal rods and cones are able to record directly our impression of the depth dimension of visual space, the retinal image being not a surface but a solid. The pigment cells, lying alongside the rods and cones, serve to record the locus of the image within these receptor cells. The special function of the rods in the peripheral retina is to compensate for the aberrations of the refractive system in this region. Both rods and cones are supposed to be specifically sensitive to all of the colors because the limits of form and color perception are the same. The visual purple is regarded as the essential factor in color perception and its color is supposed to be determined by interference processes within the small disks of which the rods are composed, solutions of the visual purple being colloidal suspensions of rod fragments. Light tends to break up these disks or exert pressure upon them, different colors differing quantitatively in this action. The mechanism of color perception in the macula is attributed to a different process "*qui m'a échappé jusqu'à présent.*" Evidently most of the significant results of physiological optics have "escaped" this writer.

The year presents us with a number of interesting contributions to the knowledge of vision in animals. Hartridge (43) discusses the significance of the special shapes of the pupil in various animals. The pupil of the cat when partly closed has a longer vertical than horizontal axis, which favors the clear perception of vertical contours, these being of predominant importance to a climbing animal. In the case of the sheep the partly closed pupil has a longer horizontal axis, which harmonizes with the predominant importance of landscape contours for this animal. Being hunted rather than a

hunter it needs the increased peripheral illumination along the horizontal axis which is provided by the special pupillary shape.

Rochon-Duvigneaud (83) reports measurements of the positions and sizes of the foveæ in five species of *Rapaces diurnes*. The central fovea is usually smaller and deeper than in the case of the human being and the lateral is smaller and shallower than the central one. The thickness of the retina in the region of the foveæ is about $170\ \mu$. In the buzzard the cones in the center of the central fovea are less than $1\ \mu$ in diameter but are $65\ \mu$ long, those of the lateral fovea being shorter. The author doubts whether the lateral foveæ in the bird have a binocular or stereoscopic function. He believes that each eye-functions separately and that the foveæ of the single eye also act independently, much as do the fingers of the hand. In a second article (82) the same investigator gives further details regarding retinal structure in the same birds considered above. He finds that the colored oil droplets are smaller in the fovea than elsewhere corresponding with the decreased diameters of the cones. The colors found are yellow, orange and red, and their functions are probably to form a protective filter. The structure of the birds' fovea is in general finer and more complicated than that of the human being. In day-birds the rod-free region is larger than in man although the fovea itself is smaller. The ganglionic layer is very complex. In the *Rapaces nocturnes* there is only one fovea, which corresponds to the lateral fovea of the *Rapaces diurnes*, and in this there is as large a proportion of rods as in the remainder of the retina, although cones are also present.

Wager (93) reports experiments in which lumps of sugar were utilized on pieces of colored paper to test the chromatic vision of wasps. He finds that these insects are attracted by color and color contrasts. Minnich (70) finds that light stimulates the honey bee to movement, worker bees having a strong positive phototropism. When one eye is blackened the insects move in a loop in the direction of the functioning eye, these "circus movements" varying with the intensity of the light. The constancy of the circus movements shows that the arthropod eye is stimulated continuously by light, not requiring intermittent illumination. Eltringham (31) has studied vision in butterflies, paying particular attention to the nature of the image formed by the compound insect eye and the sensibility of the animals to colors and distances. He finds that objects are distinguished at distances from 3 centimeters to 1 meter from the eye, and contests the view of Hess that insects are color blind.

Hecht presents very interesting data concerning, and a keen theoretical analysis of the photo-receptor process in a mollusc, *Mya arenaria*. This animal (47) is sensitive to sudden changes in intensity of illumination but comes to a sensory equilibrium at any constant illumination. Its reaction time to light can be divided into two periods, a phase of "sensitization," which is followed by a latent period of 1.3 seconds, during which the stimulus can be removed without preventing the reaction. The laws of adaptation for the animal to any given light intensity can be represented by the formation of a chemical substance according to a bimolecular reaction. Sensory equilibrium is explained in terms of the stationary state of a reversible reaction involving this substance and two precursors. The corollaries of this hypothesis, that the reaction time at equilibrium and the rate of dark adaptation should vary inversely with the temperature were verified experimentally. The author's method of obtaining various sensitivity functions in terms of the length of the sensitization period is extremely neat and is based upon work described in a previous article on another mollusc. In a second paper (48) the same author treats of the nature of the latent period, this interval being too long to be attributed to pure neuro-muscular processes. Experiments made with dark-adapted animals show that if the "sensitization" period is defined as the minimal pre-exposure necessary to produce the minimal reaction time, the latent period will be found to vary inversely as the exposure. It therefore seems likely that the latent period is determined by an independent chemical reaction which is *catalyzed* by the presence of a substance formed during the pre-exposure period. The reciprocal of the latent period must represent the speed of the process which determines it, and this in turn must be proportional to the amount of catalytic substance formed. The essential element in the reaction of the animal to light is, therefore, the formation of a catalyzer or enzyme. The theoretical analysis is extremely keen and convincing. In a third article (49) Hecht considers further the effect of temperature on the latent period. He finds that for temperatures below 21° C. the relation is expressed by Arrhenius's equation but that above this temperature it increases more rapidly. This discrepancy is explained by the conception that the product formed during the latent period is inactivated by heat. The velocity of this inactivation is calculated from the experimental data.

Crozier and Arey (26) have studied the heliotropism of *Onchi-*

dium. In its normal environment the behavior of this animal is independent of light, but under artificial conditions it becomes negatively phototropic. Experiments show that a phototropic tendency exists but is inhibited in the natural environment, this being an instance of a definite response tendency which is non-adaptive in nature and which even tends to interfere with other adaptive actions. Hess (51) describes experiments on the vision of ten different species of crustacea. The writer's earlier results showed the same reactions to colored lights as in the color blind human being. The differential threshold for intensity in *Daphnia magna* is the same as for man. The writer claims to have determined "visibility curves" for certain crustacea with an accuracy as great as that obtainable for the human eye, by alternately illuminating the animals with homogeneous and heterogeneous light and noting the effect produced upon the swimming movements. The maximal sensitivity for *Daphnia* lies at approximately $525 \mu\mu$ and equal responses are obtained at 650 and $450 \mu\mu$ respectively. There is no Purkinje effect for these animals and in general they show no sensitivity to color or wave-length as such. Certain species of *Cladocera* are sensitive to ultra-violet light as far as $313 \mu\mu$.

White (98) reports experiments in which mud-minnows and sticklebacks were trained to associate food with certain colors, demonstrating that these fishes can discriminate between red and both blue and green and also between yellow and green, although they are unable to differentiate between blue and yellow. To determine whether this discrimination is based upon apparent brightness rather than color, variations in intensity of the several colors were introduced without interfering with the discriminations. These variations were not very great, but the animals showed very little power to differentiate between different shades of gray. They also were unable to base associations upon peculiarities of stimulus pattern.

Arey (5) finds that in the case of two fishes and a frog the retinal rods remain in a shortened condition until an intensity is reached at which ordinary print can be read, while the cones remain elongated until colors can be distinguished. The thresholds for these responses therefore correspond with the utilitarian demands of the functions which they have hitherto been supposed to subserve, although other investigators have expressed doubt on this point.

REFERENCES

1. ABELSDORFF, G. Zur Frage der Existenz gesonderten Pupillarfasern in Sehnerven. *Klin. Monatsbl. f. Augenheilk.*, 1919, **72**, 170-175.
2. ALLEN, F. On the Discovery of Four Transition Points in the Spectrum and the Primary Colour Sensations. *Phil. Mag.*, 1919, **38**, 55-81.
3. ALLEN, F. The Persistence of Vision of Colours of Varying Intensity. *Phil. Mag.*, 1919, **38**, 81-89.
4. ALLEN, H. S. A Photo-electric Theory of Colour Vision. *Nature*, 1919, **104**, 174.
5. AREY, L. B. A Retinal Mechanism of Efficient Vision. *J. of Comp. Neurol.*, 1919, **30**, 343-353.
6. BAILLIART AND MAGILOT. Recherches permettant d'estimer en millimètres de mercure la pression sanguine dans les vaisseaux retiniens. *C. r. Soc. de biol.*, **82**, 1189-1191.
7. BARD, L. Du rôle des batonnets et des pigments retiniens dans la perception des formes et des couleurs. *J. de physiol. et de pathol. gén.*, 1919, **18**, 276-294.
8. BARD, L. De l'existence d'éléments analytiques des distance dans les images sensorielles visuelles, accoustiques et gyratoires. *J. de physiol. et de pathol. gén.*, 1919, **18**, 295-304.
9. BARD, L. De l'effacement de la tache aveugle dans le champ visuel et de la localisation des images sensorielles. Rôle de "l'indice local." *J. de physiol. et de pathol. gén.*, 1919, **18**, 534-548.
10. BARRIE, T. S. Factors in Stereoscopic Vision. *Brit. J. of Ophthalmol.*, 1919, **3**, 186-187.
11. BARTON, E. M. and BROWNING, H. M. A Syntonic Hypothesis of Colour Vision with Mechanical Illustrations. *Phil. Mag.*, 1919, **38**, 338-348.
12. BELL, L. Visibility of Bright Lines. *Science*, 1919, **50**, 331-332.
13. BEST, F. Zur Theorie der Hemianopsie und der höheren Sehzentren. *Arch. f. Ophthalmol.*, 1919, **100**, 1-31.
14. BLONDEL, A. Sur une solution de la photométrie hétérochrome permettant une mesure physique de l'intensité lumineuse. *C. r. acad. de sci.*, 1919, **169**, 830-835.
15. BUISSON, H. La limite de sensibilité de l'oeil et le minimum de puissance perceptible visuellement. *J. de physique*, 1919, **9**. (Reference impossible of verification by the present reviewer.)
16. CANTONNET, A. Les nécessités visuelles de l'aviateur. *C. r. soc. de Biol.*, 1919 **82**, 637-639.
17. CANTONNET, A. Un test de vision binoculaire basé sur l'expérience du "trou dans la main." *Arch. d'ophtalmol.*, 1919, **36**, 705-715.
18. CANTONNET, A. L'examen de l'appareil visuel chez les candidats aviateurs. *Arch. d'ophtalmol.*, 1919, **36**, 404-417.
19. COBB, P. W. Dark-Adaptation with Especial Reference to the Problems of Night-Flying. *Psychol. Rev.*, 1919, **26**, 428-453.
20. COBB, P. W. A Contribution to the Study of Dark-Adaptation. *Arch. of Ophthalmol.*, 1919, **48**, 492-502.
21. COBLENTZ, W. W. Recent Progress in the Manufacture of Glasses for Protecting the Eye from Injurious Radiations. *J. of the Franklin Inst.*, 1919, **188**, 255-261.
22. COBLENTZ, W. W. Spectral Energy Distribution in the Acetylene Flame. *J. of the Franklin Inst.*, 1919, **188**, 399-400.

23. COBLENTZ, W. W. Note on the Distribution of Energy in the Visible Spectrum of a Cylindrical Acetylene Flame. (Proc. of the Amer. Phys. Soc.) *Phys. Rev.*, 1919, 14, 168-169.
24. COHEN, M. A Device for the Examination of Distant Stereoscopic Vision for Form and Colors. *Arch. of Ophthalmol.*, 1919, 48, 142-143.
25. COWDRICK, M. and WINFIELD, M. The Adjustment of the Hering Color-Blindness Apparatus. (Minor Studies from the Psychol. Lab. of Cornell Univ.) *Amer. J. of Psychol.*, 1919, 30, 418-422.
26. CROZIER, W. J. and AREY, L. B. The Heliotropism of Onchidium: A Problem in the Analysis of Animal Conduct. *J. of Gen. Physiol.*, 1919, 2, 107-112.
27. DOWNEY, J. W., JR. Determination of Minimum Light Sense and Retinal Dark Adaptation with Presentation of a New Type of Photometer. *Amer. J. of Ophthalmol.*, 1919, (3) 2, 13-20.
28. EATON, E. M. Factors in Stereoscopic Vision and in the Visual Estimation of Distance. *Brit. J. of Ophthalmol.*, 1919, 3, 63-78.
29. EATON, E. M. The Visual Perception of Solid Form. *Brit. J. of Ophthalmol.*, 1919, 3, 349-363, 399-408.
30. ENGELKING, E. Der Schwellenwert der Pupillenreaktion und seine Beziehungen zum Problem der pupillomotorischen Aufnahmeorgane. *Zeitsch. f. Sinnesphysiol.*, 1919, 50, 319-337.
31. ETRINGHAM, H. Butterfly Vision. *Trans. of the Entomol. Soc. London*, 1919, 1-49.
32. FERREE, C. E. and RAND, G. Chromatic Thresholds of Sensation from Center to Periphery of the Retina and Their Bearing on Color Theory. Part I. *Psychol. Rev.*, 1919, 26, 16-41.
33. FERREE, C. E. and RAND, G. Chromatic Thresholds of Sensation from Center to Periphery of the Retina and Their Bearing on Color Theory. Part II. *Psychol. Rev.*, 1919, 26, 150-163.
34. FERREE, C. E. and RAND, G. The Speed of Adjustment of the Eye for Clear Seeing at Different Distances. (A Study of Ocular Functions with Special Reference to Aviation.) *Amer. J. of Psychol.*, 1919, 30, 40-61.
35. FERREE, C. E. and RAND, G. Some Experiments on the Eye with Different Illuminants. Part II. *Trans. of the Illum. Eng. Soc.*, 1919, 14, 107-116.
36. FILEHNE, W. Über irdische Vorgänge, die nur in der Dämmerung sichtbar sind, und über Dämmerungsvorgänge am Planeten Venus. *Zeitsch. f. Sinnesphysiol.*, 1919, 50, 338-346.
37. FORSYTHE, W. E. Speeds in Signaling by the Use of Light. (Proc. of the Amer. Phys. Soc.) *Phys. Rev.*, 1919, 13, 149-150.
38. FRENCH, J. W. The Unaided Eye. *Trans. of the Optical Soc., London*, 1919, 20, 209-232; 21, 1-24.
39. GIBSON, C. R. Experiments on Color-Blindness. (Proc. of the Phys. Soc.) *Nature*, 1919, 102, 299.
40. GIBSON, K. S., TYNDALL, E. P. T., and McNICHOLAS, H. J. The Spectral Transmission of Filters Used to Detect Camouflage or Improve Visibility. (Proc. of the Amer. Phys. Soc.) *Phys. Rev.*, 1919, 14, 261-263.
41. GRIFFITHS, C. H. and BAUMGARTEN, W. J. The Correlation Between Visualization and Brightness Discrimination. *Psychol. Rev.*, 1919, 26, 75-82.
42. HARTRIDGE, H. Physiological Eye-Strain. (Proc. of the Physiol. Soc.) *J. of Physiol.*, 1919, 53, i-ii.

43. HARTRIDGE, H. The Shape of the Pupil in Various Animals. (Proc. of the Physiol. Soc.) *J. of Physiol.*, 1919, 53, vii-viii.
44. HARTRIDGE, H. Marginal Aberrations of the Eye. (Proc. of the Physiol. Soc.) *J. of Physiol.*, 1919, 53, viii-ix.
45. HARTRIDGE, H. Optics of Crystalline Lens. (Proc. of the Physiol. Soc.) *J. of Physiol.*, 1919, 53, x-xi.
46. HARTRIDGE, H. The Limit of Peripheral Vision. (Proc. of the Physiol. Soc.) *J. of Physiol.*, 1919, 53, xvii-xviii.
47. HECHT, S. Sensory Equilibrium and Dark Adaptation in *Mya arenaria*. *J. of Gen. Physiol.*, 1919, 1, 545-558.
48. HECHT, S. The Nature of the Latent Period in the Photic Response of *Mya arenaria*. *J. of Gen. Physiol.*, 1919, 1, 657-666.
49. HECHT, S. The Effect of Temperature on the Latent Period in the Photic Response of *Mya arenaria*. *J. of Gen. Physiol.*, 1919, 1, 667-686.
50. HENNING, H. Die besonderen Funktionen der roten Strahlen bei der scheinbaren Grösse von Sonne und Mond am Horizont, ihr Zusammenhang mit dem Aubert-Försterschen und Kösterschen Phänomen und verwandte Beleuchtungsprobleme. *Zeitsch. f. Sinnesphysiol.*, 1919, 50, 275-310.
51. HESS, C. v. Der Lichtsinn der Krebse. *Arch. f. d. ges. Physiol.*, 1919, 174, 245-281.
52. HOEVE, J. VAN DER. Die Bedeutung der Gesichtsfeldes für die Kenntnis des Verlaufs und der Endigung der Sehnervenfasern in der Netzhaut. *Arch. f. Ophthalmol.*, 1919, 98, 243-251.
53. HOUSTOUN, R. A. A Theory of Colour Vision. *Phil. Mag.*, 1919, 38, 402-417.
54. HOWARD, H. J. A Test for the Judgment of Distance. *Amer. J. of Ophthalmol.*, 1919, (3), 2, 656-675.
55. HYDE, E. P., FORSYTHE, W. E., AND CADY, F. E. Note on the Distribution of Energy in the Visible Spectrum of a Cylindrical Acetylene Flame. *J. of the Franklin Inst.*, 1919, 188, 129-130.
56. HYDE, E. P., FORSYTHE, W. E., AND CADY, F. E. A New Experimental Determination of the Brightness of a Black Body, and of the Mechanical Equivalent of Light. *Phys. Rev.*, 1919, 13, 45-58.
57. HYDE, E. P., FORSYTHE, W. E., AND CADY, F. E. Note on the Distribution of Energy in the Visible Spectrum of a Cylindrical Acetylene Flame. (Proc. of the Amer. Phys. Soc.) *Phys. Rev.*, 1919, 13, 157-158.
58. IVES, H. E. The Photometric Scale. *J. of the Franklin Inst.*, 1919, 188, 217-235.
59. JOLY, J. A Photo-Electric Theory of Colour Vision. *Nature*, 1919, 104, 74.
60. JONES, L. A. The Low Visibility Phase of Protective Coloration. *J. of the Franklin Inst.*, 1919, 188, 363-387, 501-533.
61. KAILA, E. Versuch einer empiristischen Erklärung der Tiefenlokalisation von Doppelbildern. *Zeitsch. f. Psychol.*, 1919, 82, 129-197.
62. KOFFKA, K. Beiträge zur Psychologie der Gestalt- und Bewegungserlebnisse. IV. Zur Theorie einfachster gesehener Bewegungen. Ein physiologisch-mathematischer Versuch. *Zeitsch. f. Psychol.*, 1919, 82, 357-292.
63. KUILE, T. E. ter. Stereokinematoskopie, dichopisch gesehener harmonischer Punktbewegungen. *Arch. f. d. ges. Physiol.*, 1919, 174, 233-243.
64. LAMB, H. The Kinematics of the Eye. *Phil. Mag.*, 1919, 38, 685-695.
65. LIDDELL, H. S. Eye-Movement During Fluctuations of Attention. *Amer. J. of Psychol.*, 1919, 30, 241-252.

66. LOCKWOOD, R. M. Spherical Aberration of the Eye. *Optician*, 1919, p. 50.
67. LODGE, O. A Photo-Electric Theory of Colour Vision. *Nature*, 1919, **104**, 92.
68. LUCKIESH, M. The Visibility of Airplanes. *J. of the Franklin Inst.*, 1919, **187**, 289-312, 409-459.
69. LUCKIESH, M. The Principles of Camouflage. *Trans. of the Illum. Eng. Soc.*, 1919, **14**, 234-255.
70. MINNICH, D. E. The Photic Reactions of the Honey-Bee, *Apis Mellifera* L. *J. of Exper. Zool.*, 1919, **29**, 343-425.
71. MONBRUN, A. Le centre cortical de la vision et les radiations optiques. Les hemianopsies de guerre et la projection rétinienne cérébrale. *Arch. d'ophtalmol.*, 1919, **36**, 641-670.
72. MORAX, V. Discussion des hypothèses faites sur les connexions corticales des faisceaux maculaires. *Ann. d'oculist.*, 1919, **156**, 25-35.
73. MORAX, V., MOREAU, F., ET CASTELAIN. Les différents types d'altérations de la vision maculaire dans les lésions traumatiques occipitales. *Ann. d'oculist.*, 1919, **156**, 1-25.
74. NORDENSSON, J. W. Über die Durchlässigkeit der vorderen Grenzschicht des Glaskörpers beim Menschen in verschiedenen Lebensaltern. *Skand. Arch. f. Physiol.*, 1919, **37**, 216-240.
75. OSBORNE, W. A. A Contribution to the Physiology of the Aqueous Humour. *J. of Physiol.*, 1919, **52**, 347-350.
76. PIÉRON, H. Temps de latence et temps d'action liminaires. Interprétation de la loi générale de variation en fonction des intensités excitatrices. *C. r. soc. de biol.*, 1919, **82**, 1162-1165.
77. PIKLER, J. *Schriften zur Anpassungstheorie. I. Hypothesenfrei Theorie der Gegenfarben.* Leipzig, Barth, 1919. Pp. viii+104.
78. PRANTL, R. Die Schnelligkeit des optischen Erkennens als Funktion der Objekt-lage. *Zeitsch. f. Psychol.*, 1919, **82**, 293-313.
79. PÜTTER, A. Studien zur Theorie der Reizvorgänge. V. Der Verlauf der Dauererregung. VI. Allgemeine Folgerungen aus den bisherigen Untersuchungen. *Arch. f. d. ges. Physiol.*, 1919, **175**, 371-397; **176**, 39-69.
80. RAMAN, C. V. The Scattering of Light in the Refractive Media of the Eye. *Phil. Mag.*, 1919, **38**, 568-572.
81. RICH, G. J. The Daylight Mazda Lamp in the Psychological Laboratory. (Minor Studies from the Psychological Laboratory of William Smith and Hobart Colleges.) *Amer. J. of Psychol.*, 1919, **30**, 313-315.
82. ROCHON-DUVIGNEAUD, A. Quelques données sur la fovea des oiseaux. *Ann. d'oculist.*, 1919, **156**, 717-732.
83. ROCHON-DUVIGNEAUD, A. La double fovea rétinienne des Rapaces diurnes. *C. r. acad. d. sci.*, 1919, **169**, 43-46.
84. ROELOFS, C. O., AND ZEEMAN, W. P. C. Über den Wettstreit der Konturen. *Arch. f. Ophthalmol.*, 1919, **99**, 79-104.
85. ROELOFS, C. O., AND ZEEMAN, W. P. C. Die Sehschärfe in Halbdunkel, zugleich ein Beitrag zur Kenntnis der Nachtblindheit. *Arch. f. Ophthalmol.*, 1919, **99**, 174-194.
86. ROELOFS, C. O., AND ZEEMAN, W. P. C. L'acuité visuelle dans la demi-obscurité. *Arch. néerl. de physiol.*, 1919, **3**, 562-586.
87. SCHWEINITZ, G. E. DE. Concerning the Ocular Phenomena in the Psychoneuroses of Warfare. *Arch. of Ophthalmol.*, 1919, **48**, 419-438.

88. SHEARD, C., AND MCPEEK, C. On the Electrical Responses of the Eye to Stimulation by Light of Various Wave-Lengths. *Amer. J. of Physiol.*, 1919, **48**, 45-66.
89. SHEARD, C. Diffraction in the Human Eye and the Phenomena of Colored Rings Surrounding Luminous Sources. *Amer. J. of Ophthalmol.*, 1919, (3) **2**, 185-195.
90. SPEARMAN et al. Discussion on Visual Requirements of Aviators. *Arch. of Ophthalmol.*, 1919, **48**, 519-521.
91. SPALDING, J. A. Two Rarely Described Instances of Scintillating Scotoma; Self-Observed. *Arch. of Ophthalmol.*, 1919, **48**, 38-42.
92. STEFANINI, A. Sur les mouvements des yeux déterminés par des stimulus acoustiques. *Arch. ital. de biol.*, 1919, **69**, 134-136.
93. WAGER, H. The Colour-Sense of Wasps. (Proc. of the Linnean Soc.) *Nature*, 1919, **103**, 58.
94. WASSENAAR, T. La visibilité des vaisseaux de la rétine sur un disque tournant et scintillant. *Arch. néér. de physiol.*, 1919, **3**, 440-442.
95. WASSENAAR, T. Un phénomène lumineux singulier observé par éclairage perpalpébral. *Arch. néér. de physiol.*, 1919, **3**, 528-529.
96. WEYMOUTH, F. W., AND OGATA. Foveal and Parafoveal Vision. *Optician*, 1919, p. 248.
97. WEVE, H. Zur Physiologie des Lichtreflexes der Pupille. *Arch. f. Ophthalmol.*, 1919, **100**, 137-156.
98. WHITE, G. M. Association and Colour Discrimination in Mud-minnows and Sticklebacks. *J. of Exper. Zool.*, 1919, **27**, 443-495.
99. WILSON, J. A. Gunshot Injuries of the Cortical Visual Areas. *Brit. J. of Ophthalmol.*, 1919, **3**, 453-459.
100. WINGENDER, P. Beiträge zur Lehre von den geometrisch-optischen Tauschungen. *Zeitsch. f. Psychol.*, 1919, **82**, 21-66.
101. WOOG, P. De la persistance variable des impressions lumineuses sur les différentes régions de la rétine. *C. r. acad. d. sci.*, 1919, **168**, 1222-1224.
102. WOOG, P. De la persistance variable des impressions lumineuses sur les diverses régions de la rétine. *C. r. acad. de sci.*, 1919, **169**, 93-94.

HEARING

BY R. M. OGDEN

Cornell University.

Stumpf (22) has recently made a careful investigation of vocalic sound. His work falls into three main divisions. With the aid of resonating forks, he has analyzed vowels uttered by the human voice and finds that the voice contains a much larger number of partials than had hitherto been suspected. In some cases he was able to detect a resonance of the 36th partial. The relative intensity of the various partials for each vowel was estimated, and the characteristic regions of resonance for each vowel sound thus

determined. All partials were found to belong to the harmonic series. As the fundamental appears also as a difference-tone of all the partials, its resonance is often much weaker than it appears as heard. In the second part of his investigation, Stumpf subjected the sung vowels to a more careful analysis with the aid of a large number of appropriately adjusted interference-tubes. This enabled him to eliminate the partials successively down to the fundamental, and then to add them gradually until the vowel sound was reconstructed. These experiments substantiated those of the introductory series, and, in addition, defined the characteristic formants or regions of resonance for each of the vowel sounds: *u*, *o*, *a*, *ä*, *ö*, *ü*, *e*, *i*. The formants in question are fixed regions of resonance ordinarily embracing an interval of a minor third. They remain fixed without regard to the fundamental tone upon which they are sounded; and hence they do not appear unless the fundamental contains the partials needed to establish the formant of the vowel in question. As constituted, the vowel sounds are entirely composed within the series of partial tones; there was never any sound left over after the interference with the partials was complete. All stages in the development of the sound upwards from the fundamental were found to be vocalic. Aside from *u*, the lowest of the vowels, each has its foundation in another vowel, as *o* in *u*, *a* in *o*, *ä* in *ao*, *e* in *o*, etc. While the specific character of the vocalic sound always rests upon a number of tones, the formants stand out as peculiar regions of resonance which distinguish the chief vowels from one another. The location of these regions is not such as to justify Köhler's octave law,¹ but is in remarkable agreement with other investigators, notably D. C. Miller² and H. Schole.³ For *u* Stumpf finds a formant ranging downwards from g^1 to c , which usually coincided with the fundamental tone. The formant of *o* is at g^1 , which now occurs as a partial, and not as a fundamental; for *a* the formant is at a^2 ; for *o* there are two formants, the primary lying at a^3 , the secondary at g^1 ; for *a* the primary formant is slightly higher at $a^{#3}$, the secondary formant lying at g^2 ; for *ü* the primary formant is again at $a^{#3}$, the secondary formant being that of *u*, the fundamental, and ranging downwards from g^1 ; for *e* the primary formant lies at d^4 and the secondary at g^1 , the sound embracing, as it were, the vowel *o*; while for *i* the primary formant is at b^4 with a secondary formant at e^4 ,

¹ Cf. *Zsch. F. Psychol.*, 1910, 58, 59-140.

² Cf. *The Science of Musical Sounds*, New York, 1916.

³ Cf. *Arch. f.d. ges. Psychol.*, 1918, 38, 12-70.

and the whole embracing also the fundamental or *u* formant which ranges from *g*¹, downwards.

In a synthetic experiment in which artificial vowels produced by pipes and interference-tubes were compared with the sung vowels of a human voice, the artificial sounds proved to be more satisfactory to a majority of persons who did not know which was which, than were the sounds of the human voice. Supplemental experiments are cited to indicate that all spoken sounds, whether vowels or consonants, may be analyzed by these means into a series of partial tones with characteristic regions of resonance. Köhler's conclusion that the sounds of *sch*, *f* and *ch* pass beyond the normal range of hearing was not substantiated, for the last or highest of these could be produced within the region of *a*⁴ to *b*.⁴ In conclusion, Stumpf outlines three problems for further investigation. (1) How and under what conditions is it possible for a multitude of single tones to fuse into a unity that will give the impression of a vocalic sound? (2) How does the specific quality of the vowel relate itself to the characteristics of the partials which compose it? (3) How does the intensity of the total clang compare with the intensity of its constituent partial tones?

Perrett (14) criticizes the phonetic theory derived from Helmholtz, and, going back to Willis, contends that vowel sounds are gliding in nature and have nothing to do with the presence or absence of reinforced harmonics. The characteristic pitch of the chief vowels is, however, indicated; though the discrepancy between his results and those of Helmholtz and later investigators who have attacked the problem is marked. The fifth chapter of Perrett's book on *The Perception of Sound* has already been reviewed in this BULLETIN.¹

Ogden (13) gives a graphic representation of the tonal manifold, indicating the range of tones from low to high each with its appropriate volume, inherent intensity and pitch-brightness. The discriminability of volume also indicates the basis of judgment for intervals and the position which the octaves take in the total series of tones. The possibility of brightness as an attribute is also discussed, in connection with the transition of sound from a tone of salient pitch to a vocalic formant of reduced brightness, but without alteration of pitch.

Smith and Bartlett (20) report upon the conditions of listening to sounds of weak intensity—results obtained in an investigation

¹ See Vol. 16, pp. 349-350.

of appropriate means for selecting candidates in the anti-submarine service. As the source of sound, both a buzzer and an electrically driven tuning fork were used. Binaural hearing proved better than uniaural, the best results being obtained with a small range of finely graded stimuli near the threshold. Weak sounds were sometimes found to require as much as 4" in time to produce their full effect. There was little evidence of sensory fatigue; the sounds were often localized and sometimes seemed to move. Sound-stimuli were frequently perceived when they could not be heard; and the cessation of sound then gave rise to a positive experience of silence. Many other than auditory factors enter into the perception of weak sounds, and distracting sounds proved most detrimental to judgment when they were irregular of occurrence, similar to the sound listened for, or familiar to the observer. The subject's own estimate of his efficiency was likely to be accurate only when it was favorable; not when it was unfavorable. Piéron (15) gives some measurements of the latent time of sounds of weak intensity in listening to the buzzing of the lamella of a Hipp chronoscope. The sound was communicated telephonically to the observer, and its intensity reduced to a liminal value by increasing the distance of the observer from the instrument. The experimenter started the chronoscope, and at a given moment closed the circuit of the telephone. The observer was instructed to react in a way that stopped the clock as soon as he heard the sound. As the experimenter closed the circuit of the telephone, a slight click was produced which was heard by the observer after he had reacted to the whirring of the clock. The appearance of this secondary sound-stimulus in consciousness measures the latent time whose length is determined by a second reaction. The intensities of the primary sound were measured in multiples of the liminal intensity, and it was found that with the increase of intensity the latent time decreases from about 500σ at the threshold to about 200σ at 400 times this intensity. With still greater intensities the sound of the clock was masked by the sound of the lamella and appeared simultaneously with it.

Kovács (9) experimented upon music students in order to determine variations in ability to recognize errors in musical pieces and to reproduce by playing or singing what had previously been heard. He found the ability to recognize and the ability to reproduce fundamentally different. Recognition involves a passive attitude with attention upon the whole piece, whereas ability to reproduce in performance requires an active attitude with attention upon parts

and their serial order. The teacher of music is in need of the first-named ability, the virtuoso of the second. Those who study music chiefly for its cultural value should be trained more to the passive attitude of appreciative recognition, and can afford to devote less effort than is commonly required of them in accuracy of reproduction.

Schilling (17) describes four cases of deafness with attendant musical defects—both raising and lowering the apparent pitch in certain regions of the scale. Most cases of this kind may be referred to suppuration in the middle ear chamber, but since pressure on the round window could hardly explain defective hearing for definite regions of the scale, the author suggests an osmotic connection of exudations in the drum-cavity through the round window into the labyrinth which might occasion localized affections in the organ of Corti. Marage (11) after studying the coördination of the laryngeal muscles and their action in voice-production, concludes that the artificial timbre of the voice of the deaf is occasioned by a fixed position of the mouth in giving utterance to a particular sound, whereas in the case of persons who hear, the larynx alters its form with each note or vowel.

Zwaardemaker (26) classifies different types of apparatus designed to improve the hearing of deaf persons. They are five in number: (1) those that supply a means of conduction when the drum or ossicles have ceased to function; (2) apparatus to bring the source of sound nearer the ear; (3) apparatus to magnify the space from which vocables are apprehended; (4) apparatus to intensify the sound by resonance; and (5) apparatus to intensify the sound by transformation and magnification of its energy. In considering the use of each type of apparatus the individual needs of the deaf must be taken into account. When a very deaf person has forgotten how to listen to spoken sound, and supports his efforts by lip-reading, an apparatus which restores his hearing in some measure will be of little use without reëducation in listening. For minor defects of hearing where the patient is still able to distinguish whispered words at a distance of from one to two meters, much benefit can be derived from intensive practice in listening to whispered words in brief periods daily. In the experience of the author, the whispered word is a better source of sound in such cases than the artificial sounds of the vowel siren, for instance; but to be successful, training of this kind must be carefully supervised by an experienced physician. With various forms of apparatus designed

to bring the source of sound nearer, or to magnify the space and provide multiple resonance, care must be exercised with regard to the mean intensity of the sound as magnified, with regard to special zones of favored intensities which may either help or hinder the patient, and finally with regard to the often distressing reverberation produced by the apparatus in certain sounds which it modifies.

When a small number of holes is closed in the revolving disk of a siren and brief pauses occur between the sounding pulsations, secondary tones are produced by the interruption which are lower in pitch than the fundamental, and have been sometimes regarded as difference tones of subjective origin. Koch (8) has investigated the nature of the impulses that produce these sounds. With the aid of a manometric flame, as the generator of the sound, he finds that the distribution of energy, indicated by the appearance of the flame above and below the disk, produces these secondary pulsations in the same manner as the primary or fundamental tone. They arise through a lack of uniformity, or a disturbance occasioned by the alternation of the opened and closed stretches on the disk; and are an effect of friction. While the fundamental tone has its origin in the central portion of the flame, the secondary tones are produced at the outer edges of the flame, both above and below the disk.

In a series of communications to *Nature* (2) W. M. Bayliss has criticized Sir Thomas Wrightson's theory of the analytic mechanism of the ear,¹ and rejoinders have been made by Wrightson and his collaborator, Arthur Keith, together with additional comments by Lord Rayleigh, Wilfred Perrett and D. Fraser Harris.

Azoulay (1) records the case of a woman painter who upon hearing a noise in the dark invariably sees a flash of white light. The phenomenon does not seem to arise from the reflexive pressure of winking; for whenever pressure is exerted upon her eyeballs she sees vivid colors, but never white. Though very sensitive to both color and music, the subject has never experienced any other phenomena of color-hearing than the white flash described. The author regards the case as suggesting an elemental type of color-hearing.

Wittmaack (25) describes a series of experiments with guinea pigs in which the comparative effects of continuous sound stimulation and of continuous jars to the whole body of the animal were studied. The sound of a falling hammer whose pitch was in the region of the fourth octave produced, after two month's treatment,

¹ Cf. *An Enquiry into the Analytical Mechanism of the Internal Ear*, London, 1918.

noticeable changes in the organ of Corti near the base of the cochlea, both for animals resting on the same board which the hammer struck and for a second group resting upon an adjacent detached board. When the sound of the hammer was greatly reduced by allowing it to fall upon a felt mat, a degeneration of the nerve-fibers near the apex of the cochlea was produced after five or six months in those animals that rested upon the board receiving the jars, but no disturbance was found in the organs of the animals placed on the adjacent detached board. The conclusion is reached that many cases of gradually developing deafness among workers, such as railway engineers and firemen, who are subjected to constant jarring of the body, are produced in this manner, their deafness beginning with the lower register of the scale; whereas deafness produced by sound is more likely to begin with sounds of high pitch. Esclangon (5) notes that the sound of certain projectiles in artillery-fire gives no impression of pitch, and concludes that the effect of sudden variation of atmospheric pressure on the ears is a sort of manometric percussion without periods of resonance in accordance with which the organ of hearing is affected as a whole. In a brief paper Seashore (18) describes his new apparatus for measuring the acuity of hearing at any level of pitch. The apparatus consists of a motor-driven toothed wheel revolving about a stationary wheel likewise toothed. The speed is subject to control and measurement, and the vibrational frequency may thus be accurately determined. The sound, which is communicated by telephone with the ear, is varied in strength by allowing the current of the telephone to pass through a resistance-box. In this way the intensity of any tone within the range of hearing can be readily varied, and the acuity of hearing at any level of pitch quickly and accurately tested.

Hartley (6) reports a striking agreement between the theoretical location of a pure tone in terms of its phase-difference at the two ears, and actual tests of localization with a moving source of sound. Accurate judgment extended, in his experiments, only to tones of about 600 v.d. Beyond this frequency the judgment is confused by the appearance of secondary images of sound which may likewise be attributed to the influence of the phase-difference. He concludes that the localization of pure tones is more likely to be a result of the perception of phase than of cross-conduction within the head from one ear to the other. Stewart (21) returns to this question of sound-localization, bringing additional evidence for the perception of

phase-difference as the basis of judgment in locating the position of a pure tone. Experiments in which intensity was varied but phase was kept constant, gave evidence of difficulty in keeping the sound fused when the vibrational frequency exceeded 800 v.d. Even within this range the difference between the theoretical and experimental locations of a pure tone was found to be so great that one can hardly consider intensity to be an important factor. The logarithmic law of intensity-effects, previously reported by this author as a possible extension of Weber's Law,¹ is now regarded by him as merely a statement in terms of angular displacement of "the form taken by the recognition of the differences between the nature of these two nerve-responses" at the two ears. Experimenting with phase-differences and constant intensity, the author finds the apparent movement of a source of sound to be clearly defined for frequencies as high as 1,200 or 1,500 v.d. Above this level the sound-image becomes multiple and the judgment confused. With the lower rates of frequency, however, "the angular displacement from the median plane produced by a given phase-difference at the two ears proves to be the very position for the source of sound that will theoretically produce the aforesaid phase-difference at the ears." The effect of phase cannot be that of the time-interval involved, because equal time-intervals do not correspond to equal angular displacements except at higher frequencies. The conclusion is reached that the localization of sound is chiefly dependent upon a direct perception of phase. Cross-conduction through the skull mediates sounds of internal localization whose quality is quite other than that of sounds externally localized. As a crucial test of the relative importance of intensity and phase, Stewart cites the results of two of his observers who were quite unable to locate a sound of 1,024 v.d. when the intensity at the two ears was markedly different, though they did localize this tone with ease when there was a difference of phase.

Investigating the effect of amplitude upon electrically driven tuning forks Miller (12) finds that variation of amplitude seems to change the effective length of the fork, the frequency being lowered when the amplitude is increased. A formula is given to cover variations of this sort.

Dadourian (4) reports a variety of experiments upon conditions which affect the period of an electrically driven fork, such as the massiveness of the fork's base, a change in the constants of the

¹ Cf. *Psychol. Rev.*, 1918, 25, 242-251.

electrical current, an increase in the length of gaps between contact springs and points, amplitude, temperature, velocity of sound in the steel, the coefficient of elasticity, etc. Love and Dawson (10) report experiments with the Stern variator, and with an organ pipe, in which a change of air pressure, measured by a water manometer, with the corresponding alteration of intensity, measured by a modified Rayleigh resonator, showed that the intensity of sound varies almost directly with the blowing-pressure. With increased pressure the pitch of the variator rises, and in order to hold it at a fixed value the volume of the variator must be correspondingly increased. Knipp (7) reports that a mercury vapor-trap of pyrex glass—which is shaped like a test-tube with a transverse tube opening into it at right angles about half way up its length—will emit a clear pure tone from the side tube when the upper end of the main tube is stopped and the lower end is heated over a Bunsen burner. The tone remains constant in pitch, air being both received and discharged at the side tube. If extra side tubes are fused into the vibrating column, the pitch of the tone is raised; and when they are stopped, it is lowered. With tubes of different dimensions different pitches may be obtained which remain constant for an indefinite period if the heat is applied at a constant rate.

Watson (24) reports experiments with a rectangular megaphone constructed upon Rayleigh's theory that when a train of parallel waves passes through a slit whose width is equal to or smaller than half the wave-length, they spread out as if they came from the aperture as the center of disturbance. If, however, the width is large, as compared with half a wave-length, there is little or no spreading of the sound. When such a rectangular megaphone was used in an open space with its opening held vertical there was a diffraction of more than 90° in the sound of the voice, but when held horizontally, the speaker's voice was much less distinct to persons standing at the side.

Buck's *Acoustics for Musicians* (3) is a brief but comprehensive treatment of some of the chief principles of acoustics which an intelligent musician ought to know. The book is clearly written and includes many explanatory diagrams.

Pikler's (16) theory of consonance and dissonance has already received a special review in this BULLETIN,¹ as has Seashore's volume on *The Psychology of Musical Talent*² (19). Watt's new

¹ Cf. BULLETIN, 1919, 16, 350-352.

² Cf. BULLETIN, 1919, 16, 352-355.

book on *The Foundation of Music* (23) is reserved for similar treatment.

REFERENCES

1. AZOULAY, L. Audition lumineuse des bruits. *C. r. soc. de biol.*, 1918, **81**, 1081-1082.
2. BAYLISS, W. M.; KEITH, A.; WRIGHTSON, T.; PERRETT, W.; RAYLEIGH; HARRIS, D. F. The Perception of Sound. *Nature*, 1918, **102**, 124-125; 164-165; 184-185; 225-226; 263-264; 304; 325; 365.
3. BUCK, P. C. *Acoustics for Musicians*. Oxford: 1918. Pp. 152.
4. DADOURIAN, H. M. On the Characteristics of Electrically Operated Tuning Forks. *Phys. Rev.*, 1919, **13**, 337-359.
5. ESCLANGON, E. Sur les sensations physiologiques de détonation. *C. r. acad. de sci.*, 1919, **168**, 699-700.
6. HARTLEY, R. V. L. The Function of Phase Difference in the Binaural Location of Pure Tones. *Phys. Rev.*, 1919, **13**, 373-385.
7. KNIPP, C. T. A Possible Standard of Sound. *Phys. Rev.*, 1918, **12**, 491-492.
8. KOCH, E. Die Entstehung der Unterbrechungstöne bei Lochsirenen. *Arch. f. d. ges. Physiol.*, 1918, **170**, 476-500.
9. KOVÁCS, S. Über das Verhältnis des erkennenden und mitteilenden Gedächtnisse auf Musikalischem Gebiet. *Arch. f. d. ges. Psychol.*, 1918, **37**, 283-299.
10. LOVE, B. F., AND DAWSON, MARGARET K. The Variation in Sound Intensity of Resonators and Organ Pipes with Blowing Pressure. *Phys. Rev.*, 1919, **14**, 49-53.
11. MARAGE, M. La timbre de la voix chez les sourds-muets. *C. r. acad. de sci.*, 1919, **168**, 286-289.
12. MILLER, D. C. The Influence of Amplitude and of Electromagnetic Driving on the Frequency of Tuning Forks. *Phys. Rev.*, 1918, **11**, 497-498.
13. OGDEN, R. M. The Tonal Manifold. *Psychol. Rev.*, 1920, **27**, 136-146.
14. PERRETT, W. *Some Questions of Phonetic Theory*. Cambridge: W. Heffer & Sons. Part I. Chapters I-IV, 1916, pp. viii + 110; Chapter V, 1919, pp. 39.
15. PIÉRON, H. De la loi de variation des temps de latence en fonction des intensités excitatrices pour les sensations auditives. *C. r. soc. de biol.*, 1919, **82**, 1116-1118.
16. PIKLER, J. *Theorie der Konsonanz und Dissonanz*. Leipzig: Barth, 1919, pp. 34.
17. SCHILLING, R. Über musikalisches Falschhören. *Arch. f. Ohren-Nasen u. Kehlkopfheilkunde*, 1919, **105**, 65-74.
18. SEASHORE, C. E. The Iowa Pitch Range Audiometer. *Journal-Lancet*, 1919, Oct. 15, pp. 8.
19. SEASHORE, C. E. *The Psychology of Musical Talent*. Boston: Silver, Burdett, 1919, pp. xvi + 288.
20. SMITH, E. M., AND BARTLETT, F. C. On Listening to Sounds of Weak Intensity. *Brit. J. of Psychol.*, 1919-20, **10**, 101-129, 133-168.
21. STEWART, G. W. The Function of Intensity and Phase in the Binaural Location of Pure Tones. I and II, *Phys. Rev.*, 1920, **15**, 425-431, 432-445.
22. STUMPF, C. Die Struktur der Vokale. *Sitzungsber. d. Preuss. Akad. d. Wissensch.*, 1918, I. Halbband, 333-358.
23. WATT, H. J. *The Foundations of Music*. Cambridge: 1919, pp. xvi + 239.
24. WATSON, F. R. A Megaphone with a Rectangular Aperture. *Phys. Rev.*, 1918 **11**, 244-245.

25. WITTMACK, K. Vergleichende Untersuchungen über Luftschall—Luftleitung und Bodenschwingung—Körperleitungsschädigungen des akustischen Apparates, *Arch. f. Ohren-, Nasen-, und Kehlkopfheilkunde*, 1918, 102, 96–107.
26. ZWAARDEMAKER, H. Über Hörapparate. *Arch. f. Ohren-, Nasen-, und Kehlkopfheilkunde*, 1919, 104, 1–38.

BOOKS RECEIVED

- PRATT, J. B. *The Religious Consciousness*. New York: Macmillan, 1920. Pp. viii + 486.
- OWEN, TUDOR. *The Child Vision*. Manchester: Longmans, Green, 1920. Pp. xvi + 180. \$2.50.
- HALL, G. STANLEY. *Morale. The Supreme Standard of Life and Conduct*. New York: Appleton, 1920. Pp. ix + 378.
- FREUD, SIGMUND. *A General Introduction to Psychoanalysis*. New York: Boni and Liveright, 1920. Pp. x + 406. \$4.50.
- FRÖBES, JOSEPH. *Lehrbuch der experimentellen Psychologie*. Freiburg im Breisgau: Herder and Co., 1920. Pp. xviii + 704. \$6.00.
- ROUGIER, LOUIS. *Les Paralogismes du Rationalisme*. Paris: Alcan, 1920. Pp. xiv + 540. 15 fr.
- ROUGIER, LOUIS. *La Philosophie Géométrique de Henri Poincaré*. Paris: Alcan, 1920. Pp. 208. 7 fr. 50.
- LIPMANN, OTTO and STOLZENBERG, OTTO. *Methoden zur Auslese hochwertiger Facharbeiter der Metallindustrie*. Leipzig: Barth, 1920. Pp. 79. 4.30 M.
- BENARY, W. *Rurzer Berichtüber Arbeiten zu Eignungsprüfungen für Flieger-Beobachter*. Leipzig: Barth, 1920. Pp. 61. 3.60 M.
- HENNING, HANS. *Die Wirtschaftspsychologie und Berufseignung in Ueberseeländern*.
- STEINMETZ, S. RUDOLF. *Fragen zur Erforschung des Wirtschaftslebens der Naturvölker*. Leipzig: Barth, 1920. Pp. 52. 4.30 M.
- SACHS, HILDEGARD. *Zur Organisation der Eignungspsychologie*. Leipzig: Barth, 1920. Pp. 16. 3. 35 M.
- HASSE, HEINRICH. *Das Problem der Gültigkeit in der Philosophie David Humes*. München: Reinhardt, 1920. Pp. 192.
- WERNER, HEINZ. *Die Ursprünge der Metapher*. Leipzig: Engelmann, 1919. Pp. 238. 14 M.

STEINBERG, WILHELM. *Die Raumwahrnehmung der Blinden*. München: Reinhardt, 1920. Pp. viii + 150. 9125 M.

Anal. de L'institut d'Orientació Professional. Barcelona, 1920. Vol. I. No. 1.

Archivio Italiano di Psicologia. Edited by F. Kiesow and A. Gemelli. Turin, 1920. Vol. I, No. 1, July, 1920.

Archivio Storico Lombardo. Giornale della Società Storica Lombardo. Milan: Bocca, 1920.

NOTES AND NEWS

THE following items have been taken from the press:

PROFESSOR JAMES H. TUFTS, of the University of Chicago, will be visiting professor at Columbia University next year.

PROFESSOR W. M. URBAN, of Trinity College, has been appointed Stone professor of intellectual and moral philosophy at Dartmouth College.

PRESIDENT G. STANLEY HALL, of Clark University, and President Edmund C. Sanford, of Clark College, have both resigned. President Hall will devote his entire time to writing and to research. President Sanford will spend next year at the Johns Hopkins University and will then return to Clark University as professor of psychology and education.

DR. CARL C. BRIGHAM has been appointed assistant professor of psychology at Princeton University.

THE following grants for research have been made by the American Association for the Advancement of Science:

ONE hundred dollars to Mr. S. D. Robbins, of the Harvard Psychological Laboratory, for measurements of blood pressure of a trephined stammerer.

TWO hundred dollars to Professor Daniel W. LaRue, Stroudsburg State Normal School, Pennsylvania, in support of experimental work on a phonetic alphabet.

TWO hundred dollars to Professor Margaret F. Washburn, Vassar College, for a study of emotional characteristics of certain racial groups in New York City.

Two hundred dollars to Professor Joseph Peterson, George Peabody College for Teachers, Tennessee, in support of a study of the qualitative differences in the mentality of whites and negroes.

Two hundred dollars to Professor A. A. Schaeffer, University of Tennessee, in support of an experimental study of orientation and the direction of movement of animals, and particularly of the "spiral path" in man.

At a recent meeting of the American Philosophical Society, the afternoon of April 23 was devoted to a Symposium on Psychology in War and Education. The following papers were presented:

INTRODUCTION: Professor Lightner Witmer, University of Pennsylvania.

METHODS: DR. J. McKeen Cattell, editor of Science.

PSYCHOLOGICAL examining and classification in the United States Army; Robert M. Yerkes, National Research Council.

THE relation of psychology to special problems of the army and navy: Raymond Dodge, Wesleyan University.

RELATION of Psychology to the National Research Council: James R. Angell, National Research Council.

PSYCHOLOGICAL methods in business and industry: Beardsley Ruml, Philadelphia.

THE individual in education: Arthur J. Jones, University of Pennsylvania.

THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

VISUAL SPACE

BY MABEL C. WILLIAMS

University of Iowa

Under a somewhat misleading title Koffka (4) has brought together a series of articles which had previously appeared in the *Zsch. f. Psychol.* Mention of the subjects of the several articles in this compilation is warranted by the general interest. Kenkel discusses the connection between apparent size and apparent movement. Korte (deceased) reports some investigations of problems connected with the cinematoscope. Koffka discusses the foundations of a psychology of perception which is chiefly an explanation of Benussi's theories. Koffka also presents an attempt at a physiological-mathematical theory of the perception of movement.

Henning (2) defines the content of his article in its title. The novel part of the research is the explanation of the apparent increase in size of the setting and rising sun (and moon) in terms of the clearer definition of objects illuminated by the longer light waves which predominate at such times. Being clearly and more distinctly seen the sun appears to be nearer and therefore larger. The change in apparent size occurs in other objects as well. There are many other factors entering into the illusion and the author enumerates and discusses these and refers some of them to the laws referred to in the title. Some experimental evidence, chiefly qualitative, is given.

Meyer (5) presents a continuation of previous research published some years ago (*Zsch. f. Psychol.*, 1913, 64, pp. 66 ff.), on the memory for spatial position for certain oddly shaped figures. In the present research the same figures are presented in different

positions of rotation toward left, right, backward, and forward. After twenty-four hours' interval the observers were required to identify the position in which any given figure was presented. Various tendencies to error are noticed, especially the identification of neighboring and symmetrical positions with the original, and inability to determine the degree of rotation through the direction was correctly given.

Wingender (6) studied a series of well known geometrical figures presented under unique conditions of illumination. The main or base line or lines of such figures as the Hering, Müller-Lyer, Zöllner, were rendered visible through reflected light, the accessory lines through transmitted light. The whole figure was visible with simultaneous illumination from both sources. Alternating the two types of illumination produced marked changes in the figures, some of which became very elastic. The "critical frequency," the rate of alternation in illumination which brings about constant unrest, was determined for the various figures and different observers. Similar procedure was followed in the study of proportion and stereoscopic forms.

Kaila (3) does not attempt a complete empirical explanation of the perception of depth through disparity: rather he discusses depth localization through double images on the basis of an acquired "association mechanism." The author devotes considerable space to a critical review of the theories of various writers on depth perception and illustrates his own theory of how the association mechanism is built up in the child with the result that definite ideas of depth are associated with the stimulation of all correspondingly paired retinal points.

Enjalran (1) in a long historical, descriptive, and critical article, does not attach so much significance to the part played by corresponding retinal points in perception of depth as is customary. His theory of visible relief is based upon the apparent oblique directions of lines and surfaces in the object seen. He does, however, lay considerable stress upon the significance of retinal disparity.

REFERENCES

1. ENJALRAN, L. Sur la signification de la correspondance birétinienne. *Rev. Philos.*, 1918, 85, 268-325.
2. HENNING, H. Die besonderen Funktionen der roten Strahlen bei der scheinbaren Grösse von Sonne und Mond am Horizont, ihr Zusammenhang mit dem Aubert-Försterschen und Kosterschen Phänomen und verwandte Beleuchtungsprobleme. *Zsch. f. Sinnesphysiologie*, 1918, 50, 275-310.
3. KAILA, E. Versuch einer empiristischen Erklärung der Tiefenlokalisation von Doppelbildern. *Zsch. f. Psychol.*, 1919, 82, 129-197.

4. KOFFKA, K. Beiträge zur Psychologie der Gestalt. Leipzig, 1919. Pp. 323.
5. MEYER, P. Weitere Versuche über die Reproduktion räumlicher Lagen früher wahrgenommener Figuren. *Zsch. f. Psychol.*, 1919, 82, 1-20.
6. WINGENDER, P. Beiträge zur Lehre von den geometrisch-optischen Täuschungen. *Zsch. f. Psychol.*, 1919, 82, 21-66.

SPACE ILLUSIONS

BY EDWARD S. ROBINSON

University of Chicago

In a paper of philosophical rather than psychological interest Pratt (1) takes Professor Spaulding to task for the latter's discussion of illusions, hallucinations, and dreams in his book, *The New Rationalism*. According to the critic, Professor Spaulding states that existents are of two kinds, physical and mental. He also states that illusory and hallucinatory objects do not exist and that they never have existed. They simply subsist. Pratt doubts the validity of Spaulding's attempt to reconcile these two statements by showing that, whereas normal mental entities are existents, hallucinatory ones are non-existents. According to Pratt, if dreams and hallucinations, dream objects and hallucinatory objects, do not exist, then no psychical entities exist.

Wingender (2) studied various geometrical-optical illusions, including the Hering, Zöllner and Müller-Lyer figures. The apparatus was so arranged that the main or illusory lines of each figure could be exposed with or without the neighboring or illusion-inducing lines, which could be brought into view or taken away at will by the experimenter. He noticed that, upon the bringing in or taking out of the illusion-inducing lines, the illusory effect sometimes developed or disappeared slowly and sometimes suddenly. Wingender explains this variation in terms of individual differences. He states, however, that cases were rare where both the development and disappearance of an illusion took place suddenly for any subject. A similar phenomenon was noticed in connection with the controlled production of disparation in stereoscopic vision. The paper reports the confirmation of a number of facts regarding the influence of analysis, synthesis, point of fixation etc. upon the amplitude and character of space illusions.

REFERENCES

1. PRATT, J. B. Professor Spaulding's Non-Existent Illusions. *J. of Phil., Psychol., Etc.*, 1918, 15, 688-695.
2. WINGENDER, P. Beiträge zur Lehre von den geometrischoptischen Täuschungen. *Zsch. f. Psychol.*, 1919, 82, 21-66.

TIME PERCEPTION AND RHYTHM

BY P. F. SWINDLE

Marquette School of Medicine, Milwaukee

There is either a practically complete dearth or an abundance of work on the perception of time—this depends on our viewpoint. If the expression “time perception” must be used either in the title or in the body of the paper, the interest shown for this subject appears to be accidental and almost negligible. On the other hand, if we consider that every response an organism can execute has a specific temporal attribute and that manifesting a conscious response means the perception of a characteristic and definite time— independently of whether or not this conforms with any of our physical measurements that may indicate *according to them* the duration of the response—numerous investigators have been concerned with time perception in one or another of its various forms. With this last consideration in mind, I have selected for review a small number of articles on the perception of distance, as well as the very small amount of work which is unmistakably on time perception.

The work on rhythm is small in amount, and it is similar in certain respects to the work on time perception. The term rhythm, like time perception, is very equivocal.

Kaila (6) offers a nativistic and empirical explanation of space perception. The classification of our perceptions of space into the two- and three-dimensional seems to have but little foundation. Each response, as was earlier suggested by G. E. Müller (Lotze is not mentioned in this connection), has its own spatial attribute, and its manifestation means the perception of space in a particular form or dimension. If we touch the tongue, the associated peripheral and central structures that respond are different physiologically from those which respond when the leg is similarly stimulated. The accompanying sensations are also different. If we speak of the tongue or the leg we are by this act reporting a perception of space, either two- or three-dimensional, this depending to a great extent upon the other ways we are responding at the same time. The same things can be said of the peripheral and central visual structures. The expression “local sign” means an association of a peripheral and a central set of structures. Each “substitute for the local sign” is itself a local sign; only it is one that is

acquired through experience or training (*Erfahrung*). The spatial attributes of the original and the new nervous complexes are different. Through training two or more sets of peripheral structures may be associated with one set of central ones. Therefore, under similar conditions of stimulation we may make the same estimation of distance when points at different regions of the retina are stimulated.

Kipfer (7) observed the second and third of a series of four fusion figures which were formed from eight hairs by means of the haploscope. When the component images of one of the fusion figures were not more than 0.375μ apart, *i.e.*, $\frac{1}{8}$ the diameter of a retinal cone, there was in neither case a crossed or uncrossed disparity of them; both figures appeared simple and at the same distance from the observer. When the hairs for figure No. 2 were adjusted so that crossed disparity should occur there, the subjects, who attempted to hold the eyes entirely still, made the following observations: No. 2 crossed and No. 3 simple; No. 2 crossed and No. 3 uncrossed; No. 2 simple and No. 3 uncrossed. If the eyes moved any at all, these results are exactly what one should expect. It is essentially the same as walking to the right to see one side of a house and back to the left to see the other. K. speaks, however, of this as a phenomenon of contrast and does not consider it in the simple way here indicated.

Wölflin (12) found that with the increased thickness of objects the better were they detected by blind subjects who did not actually come in contact with them; and that objects consisting of different substances were detected by the subjects at different distances. When wood was brought up close to the subject and then gradually removed it disappeared when closer to the subject than when it was brought up first from the distance; for cardboard just the reverse was the case. When the weight of a body was increased 300 per cent. the increase in the acuteness of perception for it at a distance amounted to only ca. 5-10 per cent. The acuteness of perception increased much more slowly with iron than with wood or cardboard of correspondingly increased thickness. When a double clothes line mask was placed over the head of the subject, the distance perception for an iron plate sank from 1 m. 65 cm. to 1 m. When two such iron plates were superimposed, one behind the other, they disappeared at 1 m. 10 cm.; and when a triple mask was used, this value sank to 90 cm. W. believes that radiations (*Strahlungen*) characteristic of the different substances, and perhaps quite un-

known to us yet, are emitted from the surfaces of the various objects and stimulate especially the forehead.

Carr and Hardy (2) studied the judgments of the relative amounts of motion of two lights which could be adjusted in different ways. Some of the more important results are: 1. Perceptual accuracy is a function of both relative and absolute intensity. On the one hand an inequality in the intensity of the lights is a condition for more correct judgments than is equality. On the other hand when they are equal in intensity, the greater number of correct judgments occur with the lower illumination. The degree of illumination is possibly the more effective of the two factors. 2. The amplitude of motion is not an important factor. 3. In the majority of cases, perceptual accuracy is greater for the faster rates of motion. 4. The greater perceptual efficiency was attained by fixating the stationary object. 5. When one of the lights was stationary, some individuals gave the better judgments when the moving light was fixated; the majority, however, perceived the extent of motion more accurately with stationary eyes, *i.e.*, when the moving light was perceived with indirect vision.

Frey and Meyer (3) made a detailed investigation of the means of perceiving motion of the thumb and lower arm when the angular velocities of these were slow and the amplitudes of movement small. The velocities approximated 10'/sec. The threshold for the perception of movement of the arm is invariably higher than for the thumb, the latter having the more sensitive skin. By anesthetizing the skin at the points of contact of the apparatus, the threshold for the perception of movement of the arm was increased about five to six times; and when the wrist was stimulated with a weak faradic current, the threshold was almost doubled. A strip of adhesive plaster (*Leukoplast*) measuring 4.5 cm. by 10 cm. was stuck to the fully extended arm in such a way that the middle of it was about on the olecranon. The threshold for flexion was reduced to about one half of that for extension. Flexion of the arm meant stretching the plaster and accordingly affecting a greater number of pressure organs in the skin. The authors believe the slow motion of small amplitude used in their experiments is perceived through the pressure sense only. They call attention to the possibility that even in rapid motion the kinæsthetic sensations might be of very little importance; the rapid motion results in deforming the skin more suddenly and accordingly in stimulating a greater number of pressure end-organs per unit time.

In a separate article, Frey (4) reports similar results which he obtained from a subject whose elbow had been mutilated by shrapnel, fracture of the proximal end of the ulna. Two months after an operation—when the experiment was performed—the sensibility in the joint could not be established; the deeper lying nerves had not had time to develop. The angular velocity employed was 5°/sec. instead of approximately 10°/sec., but the threshold was found to be approximately the same as that determined by Frey and Meyer (3) on normal subjects under conditions of experimentation which were otherwise the same. F. determined, also, that voluntary movements of small amplitudes of an anesthetized finger may be executed according to instructions but without being perceived by the subjects.

Werner (11) presented alternately two series of the same number of electric sparks in a slow tempo. When the sparks of only one of the series were intense, the duration of this series was underestimated relatively. When the tempo of the elements of both series was made more rapid, the duration of the series of intense sparks was overestimated relatively. W. explains these results on the assumption that when the tempo is rapid and the sparks intense the observer involuntarily and unconsciously directs his attention to the sparks primarily, while if the tempo is slow and the sparks intense the observer then has the opportunity to direct his attention to the pauses as well as the sparks. W. concludes that a series of sparks which are not too intense and which occur in a relatively slow tempo should be considered a rhythmical series and that it is perceived as such, the pauses being the unaccentuated elements. A series of alternately black and white forms, *e.g.*, squares, may or may not mean a visual rhythm to the observer; if the attention is directed primarily to the dark spaces these would be the group accents, if primarily to the white spaces they would be the group accents, and if to one as much as to the other the series would be non-rhythmical. At least three forms, two of which are identical, are necessary to arouse the rhythm consciousness. If the background is white, two black forms separated by a white one are more easily perceived as rhythmical than are two white forms separated by a black one. Two adjacent forms are never perceived as rhythmical; three is the minimum number.

Isaacs (5) reviewed a large number of articles on rhythm, and defined rhythm as the experience arising from the periodic, pendular, reflex response of characteristic organs to objective stimulation.

Visual rhythm is essentially the same as any other rhythm. Since two elements of the series cannot be coexistent, the visual rhythm is temporal in the aspect of serial stimulation. To the present writer the discussion of the refractory phase of muscles in connection with rhythmical acts is not very clear. More indefinite still is the discussion of attention as a factor in rhythmizing a series of elements. He states, "Rhythm arises from the reflex response, accent and grouping are the result of attention."

Philippe (8) describes a rhythmical series as a number of shocks or sensations separated by pauses or cadences. According to P. there are such things as semi-voluntary or even involuntary rhythms, for example, breathing, the heart beat, and some of the rhythmical movements of the skeletal muscles, but he is interested primarily in conscious rhythms of which voluntary movements are the elements. He would consider speaking as a modified form of breathing, and, as breathing can be controlled to a certain extent, the cadences in speech can be controlled also. A voluntary rhythm may be affected appreciably by an involuntary or semi-voluntary one. Reading poetry, singing, and dancing are some of the more spectacular forms of rhythmical activity. Any of these rhythms is contagious in all of the nerves and accordingly involves all parts of the mechanism.

Swindle (9) and (10) investigated rhythms of bird, reptile, crustacean, and human subjects. His results seem to justify the definition of rhythm of movement as a series of associated elements which are accentuated as regularly or irregularly as the organism has been trained to produce accents. An accent is a composite element of a series of associated, pendular movements. It indicates an unusual amount of muscular energy but not necessarily an increase in the amplitude of movement. If the initial element of a series of movements is conditioned the response runs its course unless it is inhibited by some other response, and even then it continues but as a weak response instead of a strong one. If the inhibiting response is introduced at the sixth element of a series, it becomes associated with that element and complicates it. We have then a unitary 6-group with a final accent. If the organism is stimulated in such a way at the third movement that this element is complicated by a brief response which does not inhibit the last three elements of the 6-group, a series of two 3-groups, *i.e.*, a 3-rhythm, is established. In this way we may establish a large number of 3-groups or groups of any other numerical value. The

process of modifying every third element of a dominant response of many elements is the process of modifying at the same time every third element of many other subdominant or weak responses consisting of many elements. These subdominant responses are executed simultaneously with the strong one and their natural tempos are forced to be that of the strong one. (Bock's (1) data make it clear that this statement is not inclusive enough. In reality, the subdominant responses occur not only in the same tempo as the dominant one but also in other combinations such as higher and lower "octaves" of the strong response.) This circumstance of the "forced" tempo has two important consequences. 1. Train an organism to produce a rhythm with a bodily member, and it will also produce with the same and other members rhythms of the same numerical value, but in various tempos, directions, and amplitudes of movement. 2. When the 3-rhythm is dominant or strong the 7-rhythm (and any others that the organism has learned) is present as a subdominant one, and vice versa.

Bock (1) worked with the unitary groups of human subjects. He instructed his subjects to tap with the finger on a tambour, as long as they wanted to, to rest as long as they wanted to, then to tap again, etc. He secured kymograph records of a large number of groups and pauses. He made the following very significant discoveries for which Swindle's technique was not entirely adequate: 1. "The tempi of the groups are to each other as the ratios of small integers, octaves and fifths predominating"; the same is true generally of the durations and also the numerical values of the groups. B. states, "The organism, when beating the 22 group, is simultaneously beating and simultaneously conditioning multiple groups in related durations and tempi and the same groups in related durations and tempi." Further, B. presents a "theory of integrands" which is interesting for several reasons and which the present writer feels should be read in full, since it is very much condensed as it is. It seems as if B.'s results might have far-reaching significances for theory.

REFERENCES

1. BOCK, C. W. The Neural Correlates of Instincts and Habits. *Amer. J. of Psychol.*, 1919, 30, 377-405.
2. CARR, H. A. & HARDY, M. C. Some Factors in the Perception of Relative Motion. A preliminary experiment. *Psychol. Rev.*, 1920, 27, 24-37.
3. FREY, M. & MEYER, O. B. Versuche über die Wahrnehmung geführter Bewegungen. *Zeit. f. Biol.*, 1918, 68, 301-338.

4. FREY, M. Weitere Beobachtungen über die Wahrnehmung von Bewegungen nach Gelenkresektion. *Zeit. f. Biol.*, 1919, **69**, 322-330.
5. ISAACS, E. The Nature of the Rhythm Experience. *Psychol. Rev.*, 1920, **27**, 270-297.
6. KALLA, E. Versuch einer empiristischen Erklärung der Tiefenlokalisation von Doppelbildern. *Zeit. f. Psychol.*, 1919, **82**, 129-197.
7. KIPFER, R. Ueber die Beteiligung des Kontrastes an der elementaren physiologischen Raumempfindung. *Zeit. f. Biol.*, 1918, **68**, 163-222.
8. PHILIPPE, J. Contribution à la Psychologie de nos Mouvements. *Rev. Phil.*, 1919, **88**, 78-103.
9. SWINDLE, P. F. The Peristaltic-like Nature of Organic Responses. *Amer. J. of Psychol.*, 1919, **30**, 187-210.
10. SWINDLE, P. F. Some Forms of Natural Training to Which Certain Birds are Subjected. *Amer. J. of Psychol.*, 1919, **30**, 165-172.
11. WERNER, H. Rhythmik, eine mehrwertige Gestaltenverkettung. *Zeit. f. Psychol.*, 1919, **38**, 198-218.
12. WÖLFFLIN, E. Weitere Untersuchungen über das Wesen des Fernsinns. *Zeit. f. Sinnesphysiol.*, 1919, **50**, 311-318.

GRAPHIC FUNCTIONS

BY JUNE E. DOWNEY

University of Wyoming

One of the most significant reports on mirror-writing with which the reviewer is acquainted is the recent one by Pfeifer (6). Pfeifer studied the case of an illiterate man of good intelligence who was taught to write eight words. After such instruction, when he was asked to use the left hand, he commenced writing at the right edge of the paper and produced a rapid free, well-coördinated mirror-script. The left-hand writing (adductive) which resulted when he started writing from the left edge of the paper, was slow and uncoördinated. Practice in such left-hand writing was next instituted. It was produced with effort and with a particular inhibition operating in the case of letters previously learned in writing with the right hand. After the left-hand writing of the given words was well established it was found that they could be written by the right hand, fluently in mirror-script but with difficulty in abductive script. A resumption of practice with the right hand showed inhibitions in the form of a tendency to symmetrical movements operating to such an extent as to make impossible, at least for a time, the former free rapid movements.

In an attempt to answer the question which hemisphere initiates such inhibitions some very valuable hospital observations are cited.

For example, it is found in teaching patients who are paralyzed on the right side to write with the left hand that increased awkwardness of the left hand does not accompany a greater extent of paralysis. Quite the reverse. Apparently, in total paralysis, the inhibitions are removed which would in health be initiated by the left hemisphere. There is, on the other hand, evidence of strong inhibition operating in cases of partial paralysis.

Amputation cases afford another field for observation. Learning to write with the left hand under such circumstances is not directly comparable to the acquisition of left-hand writing by the paralytic.

The observations indicate not a native incapacity of the left hand but rather an incapacity resulting from inhibitions originating from habitual use of the right hand. It is urged in conclusion that the problems of handedness need restatement.

Watson (9) in his summary of the instinctive activities of infants reports on several methods of attack of handedness, such as relative duration of suspension with right or left hand; registration on a smoked drum of relative amount of activity of the two hands; measurements of the diameter of the right and left biceps, and the length of the right and left forearms from the elbow to the second joint of the midfinger. He states "We are left without conclusions as to the problem of handedness."

A critical statement concerning various problems that center around handedness is given by Kerr (5). Dextrality is defined as the "specialized aptitude or capacity associated with the psychical phenomena of speech and reasoning which is so marked in the left brain." Three classes of functional attainment in dextrality are described: (1) "The highest development of both hands in true ambidexterity"; (2) "The ordinary development, one hand well developed in function, the other mainly accessory"; (3) "Defective functioning of both, a poor dextrality which is more an ambisinistrality and probably includes many so-called left-handed." With the small first class is associated high intellectual expressive attainments whether by hand or word. In the majority who constitute the second class right or left-handedness is an accident which does not affect mentality. The last class includes individuals whose dextrality has not developed properly and who show not merely *gaucherie* but speech defects and many degenerative stigmata. Kerr states that in cases of poor dextrality associated speech defects are common but that the evidence for direct production of speech defects through faulty training in handedness is trivial.

Barnils (3) calls attention to the unsolved problems of the hereditary elements in language. The observation of accent in the speech of a deaf-mute immediately on his recovery of hearing and the recognition of dialectical accents in pupils in a school for deaf-mutes call in question the assumption of a minimal predisposition. Other observations are cited in support of a predisposition to a verbal-motor image of a particular sort.

Hertz's (4) scholarly treatment of the historical development of certain graphic symbols is of anthropological, rather than of psychological, import.

A valuable study of graphic disturbances resulting from rapid or chronic bromide poisoning in epileptic subjects is reported by Ammann (1). A knowledge of such changes is of practical value in the detection of intoxication. A number of graphic signs of poisoning are listed and illustrated by specimens of the writing of a patient during an attack and at various stages of recovery until writing was restored to normal. Such graphic symptoms include writing-tremor, ataxic writing, vacillating and pressure-weak writing, and spatial difficulties due to loss of visual control. There results from this last cause inability to follow a line or to space words properly. Writing size fluctuates. Most patients show a decrease in writing amplitude due to the difficulty of movement and to emotional depression. On lined paper the size of writing remains normal except in cases of very severe poisoning. Errors in alignment follow the dominant mood. The author cites his observations as in complete agreement with the contention of graphologists that rising alignment is a sign of exaltation and falling alignment of emotional depression. Various graphic lapses occur in the writing of the cases studied. These graphic lapses parallel the speech disturbances. Perservative lapses are very frequent.

The general effect of oxygen deficiency upon handwriting is reported by Watson (9). At 22,000 feet legibility and alignment were seriously affected and, also, accuracy in copying words. The cuts used in illustration show also other evidences of tension not evaluated by Watson.

The growing interest in handwriting as a possible material for psychological study is evident in the increased space devoted to it in the newer textbooks. Although graphological contentions are dismissed summarily, the problem of graphic individuality is recognized.

Investigation of pedagogical problems of handwriting continues.

Since voluntary and involuntary imitation both play a part in acquisition of skill Almack (2) calls attention to the quality of the teacher's writing as influential in determining the pupil's progress. Obtaining specimens of the penmanship of about forty per cent. of the rural school teachers in Oregon, he concludes that twenty per cent. of rural teachers do not write well enough to qualify them to teach penmanship, the minimum attainment being set at quality II on the Thorndike scale.

Starch reports further results obtained in rechecking the values of the Thorndike and the Ayres writing scales. Some of the discrepancy found in ratings appears to be due to differences in the samples of writing produced by printing; to differences in groups of judges; and to differences in public opinion between today and ten years ago regarding merit in penmanship.

Supplementary work in revision of the Starch writing scale is also outlined by Starch. The twenty steps of the original scale are increased to twenty-five.

REFERENCES

1. AMMANN, R. Die Bromvergiftung und ihre Schriftstörungen. *Zsch. f. d. ges. Neur. u. Psychiat.*, 1916, **34**, 12-69.
2. ALMACK, J. C. The writing ability of teachers. *School & Soc.*, 1919, **10**, 389-390.
3. BARNILS, P. Les éléments héréditaires dans le langage. *Bull. Soc. de Biol.*, 1919, **82**, 828-829.
4. HERTZ, A. Ein Beitrag zur Entwicklung der Schrift. *Archiv f. die ges. Psychol.*, 1916-17, **36**, 359-390.
5. KERR, J. Lefthandedness and Mirrored Writing. *School Hygiene*, 1920, **11**, 39-44; 74-82.
6. PFEIFER, R. A. Beobachtungen an Rechts- und Linkshänderschrift von anscheinend weittragender Bedeutung. *Zsch. f. d. ges. Neur. u. Psychiat.*, 1919, **45**, 301-315.
7. STARCH, D. Methods in constructing handwriting scales. *School & Soc.*, 1919, **10**, 328-329.
8. STARCH, D. A Revision of the Starch Writing Scale. *School & Soc.*, 1919, **10**, 498-499.
9. WATSON, J. B. *Psychology from the Standpoint of a Behaviorist*. J. B. Lippincott Co., Phila., pp. IX + 429.

MEMORY, THOUGHT, AND LOGIC

BY W. C. RUEDIGER

George Washington University

Fernberger (1), with the aid of ten observers, subjected the process of comparing to introspective analysis. He used lifted weights, length of lines, noises, and series of grays and proceeded just as is done in quantitative experimentation, but instead of centering the attention solely upon the objective results, it was centered primarily upon the conscious processes involved. Immediately upon rendering his final judgment, an introspective description was given by the subject of everything that appeared in consciousness from the first to the final comparison. The process of comparing was found to consist essentially in the awareness of a change or persistence of an actually innervated muscular set, while the structural components consist primarily of sensations and images. The attributive pattern of the process varies to a certain extent with the material presented.

Under the title "An Experiment with an Automatic Mnemonic System," Hill (2) gives us, not an experiment on memory, but a description of an ingenious mnemonic system, devised by himself, together with pedagogical suggestions in respect to its use in a psychology class. He suggests the following values when used as a class experiment: (a) It demonstrates and then exposes a method by which some traveling lecturers on memory startle their audiences by seemingly difficult feats of memorization. (b) A right evaluation of the mnemonic principle is made possible. (c) The process gives a cue and an impetus for the study and analysis of associative processes. (d) It is productive of interest in the possibility of modifying learning processes by means of economical methods rather than by trial and error. (e) It may be made a stimulus to experimentation of a serious nature.

Whipple (6), in 45 numbered topics, develops the psychology of observation and report as a text for the Students Army Training Corps. The first six topics are introductory and deal with the importance of full and accurate information as a guide to action for the individual and especially for a group, like an army. Topics

7-19 deal with sensation and bring out the significance of sensory defects, variations in acuity, illusions, and the like. Hallucinations and the influence of expectation are treated in topics 19-23, while the next four topics deal with the nature and limitations of attention. Memory and its operation are treated in topics 27-35, when the treatment shifts naturally to testimony, collusion, and the outstanding characteristics of written reports, topics 35-44. Topic 44 deals with the factor of certainty as felt and indicated by the reporter, and topic 45 with the estimation of distances, heights, angles, number and dimensions.

Warren (5), in exemplification of the well-known fact that in old age incidents of early life are often recalled without apparently having been brought up meanwhile, reports two well authenticated cases of long latent memory. D. T. W., at the age of 90 suddenly recalled and recited in part a poem that he had learned and recited when he was about fifteen. J. R. D., at the age of 83, on the occasion of being offered an honorary degree by Dartmouth for being the oldest living alumnus, recalled and delivered his Freshman oration which had been delivered 69 years before. In both of these cases it seems clear that there had been no intermediate recall.

In discussing the syllogism and other logical forms, Shelton (3) restricts formal logic to deduction and differentiates this from induction or "methodology." He emphasizes the process of formalizing, yet does not lose sight of the fact that truth pertains to reality and is always subject to empirical verification. The syllogism, whose "object it is to formalize and verify, not to displace ordinary rough and ready argument," he recognizes as the primary form of deduction and he maintains that every argument, valid or invalid, can be expressed in the form of one or more syllogisms. When this is granted it follows that all other logical forms are but variations of the syllogism, that they imply the syllogism, and that they may be reduced to the syllogism. Of these other forms he briefly discusses three: (a) hypothetical arguments, (b) substitution of similars, and (c) arguments *a fortiori*. He shows that in each of these a universal is implied and that there could be no argument without this universal. Teachers of logic will find Shelton's discussion integrating and helpful.

Under the heading "Sixteen Logical Aphorisms," Swenson (4) divests himself of sixteen detached paragraphs which may be logical in the sense of being true but they are not logical in the sense of belonging to logic. They belong to the realm of meta-

physics and to the scholars in that field they may be left for consideration. A person not versed in recent philosophical discussion is not likely to be either enlightened or entertained by them.

REFERENCES

1. FERNBERGER, S. W. An Introspective Analysis of the Process of Comparing. *Psychol. Monog.*, 1919, 26, 161.
2. HILL, D. S. An Experiment with an Automatic Mnemonic System. *Psychol. Bull.*, 1918, 15, 99-103.
3. SHELTON, H. S. The Syllogism and Other Logical Forms. *Mind*, 1919, 28, 180-202.
4. SWENSON, D. F. Sixteen Logical Aphorisms. *J. of Phil. Psychol., &c.*, 1918, 15, 515-518.
5. WARREN, H. C. Two Cases of Long Latent Memory. *Psychol. Bull.*, 1918, 15, 207-209.
6. WHIPPLE, G. M. The Obtaining of Information: Psychology of Observation and Report. *Psychol. Bull.*, 1918, 15, 217-248.

MEMORY AND LEARNING

BY JOSEPHINE M. GLEASON

Vassar College

McDougall and Smith (4) find in the correlations between performances in certain tests support for Bergson's distinction between mechanical retention based on repetition, and "pure memory"—the memory of unique specific experiences. Tests in the recognition of ink blots following one presentation, and in the description of a picture after a few seconds' exposure gave a correlation of .53. There was a correlation of .61 between the memorizing of nonsense syllables by the learning method and the formation of a two-letter typewriting habit. But the other correlations between these four sets of data varied from $-.11$ to $.03$. The authors accordingly group the picture and blot tests as those involving "pure memory", and the others as tests which call for a memory showing the characteristics of habit formation. A fifth test, in the reproduction of the meaning of a prose passage after a single reading, may be thought—and the correlations bear this out—to have a place in each group since it gives opportunity for the reproduction verbatim of often used phrases with that of new ideas. The same article reports an experiment on "the influence of conation on the learning process." The subjects were instructed to learn certain nonsense syllables passively by repetition, and others as quickly as possible with full mental activity. Conation, incidentally, brings with it a

number of other factors—the noting of a syllable's position, for instance, or the affective reaction to it. The number of repetitions needed for complete learning was greater with the mechanical method and increased with the subjects' practice in passivity. The effects of this method, moreover, measured by re-learning and recall wore off more quickly.

Wells (6) uses reaction times and the accuracy of verbal responses as measures of the thresholds of conscious learning. His stimuli were words, paired with numbers which were duplicated on reaction keys. The pairs were shown in series, every one given a gradual exposure. The subjects were instructed to react by pressing the key corresponding to the number at hand—in the first round, as soon as the number appeared; in following series, as soon as possible after the first letter of the word had been seen. In the course of several or more rounds the words were connected with the proper responses. Wells considers that with the key responses, the initial reaction time represents the connection below consciousness; the gradually shortened reaction time, its approach to the threshold; and the anticipatory response, its presence in consciousness. In the verbal series, the false and negative responses show that the connection is subliminal; the doubtful responses, that it is just above the threshold; and the correct, certain ones mark its full establishment in consciousness. The fact that progress with the verbal responses was slower than with the key reactions, points, Wells thinks, to a partial dissociation between the two forms of connection.

Mitchell (2) offers experimental evidence against the assumption that an individual's memory span can be determined once and for all by a single day's test. He gave two sets of group tests to fifth and seventh grade children, dictating series of digits of from three to ten members to be reproduced in writing. Some trials were separated by two days, others by ten. While the average score for the group did not change in the second trial, the individual's rank in the group might: the scores of more than half of the children varied by one. The variation was greater when, instead of the usual score, the "maximum series" value was used. Mitchell concludes that although his method was not strictly that of the intelligence scale, his data indicate a need for revision in the use of the test for memory span.

Dashiell's investigation (1) of the relative merits of complete and alternate learning of two habits was under way when Pyle's

work¹ on the problem was published. Dashiell's experiments are more extensive, including maze running with children and rats, and adult tests in tracing mazes, card sorting and adding. The evidence from the animals and children in terms of the number of trials is inconclusive or slight; but in all other counts, the method which allows complete learning of the one habit before the other is attempted is the more economical.

There are three non-experimental articles. Stratton's conclusions (5) are drawn from his students' reports of their memory of unexpected crises in their experiences. They noted sometimes hypermnesia, sometimes hypomnesia, for the events experienced during excitement, but total amnesia only in instances of physical blows. A permanent retroactive hypermnesia, usually extending over not more than a day, or alternations of vivid recollections and periods of amnesia of events preceding the excitement may be the lasting emotional effects. Piéron (3) in a discussion of the psychophysics of forgetting, criticises Ebbinghaus for having blurred true forgetting with an artificial effacement through his succession of learning series. Foucault,² however, meets with the weight of the criticism: Piéron objects to the uncontrolled variations in his experimental conditions, to his equanimity over a serious disparity between his observed values and those calculated from his formula, and to a psychological inference so unparalleled in Biology as his that there is no true forgetting but only inhibition through interference. Piéron offers his own formula which gives a small disparity with experimental results, and which has the biological advantage of approximating formulae for the loss of acquired inhibitions in various species of animals. Wrinch's consideration (7) of the differentiae of memory acts is not psychological but epistemological. There may, however, be starting points for psychological investigations in her concluding definition that a memory act is an image act; that unlike an act of imagination, it is accompanied by a feeling of familiarity; and that all memory acts involving beliefs involve at least one primitive belief.

REFERENCES

1. DASHIELL, J. F. A Comparison of Complete versus Alternate Methods of Learning Two Habits. *Psychol. Rev.*, 1920, 27, 112-135.
2. MITCHELL, D. Variability in Memory Span. *J. of Educ. Psychol.*, 1919, 10, 445-457.

¹ *J. of Educ. Psychol.*, 1919, 10, 107-110.

² *Rev. Phil.*, 1918, 86, 416-434.

3. PIÉRON, H. De la détermination et de l'interprétation de la loi de l'oubli et des lois psychologiques en général. *Rev. Phil.*, 1919, 88, 104-118.
4. SMITH, M. & McDUGALL, W. Some Experiments in Learning and Retention. *Brit. J. of Psychol.*, 1920, 10, 199-209.
5. STRATTON, G. M. Retroactive Hypermnnesia and other Emotional Effects on Memory. *Psychol. Rev.*, 1919, 26, 474-486.
6. WELLS, F. L. Experiments concerning the Threshold of Conscious Learning. *Psychol. Rev.*, 1919, 26, 382-388.
7. WRINCH, D. On the Nature of Memory. *Mind*, 1920, N.S., 29, 46-61.

ATTENTION AND INTEREST

BY W. B. PILLSBURY

University of Michigan

Liddell (3) put to the test of direct registration Ferree's theory that attention waves are due to the adaptation of the part of the retina stimulated, as an explanation of the disappearance, and to the movement of the eyes as an explanation of the reappearance. He registered the eye-movements photographically by the Dodge apparatus simultaneously with the disappearances and appearances of a minimal light. The results showed no relation between the movements and the fluctuations. The waves continued while the eyes were stationary, movements during the period of no sensation did not bring back the light, and movements during the visibility period did not prevent the disappearance.

Dallenbach (2) replies to critics of his earlier work. Miss Bowman (1) shows that size is comparable with intensity as a determinant of clearness. Two Greek crosses of different sizes outlining areas of variable brightness were placed equal distances to each side of a fixation point and four observers were asked to compare the clearness as the intensity was varied. Three trained subjects found that size compensated for differences of clearness. The ratio varied from 3 : 1 to 4 : 3. For one untrained subject no compensation was apparent.

REFERENCES

1. BOWMAN, A. M. Size *vs.* Intensity as a Determinant of Attention. *Amer. J. Psychol.*, 1920, 31, 87-90.
2. DALLENBACH, K. M. Note on the Experimental Study of Attention. *Amer. J. Psychol.*, 1920, 31, 518.
3. LIDDELL, H. S. Eye-Movement during Fluctuation of Attention. *Amer. J. Psychol.*, 1920, 30, 241-252.

VALUES

BY HENRY T. MOORE

Dartmouth College

The brilliant work of Anderson (2) in the field of economics concerns the psychologist as being primarily the application of an adequate psychology of value, first to the general theory of economic value, and then to the theory of the value of money. The author of "Social Value"¹ restates the same general position in his more recent work, with insistence on two main points,—the need of an absolute concept of value for the economist, and the advantages of a social value theory as opposed to an individualistic utility theory. In the light of an economic theory based on social psychology he examines critically the significance of "ratio of exchange," "supply and demand," and "marginal utility," and attacks the problem of the nature of credit phenomena, especially in their relation to the general laws of value. Chapters I, V, and XXIII contain the more purely psychological discussion.

Three articles deal mainly with an introspective analysis of the value experience. Shand (12) in his analysis of the affective and cognitive elements in intrinsic and extrinsic value finds feeling the primary element, and intrinsic value the characteristic experience. "When we acknowledge the value of certain qualities in a cold, intellectual way, we have either realised their value emotionally in an earlier period, or we have accepted it through social suggestion." The emotions having a tendency to attribute intrinsic value to the things that excite them are joy, admiration, wonder, satisfaction, gratitude, sorrow, and pity. Of the eleven laws of value formulated in the article the following two may be cited as typical: "Whenever anything has some intrinsic value (as money), the extrinsic value which it has tends to increase its intrinsic value." "The succession of joy, sorrow, and desire about a loved object enables us to approach a truer judgment of its real and intrinsic value for us."

Picard (9) observes much the same elementary distinctions as Shand. The basis of immediate values is in feeling; that of con-

¹ For a detailed review of "Social Value" cf. the BULLETIN, 1911, VIII, 432-436.

tributory values is in cognition. Contrary to both Bush and Dewey he endeavors to show that it is not necessary to judge even when we value in a contributory fashion. Such valuation may have been the outcome of a cognitive process, such as perception or memory, without its reaching the judgment level. The mere behavioristic fact of making use of something is sufficient to establish a contributory value situation, but judgment may or may not have taken place.

Bartlett (4) traces five separate stages in the genesis of critical appreciation: (1) Simple appreciation, characterized as mere like or dislike without any reference to the past. (2) The feeling of familiarity, involving a modification of likes or dislikes according to a reference to the past, but without any separately imaged occurrence. (3) Conventional criticism, involving a reference to empirical standards. This is the outgrowth of much unanalysed experience, of many feelings of familiarity, some of which have become particularly vivid. Its references are rarely accompanied by reasons. Instead it offers emphatic assertions, generalizations, catch phrases. (4) Rational criticism, characterized by its appeal to principles founded on analytical investigation. (5) Intuitional criticism, in which the critic, having become more reliant on his own sensitiveness, ventures to express his appreciation again in a direct way, without appeal to either convention or principles.

The philosophical literature on the topic abounds in controversy and mutual misunderstanding. Bush (5) considers three very different definitions of value that have been offered respectively by Dewey, Sheldon, and Perry. Dewey's instrumentalist definition seems to him to make value synonymous with use, while Sheldon by his heroic measures to emancipate value from ego-centric difficulties has only succeeded in rendering it indistinguishable from causality. Bush inclines with Perry to reserve the term for situations involving bias or interest, and finds the ego-centric predicament not intolerable as regards valuation, because of the high degree of similarity in the affective natures of different individuals. Dewey (7) replies to the effect that Bush has misapprehended the instrumentalist theory of value in assuming that "value occurs when we face the question as to what methods are useful." Dewey himself states that the question which involves a value judgment is: What ends are desirable? Instrumentalism simply emphasizes the fact that we proceed experimentally in determining what ought to be done. It is not concerned with the technical question of how to attain a given end.

Urban (14) reaffirms as against Perry and Fisher his position regarding the value objective. He points out that Fisher, being in agreement with him as to the essential distinction between value and being, and as to the possibility of knowledge of value, becomes involved in needless inconsistency when he refuses to go further and admit his distinction between a truth judgment and a value judgment. With Perry his disagreement is more fundamental. For Perry value is merely a subjective addendum to reality, and not essential to the reality concept itself, as it is for both Urban and Fisher. Perry's relational definition of value should logically compel him to deny that there is any knowledge of value at all, "for judgment merely apprehends the facts about our interests and the relations of objects to our interests."

Schiller's (10, 11) quarrel is with the anti-pragmatists, particularly Wells. He objects vigorously to Wells' assumption that "the pragmatic fallacy" lies in confusing truth and value. Pragmatism does claim that the true is a species of the genus "value," but in this respect makes it coördinate with the good, the right, the beautiful, the pleasant. This claim has strong support in speech usage. "We no more hesitate to say that an argument is good and right, and that a piece of reasoning is beautiful, than conversely that a statue observes the true proportions, or that an enemy is false."

Despairing perhaps of finality in any philosophical controversy Costello offers an article (6) entitled "The Value of False Philosophies." The interesting paradox here presented is that although the primary business of philosophy is truth, the net result has been not truth, but value. The ideas of the great philosophers have generally been false, at least to the extent of onesidedness, but "the gaining of an insight into their vision is a priceless experience."

Katuin (8) raises the question how we arrive at an objective scale of values, such that we may say of one value that it is greater than another. And, in conformity with Dewey and Anderson, he finds the standard in the social process which the individual undergoes. For the pragmatist the seat of objectivity has come to be the social institution. The supra-individuality of the social mind is offered as the escape from subjectivism. By contrast with this position the very suggestive chapter of Adams (1) on the autonomy of values offers in the name of idealism an objectivity not far removed from the realism of Russell and Moore. Though recognizing that something in the way of feeling is always involved in

our value judgments, he dissents from the statement that the basic situation in such judgments is either interest or feeling. The worthwhile is more than the mere equivalent of the desirable, and this residue of meaning provides for the possibility of an objective good, something lodged in the environment, "at a distance from the feelings which are the immediate possessions of the organism." Esthetic values and disinterested love are cited as having contemplative aspects which place them in another psychological category than that of desire. Urging the importance of the Platonic insight as to the stability and certainty of the good, he holds "that we discover values much as we discover truths," and that the values do not depend on the organization of our interests. "Feeling is the stimulus and vehicle of our value judgments, but neither their object, nor properly speaking their source."

Shaw (13) and Blechmann (3) are concerned mainly with interpreting the function of value in life. Both find that value furnishes the key to the distinction between evolution and progress. Shaw's position approximates at many points the "purposive psychology" of Münsterberg.

REFERENCES

1. ADAMS, G. P. *Idealism and the Modern Age*. New Haven: Yale University Press, 1919. Pp. IX + 253.
2. ANDERSON, B. M., JR. *The Value of Money*. New York: Macmillan, 1917. Pp. XXVIII + 610.
3. BLECHMANN, N. *The Philosophic Function of Value*. Boston: Richard Badger, 1918. Pp. XV + 148.
4. BARTLETT, F. C. The Development of Criticism. *Proc. Aristot. Soc.*, 1918, 18, 75-100.
5. BUSH, W. T. Value and Causality. *J. of Phil., Psychol., etc.*, 1918, 15, 85-96.
6. COSTELLO, H. T. The Value of False Philosophies. *J. of Phil., Psychol., etc.*, 1919, 16, 281-290.
7. DEWEY, J. The Objects of Valuation. *J. of Phil., Psychol., etc.*, 1918, 15, 253-258.
8. KATUIN, G. A. The Ideality of Values. *J. of Phil., Psychol., etc.*, 1920, 17, 381, 386.
9. PICARD, M. The Psychological Basis of Values. *J. of Phil., Psychol., etc.*, 1920, 17, 11-20.
10. SCHILLER, F. C. S. Truth and Survival Value. *J. of Phil., Psychol., etc.*, 1918, 15, 505-515.
11. SCHILLER, F. C. S. Truth, Value, and Biology. *J. of Phil., Psychol., etc.*, 1920, 17, 38-44.
12. SHAND, A. F. Emotion and Value. *Proc. Arist. Soc.*, 1919, 19, 208-235.
13. SHAW, C. G. *The Ground and Goal of Human Life*. New York: N. Y. Univ. Press, 1919. Pp. XII + 593.
14. URBAN, W. M. Again, the Value Objective and the Value Judgment. *J. of Phil., Psychol., etc.*, 1918, 15, 393-405.

SPECIAL REVIEWS

Memory and the Learning Process. DARWIN OLIVER LYON. Baltimore: Warwick & York, 1917. Pp. 179 + 8 Pl.

Memory in common speech, Lyon reminds us, is "a gross unanalyzable term, having no claim to represent an elementary function of mental life," but standing for various independent experiences and operations. This position, familiar enough in psychology, perhaps should be repeatedly stated until it is widely recognized; but it is hard to see what contribution Lyon's development of it makes to psychological literature. If his discussion is to be much more than a list of the meanings which a term may have when loosely used; especially if it is to rank as scientific analysis, we expect, for one thing, that he will draw clean lines between the psychological aspects of memory and their possible physiological correlates. This he does not do when he apparently makes coördinate the four components into which he resolves the memory "act". He characterizes these mainly in terms of their values, but the first two are probably physiological: "with retention pure and simple the mind is not conscious that any of these knowledges exist for as soon as consciousness enters we have reproduction and representation"; and "reproduction is the process by which objects that have previously been shown . . . are brought back into consciousness for representation and use." Representation and recognition, on the other hand, seem to be more immediately in the province of psychology: representation is the "stage . . . that consists in the mind presenting to itself the objects that have previously been known"; and recognition, that in which "the object is recognized as having belonged to or been in connection with a past experience." The confusion which may come, to the reader at least, from so unfocused an analysis of memory is not lessened by Lyon's terminology, which often attributes to mind a dynamism which does not tally with psychological description, and by an apparently interchangeable use, on occasions, of such words as mind and cerebrum. The various classifications of memories, too, seem to call for specifications as to whether the subject in hand is psychological process, or physiological process or hypothesis, or, perhaps, "objects" previously known.

The experimental section of the book deals with several problems in learning. Besides summarizing the earlier work, the author reports his own experiments already published in detail in the *Columbia Univ. Psychol. Arch.* and the *J. of Educ. Psychol.* Research covering several years gives data on the relation of the length of the material to the time needed for learning it, and indirectly on the most favorable distribution of time. Lyon was his own subject, and learned his material by the "continuous" method, with complete mastery at one sitting, and the "once-per-day" method, which allows one presentation a day until complete learning. He concludes from this experiment that with meaningful material like poetry and prose, the total learning time varies directly with length of the material, except when the "continuous" method is used with passages of more than a thousand words; with digits and nonsense syllables, however, which he learned by verbal motor associations, while the "once-per-day" method gives approximately the same results as with the other material, with the "continuous" method the learning time seems to vary directly with the square of the length of the material.

Lyon's further experimentation was on the relation between quickness of learning and retention. Since his four hundred and more subjects were drawn from schools, universities, colleges, business offices, asylums, prisons, he has incidental conclusions as to the relations between these two aspects of learning and such conditions as age, sex, social position, and education. His measures of retention were three: amount reproduced of material previously learned, without new presentation; amount reproduced after one new presentation; and time for relearning the material. The subjects were free to learn the material as they chose, and to make their confidence that they knew it the criterion for complete learning. Such instructions, unfortunately, may easily make for variations in conditions which ought to be kept constant; and such introspections as subjects not specially trained can give are not to be taken too seriously as a control. So the differences in results, on the whole slight in themselves, may point to other varying conditions than those with which Lyon reckons—material, measure of retention, quickness of learning. As the results are given, both of the methods of reproduction afforded positive correlations between quickness of learning and retention, highest for prose, lowest for digits. Using relearning time as the measure, Lyon found this relation to hold for prose and poetry but not for digits. Nonsense syllables appeared to

follow the prose and poetry; single words, the digits. The averages of the results of the three methods, whatever their significance may be, showed positive correlations for all materials except digits. It is the logical material, Lyon concludes, with which quick learning will be followed by long retention.

JOSEPHINE M. GLEASON

VASSAR COLLEGE

Psychology, From the Standpoint of the Behaviorist. JOHN B. WATSON. Philadelphia: Lippincott, 1919. Pp. 430.

For the structural or functional psychologist the table of contents of this new text will reveal the absence of many topics that in the past have been regarded as fundamental. In the preface the author discusses his position and outlines the principles that guided him in the selection of his material.

Chapter I is devoted to a brief discussion of the origin and methods of behavior psychology. The goal of the study of human behavior is represented as the "ascertaining of such data and laws that, given the stimulus, psychology can predict what the response will be; or, on the other hand, given the response, it can specify the nature of the effective stimulus." The responses are classified into four groups. (1) Explicit habit responses. (2) Implicit habit responses. (3) Explicit hereditary responses. (4) Implicit hereditary responses. The ten chapters that follow are concerned with the structure, function, genesis and development of these forms of behavior. Chapter II takes up the psychological methods, of which four classes are described. (1) Observation with and without experimental control. (2) The conditioned reflex methods as applied to motor and secretion reflexes. (3) The verbal report method. (4) Methods of testing. The discussion of introspection is to be found under the verbal report method. In Chapter III, devoted to receptors and their stimuli, is given the material usually found under sensation and perception in conventional psychological texts. The modifications that occur are such as result when the emphasis is placed on the neural and behavior phenomena. The order in which the receptors and their adequate stimuli are presented is as follows: cutaneous, kinesthetic, equilibrium sense, organic sense, taste, smell, audition, vision, visual hallucination. Watson gives the material usually presented under the brain and nervous system, *after* the discussion of the sense organs.

Chapter IV includes a discussion of the elements of neuro-physiological conduction under the headings: the neuron, reflex arc, neural laws, cerebrospinal system, ganglia, conduction paths, the sympathetic nervous system. The functional relationship between the sympathetic and the cerebro-spinal system is especially well worked out. Chapter V is devoted to the organs of response. The topics are: functioning of striped muscles and reflex arcs, types of reflexes, nature and function of smooth muscles, salivary glands, pancreas, liver, kidney, thyroid, parathyroid, adrenal apparatus, pituitary apparatus, pineal gland, sex glands. The comprehensive treatment of the glands is an innovation that will be appreciated by those psychologists who regard the general metabolic constants of the individual as an important factor in the modification of behavior. The emotions are discussed in Chapter VI under hereditary responses. An emotion is defined as "an hereditary pattern-reaction involving profound changes in the bodily mechanism as a whole, but particularly of the visceral and glandular systems." The more fundamental emotions of fear, rage, love, are described in detail. The interrelation of the emotions, the methods by which they are studied, the character of the original emotional patterns, the detection of implicit emotional response, emotional diffusion and consolidation, conflict and finally the rôle of emotion in daily life, are some of the topics that will strongly appeal to all psychologists whatever their systematic interest may be. The second group of hereditary responses are described under the heading of instinct in Chapter VII. The author differentiates instinct from emotion by regarding the radius of action in an emotion as lying within the individual's organism, while in instinct the radius of action is restricted to some specific form of adjustment. A classification of the human instincts is not regarded as serviceable because of the rapidity with which the pattern-reactions are modified by habit. Nursing, grasping, right- and left-handedness, defensive movements, eye-coördination, crawling, positive and negative reaction tendencies, are given detailed consideration while those instincts commonly asserted as being human, such as acquisition and possession, hunting, collecting and hoarding, habitation, migration, fighting, maternal instincts, gregariousness, imitation, manipulation, play, are described without an attempt at a rigorous analysis of the adequate stimuli for these instincts. The rôle of instinct is regarded as primarily that of initiating the process of learning.

Passing from inherited to acquired behavior, Chapter VIII

describes the genesis and retention of explicit bodily habits. After an account of the nature and development of such habits as eye-hand coördinations, reaching, learning to shoot, there is a discussion of some of the complications in habit formation under the topics, cross-education, transfer of training, habit fixation. On the neural side are found such headings as, short-circuiting in the central nervous system, the determiners of action, practice effects. Memory is linked up with practice. In the author's words, "Memory is a general term to express the fact that after a period of no practice in certain habits—explicit bodily habits, explicit word habits, implicit word habits—the function is not lost but is retained as part of the individual's organization, although it may, through disuse, have suffered greater or less impairment." The implicit and explicit *language* habits are regarded as being so important that all of Chapter IX is devoted to them. After a detailed description of the speech mechanism, of the way in which explicit language habits are formed, of the gradual transition from explicit to implicit language, Watson derives his conception of the nature of the thought process. Thought and thinking are regarded as implicit language functions which are conditioned by the same neural principles as any form of overt behavior. A separate mental or psychical factor is not regarded as essential. In Chapter X those factors affecting the efficiency of the organism are described. The effect of fatigue, the curve of work, subvocal arithmetical functions, exercise of manual functions, the effects of drugs, climate, relative efficiency of both sexes, the factors affecting the acquisition of habits, indicate the character of the discussion. The concluding Chapter XI is devoted to personality and its disturbances. The reader who expects to find under this heading the traditional discussion of *the self* will need to content himself with such topics as, general level of behavior, general survey of emotional equipment, instinctive and emotional attitude, general habits of work, activity level, social adaptability, recreation and sports, organized sex life, reactions to conventional standards, personal bias and peculiarities, balancing factors. The character of the discussion is best foreshadowed in the author's words. "Our personality is the result of what we start with and what we have lived through."

In the reviewer's opinion the outstanding differences between Watson's new book and other text-books in psychology that have appeared within the last few years lies in: (1) An objectification of the important factors in the individual that traditional psychology

describes as *subjective*. This involves more than a mere change in terminology. The change implies that there are no psychological laws in the sense that so-called psychical phenomena are in some way non-neural. For Watson there is no mind-body problem. The study of man in all his varied activities, from the simplest reflex movements to the class of activities that may be described as creative thinking, are to be regarded as functions of the sensorimotor system. (2) A redistribution of the emphasis of the traditional psychological topics so that the social significance of action is placed into more prominent relief. Human behavior is not only a phenomenon that is characteristic of the individual. It also establishes his position within a cultural group.

The illustrations, especially those dealing with anatomy, are excellent. Binding, printing and paper are also up to date. The style, as might be expected from the author's other contributions, is forceful and clear. For those who use the table of contents a more detailed classification would be appreciated. The organization of the material is a practical one so far as class use is concerned, though the author might more frequently have used classical experiments as illustrative material. This is done in some chapters and helps the instructor who uses the book in connection with laboratory work to use the equipment he already has. While the author objects to the use of simplified diagrams of neural functions and regards brain pictures, or mechanical neural schema that compare the action of the central nervous system with a series of pipes and valves as lazy substitutes for a thorough study of the function itself, it is questionable whether even with the author's detailed chapters on the nervous system and the organs of response, the student who has not had the equivalent of at least two years of biological work will have a clear theory of neural function. The reviewer does not see why such diagrams as those used by Max F. Meyer or Knight Dunlap should be any more objectionable than the diagrammatic mechanical representations of wave form, atoms, molecules, vector quantities or wiring diagrams, that have contributed so much to the development of physical theory.

The treatment of emotion is especially clear cut, and the experiments with infants that are reported are a real contribution. The emphasis that is placed on the speech reaction ought to have a great influence in removing the spontaneous and mystic element that is usually associated with the process of introspection. The reviewer has used the text in his course in experimental psychology.

It has proved very satisfactory even though not designed for this purpose. As an elementary text it will require a teacher well trained in biology and with a tolerant attitude toward the point of view that the book represents. There is a tendency at the present time for many psychologists to stress the behavioristic aspect of psychology. In a recent book a writer describes his point of view as a combination of structuralism and behaviorism. Such a statement indicates quite clearly that neither the term structuralism or behaviorism is clearly understood. A combination of mechanism and vitalism would better describe such a compromise. This confusion is rather general and it is hoped that Professor Watson's new text will help clear up this confusion and also demonstrate that behaviorism is not merely the response side of psychology.

A. P. WEISS

OHIO STATE UNIVERSITY

STATISTICS OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION IN 1920

BY EDWIN G. BORING, SECRETARY

Clark University

Personal information returned by members of the American Psychological Association to their Secretary and printed in the Year Book of the Association afford an indication of the status of psychology in America. The Secretary has therefore compiled tables from the information printed in the 1920 Year Book. These data, it is true, are not exact since some members do not make complete returns and many allow information to stand after it has ceased to be correct. In general members keep data on academic rank up to date. The reports of degrees conferred have never, however, been complete, and the reports of the dates of these degrees are even less so. A great variety of fields of research is reported. The Secretary believes that the tendency for members to add new research topics which they have entered upon is greater than the tendency for them to withdraw older topics which they are no longer actively pursuing. It is also probable that the respectability of research is great enough to lead at times to a report of a field of research when there exists little more than the desire to undertake it. Nevertheless the Secretary believes that the analytical tables do constitute a picture of the status of American psychology in 1920.

Tables I-III show, by geographical distribution, the number of persons giving instruction in the various subjects of instruction. A person reporting more than one subject has been fractionated equally among the different columns. The geographical sections are those of the United States Census: *New England*: Maine, N. H., Vt., Mass., R. I., Ct.; *Middle Atlantic*: N. Y., N. J., Pa.; *Northeast Central*: Mich., Wis., Ohio, Ind., Ill.; *Northwest Central*: Minn., Iowa, Mo., N. Dak., S. Dak., Nebr., Kans.; *South Atlantic*: Del., Md., D. C., W. Va., Va., N. C., S. C., Ga., Fla.; *Southeast Central*: Ky., Tenn., Miss., Ala.; *Southwest Central*: Ark., La., Okla., Texas; *Mountain*: Mont., Wyo., Idaho, Colo., Utah, Nev., N. Mex., Ariz.; *Pacific*: Wash., Oregon, Calif. The term *Psychology* includes all

special psychologies except applied. *Applied Psychology* includes all forms of application, including educational psychology. *Education* includes experimental education, hygiene, school administration, etc. *Philosophy* is logic, metaphysics, ethics, history of philosophy, etc. All other subjects are listed as *Miscellaneous*. *No Instruction* covers the cases where no report is made in the Year Book for this item.

TABLE I
SUBJECT OF INSTRUCTION, 332 MEN
Number of Men Giving Instruction in Subjects Listed

	Psy- chology	Applied Psy- chology	Educa- tion	Philos- ophy	Miscel- laneous	No Instruc- tion	Total
New England.	23.7	2.5	7.3	9.3	3.0	10	56
Middle Atlantic.	36.7	13.0	16.5	18.2	4.5	18	107
N. E. Central.	34.0	4.3	6.7	10.0	1.7	11	68
N. W. Central.	16.7	8.7	4.0	4.0	0.5	2	36
South Atlantic.	10.2	2.5	2.7	2.7	1.7	6	26
S. E. Central.	1.7	0.5	1.2	0.7	.....	2	6
S. W. Central.	5.0	1.0	.....	1.0	.....	1	8
Mountain.	5.0	1.5	0.5	1.0	.....	1	9
Pacific.	7.2	5.2	1.3	0.3	1.0	.....	15
Europe. . . . .	.....	.....	.....	.....	.....	1	1
Total.	140.5	39.2	40.5	47.2	12.7	52	332

TABLE II
SUBJECT OF INSTRUCTION, 61 WOMEN
Number of Women Giving Instruction in Subjects Listed

	Psy- chology	Applied Psy- chology	Educa- tion	Philos- ophy	Miscel- laneous	No Instruc- tion	Total
New England.	2.0	.....	1.5	1.5	.....	6	11
Middle Atlantic.	12.0	2.5	1.5	0.5	0.5	4	21
N. E. Central.	2.0	1.0	.....	.....	.....	8	11
N. W. Central.	6.0	.....	.....	.....	.....	1	7
South Atlantic.	1.3	0.7	0.7	0.3	.....	1	4
S. E. Central.	0.3	.....	0.3	0.3	.....	.....	1
S. W. Central. . . . .	.....	.....	.....	.....	.....	.....	0
Mountain.	0.5	.....	.....	0.5	.....	1	2
Pacific.	3.0	.....	.....	.....	.....	.....	3
Europe. . . . .	.....	.....	.....	.....	.....	1	1
Total.	27.2	4.2	4.0	3.2	0.5	22	61

Table III, in addition to the totals for men and women, gives, in the last column, the number of psychologists in each geographical section for every million population (Census of 1920, preliminary

TABLE III

SUBJECT OF INSTRUCTION, 393 MEN AND WOMEN
 Number of Persons Giving Instruction in Subjects Listed

	Psy- chology	Applied Psy- chology	Educa- tion	Philoso- phy	Miscel- laneous	No Instruc- tion	Total	Psycholo- gists per 1,000,000 Population
New England.....	25.7	2.5	8.7	10.7	3.0	16	67	9.05
Middle Atlantic.....	48.7	15.5	18.0	18.7	5.0	22	128	5.75
N. E. Central.....	36.0	5.3	6.7	10.0	1.7	19	79	3.68
N. W. Central.....	22.7	8.7	4.0	4.0	0.5	3	43	3.43
South Atlantic.....	11.5	3.2	3.5	3.0	1.7	7	30	2.14
S. E. Central.....	2.0	0.5	1.5	1.0	.....	2	7	0.79
S. W. Central.....	5.0	1.0	.....	1.0	.....	1	8	0.78
Mountain.....	5.5	1.5	0.5	1.5	.....	2	11	3.28
Pacific.....	10.2	5.2	1.3	0.3	1.0	.....	18	3.23
Europe.....	.....	.....	.....	.....	.....	2	2	.....
Total.....	167.7	43.3	44.5	50.3	13.2	74	393	.....

report in daily press). In the continental United States, exclusive of Alaska, there are 3.70 psychologists per million population.

Tables IV-VI show fields of research reported from the geographical sections named in Tables I-III. Classification is difficult to make because of the variety of terms used. When one person reported more than one field of research, the different fields were counted equally. Thus two research interests were scored each $1/2$; three fields of research, each $1/3$; four fields, each $1/4$. It was not necessary to consider any one person as doing research in more than four different fields. The fractions are entered in the table in decimals for the sake of convenience, but the totals have been arrived at accurately by the use of exact fractions. The classes may be explicated as follows: *Philosophy*: logic, ethics, metaphysics, values, etc. *Aesthetics*: whenever the term is used. *Anthropology* includes anthropometry. *Education* includes experimental education and hygiene, but not educational tests. *Physiology and Neurology*: whenever these terms are used. *Psychiatry* includes psychoanalysis. *General Psychology* includes unqualified reports of psychology as a field of research, and a few special fields such as religious psychology, genetic psychology, analytic psychology, and synthetic psychology, which are too infrequent to be listed separately. *Abnormal Psychology* includes the definite use of this term, and all other topics that would presumably come under it (e.g., dreams, complexes) except psychiatry, psychopathology, psychoanalysis, and clinical psychology. *Psychopathology*: whenever the

TABLE IV
FIELD OF RESEARCH, 332 MEN
Number of Men Reporting the Fields of Research Listed

	Philosophy	Aesthetics	Anthropology	Education	Physiology and Neurology	Psychiatry	Psychology												Miscellaneous	No Research	Total		
							General	Abnormal	Psychopathol.	Applied	Tests	Statistics	Industrial	Clinical	Educational	Social	Animal	Experimental				Theoretical	
New England.....	3.5	.....	.....	2.0	1.2	.....	1.5	1.2	2.5	2.7	5.7	.....	1.5	0.3	3.3	0.3	2.3	13.7	7.3	0.5	6	56
Middle Atlantic.....	5.0	0.5	1.3	4.3	1.5	2.5	1.5	1.7	.....	3.6	12.5	0.5	3.0	2.7	10.6	2.6	1.7	19.7	12.6	2.0	17	107
N. E. Central.....	3.3	0.3	.....	2.0	1.0	.....	1.0	1.7	.....	1.7	9.1	.....	2.1	3.1	8.7	1.0	1.7	10.6	8.5	1.0	11	68
N. W. Central.....	1.0	.....	0.2	0.5	.....	.....	2.5	.....	.....	0.5	4.6	.....	.....	2.0	7.7	1.3	1.7	9.5	2.2	.....	2	36
South Atlantic.....	1.0	.....	1.0	0.5	.....	.....	0.5	.....	4.0	.....	2.0	.....	0.3	0.5	2.7	.....	2.7	3.0	2.5	1.0	4	26
S. E. Central.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	0.7	.....	.....	.....	0.7	.....	0.3	0.7	.....	.....	2	6
S. W. Central.....	0.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.5	.....	.....	0.3	0.7	0.3	1.0	4.2	0.3	.....	8	.....
Mountain.....	.....	.....	.....	0.5	.....	.....	.....	.....	.....	.....	1.0	.....	.....	0.5	1.3	0.3	0.3	2.7	1.0	.....	1	9
Pacific.....	.....	.....	.....	1.0	.....	.....	.....	.....	.....	0.2	3.2	0.2	.....	0.6	2.0	.....	2.0	2.5	1.5	0.5	1	15
Europe.....	0.5	0.5	1
Total.....	14.3	0.7	2.6	10.7	3.6	2.5	7.0	4.9	6.5	10.3	39.4	1.2	6.9	10.3	38.4	6.1	14.0	67.1	35.9	5.0	44	332	

TABLE V
FIELD OF RESEARCH, 61 WOMEN
Number of Women Reporting the Fields of Research Listed

	Philosophy	Aesthetics	Education	Physiology and Neurology	Psychology									No Research	Total	
					General	Abnormal	Psychopathol.	Applied	Tests	Industrial	Clinical	Educational	Animal	Experimental	Theoretical	
New England	1.0	...	1.0	...	1.7	...	...	...	2.0	...	1.5	...	...	1.5	1.0	3
Middle Atlantic	0.5	1.0	1.3	...	...	...	...	...	4.0	...	0.7	2.2	1.0	5.7	0.5	2
N. E. Central . . . . .	...	...	...	...	...	1.3	...	0.3	4.0	0.5	0.5	1.0	0.5	1.7	...	1
N. W. Central . . . . .	...	...	...	...	...	...	...	...	2.5	...	0.5	0.5	...	2.0	...	2
South Atlantic . . . . .	...	...	...	0.5	...	0.5	...	...	1.0	...	...	0.5	...	0.5	...	1
S. E. Central . . . . .	...	...	...	...	...	...	...	...	...	...	...	0.5	...	...	...	4
S. W. Central . . . . .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Mountain . . . . .	...	...	...	...	...	1.0	...	...	0.5	...	...	...	...	0.5	...	0
Pacific . . . . .	...	...	...	...	...	...	...	...	0.5	...	0.5	0.5	...	1.5	...	2
Europe . . . . .	...	...	...	...	...	...	...	0.3	0.3	...	...	0.3	...	0.3	...	3
Total	1.5	1.0	2.3	0.5	1.7	2.3	0.5	0.3	14.7	0.5	3.3	5.5	1.5	14.5	1.5	9
																61

term is used. *Applied Psychology* includes all applications not listed elsewhere (e.g., advertising). *Tests* includes mental tests, educational tests, industrial tests, and a few mentions of individual psychology. *Statistics* includes a few cases of mental measurement and one case of psychophysics. *Industrial Psychology* includes personnel, but not industrial tests. *Clinical Psychology* includes feeble-mindedness and delinquency, but not intelligence tests. *Educational Psychology* includes a few cases of child psychology which were not numerous enough for separate mention. *Social Psychology* includes racial psychology. *Animal Psychology* includes animal behavior and comparative psychology; the term comparative psychology seems to be used in the Year Book only for infra-human material. *Experimental Psychology* is usually reported as such, but special experimental interests (e.g., optics, affection) are included under it. *Theoretical Psychology* includes systematic psychology and the history of psychology. All other fields of research are listed under *Miscellaneous*. *No Research* means that there is no report of any research interest.

TABLE VII
ACADEMIC RANK, 393 MEN AND WOMEN
Number of Persons in Various Classes of Academic Status

	Presi- dents	Profes- sors	Assoc. and Asst. Profes- sors	Instruc- tors and Assist- ants	Other Collegi- ate Status	Non-col- legiate Academic Status	Non- academic Status	Profes- sional Status Not Given	Total
Men	12	162	60	28	1	13	40	16	332
Women . . .	0	11	6	14	2	4	12	12	61
Total . . .	12	173	66	42	3	17	52	28	393

Table VII gives the academic status of men and women. The geographical subdivision of this table seems to add no data of interest and is not given. As *Presidents* are listed university and college presidents. *Associate and Assistant Professors* include also adjunct professors. *Instructors and Assistants* include also lecturers, associates, research associates, and research assistants. All other persons having definite status in a university or college are listed under *Other Collegiate Status*. Persons engaged in teaching in high schools, normal schools, or other institutions not universities or colleges, are recorded as of *Non-collegiate Academic Status*. Other persons are of *Non-academic Status* or do not report their profes-

sional status. The Secretary has been unable to resolve the inconsistency that appears when persons reporting no teaching status nevertheless return a subject of instruction.

TABLE VIII
ACADEMIC DEGREES, 393 MEN AND WOMEN
Number of Persons Holding Each Degree

Degree	Men	Women	Total	Degree	Men	Women	Total
Ph.D.	290	55	345	Ph.M.	3	0	3
A.B.	231	42	273	B.L.	2	0	2
A.M.	182	26	208	D.D.	2	0	2
B.S.	35	6	41	M.E.	2	0	2
LL.D.	29	3	32	Pd.D.	2	0	2
M.D.	28	1	29	B.Ed.	0	1	1
Ph.B.	16	4	20	Ch.B.	1	0	1
M.S.	13	1	14	D.C.L.	1	0	1
B.D.	13	0	13	Litt.B.	1	0	1
D.Sc.	10	2	12	M.Di.	1	0	1
Litt.D.	3	1	4	M.C.	1	0	1
L.C.B.	4	0	4	M.L.A.	1	0	1
L.H.D.	3	0	3	M.S.D.	1	0	1
Litt.B.	3	0	3	Pe.B.	1	0	1
Pd.M.	3	0	3				

Table VIII gives the number of persons holding various academic degrees. When the same degree has been conferred more than once on the same person, only a single instance is counted. There are no cases in which the Ph.D. has been conferred more than once on the same person. The A.B., the A.M., the D.Sc., and the D.D. have sometimes been conferred twice. The LL.D. has been conferred twice on eight persons, three times on three persons, and four times on two persons. All degrees have been kept separate in the table except that B.A. has been listed with A.B., M.A. with A.M., Sc.D. with D.Sc., S.B. and B.Sc. with B.S., B.Litt. with Litt.B., and D.Phil. with Ph.D.

TABLE IX
DATE OF PH.D.
299 Degrees of which Date is Recorded

1875-1879	1880-1884	1885-1889	1890-1894	1895-1899	1900-1904	1905-1910	1911-1914	1915-1919
1	1	3	19	37	38	61	69	70

Table IX gives the date of the conferring of the Ph.D., which is the most representative professional degree for psychologists. The date of conferring is reported in only 299 cases of the 345 Ph.D.'s reported. One Ph.D. in 1920 is omitted.

BOOKS RECEIVED

- GRUENDER, H. *Experimental Psychology*. Chicago: Loyola Univ. Press, 1920. Pp. 295. \$1.50.
- CORIAT, I. H. *The Hysteria of Lady Macbeth*. New York: Moffat, Yard and Co., 1912. Pp. 94.
- COEN, AUGUSTO MARIO. *L'Estetica Sperimentale*. Roma: Maglione and Strini, 1920. Pp. 63.
- Revista de Educacion Nacional*. Santiago de Chile: Asociacion de Educacion Nacional, 1920. Vol. XVI, Nos. 1 and 2.
- GENTILE GIOVANNI. *Discorsi de Religione*. Firenze: Vallecchi, 1920. Pp. 136.
- ANGELL, J. R. The Development of Research in the United States. *Reprint and Circular Series of the National Research Council*, No. 6. Pp. 19.
- University of Buffalo Studies*, Vol. 1, No. 2. June, 1920.
- Bull. of the Mass. Commission on Mental Diseases*, July, 1919.
- WHEELER, R. H. The Synaesthesia of a Blind Subject. *Univ. of Ore. Publs.* Vol. 1, No. 5. May, 1920. Pp. 61.
- WALLIN, J. E. W. Psycho-Educational Clinic and Special Schools. *Report of the Superintendent of Instruction, St. Louis, Mo. Public Schools*, 1918-1919. Pp. 68-121.

NOTES AND NEWS

DR. JAMES H. HYSLOP died on June 17th, at the age of 66 years. For some years Dr. Hyslop has been director and secretary of the American Society for Psychical Research. He has been professor of philosophy, ethics and psychology successively at Smith College, Bucknell University and Columbia University.

DR. ETHEL BOWMAN has been made Associate Professor of Psychology at Goucher College.

DR. GILBERT J. RICH has left Drake University to accept an instructorship in psychology at the University of Pittsburgh.

DR. HORACE B. ENGLISH has been made assistant professor of psychology at Wellesley College.

DR. MARTIN L. REYMERT has left the University of Iowa to return to Norway.

WE are pleased to announce the appearance of a new Italian journal for psychology, *Archivio Italiano di Psicologia*, edited by Professors F. Kiesow and A. Gemelli, with Professors V. Benuzzi, L. Botti, C. Colucci, S. de Sanctis, E. Morselli, and M. Ponzo as collaborators. The *Archivio* is published from the Institute of Experimental Psychology, of the University of Turin, and the subscription price is L. 40.

THE following items have been taken from the Press:

DR. BUFORD J. JOHNSON has been appointed associate professor of psychology at Johns Hopkins University.

PROFESSOR C. LLOYD MORGAN has resigned as vice-chancellor of Bristol University and has been appointed emeritus professor of psychology and ethics.

DR. DANIEL STARCH, of the University of Wisconsin, has become associate professor of psychology in the school of business administration at Harvard University.

DR. JOHN T. METCALF, psychological examiner with the Illinois Department of Public Welfare, has been appointed assistant professor of psychology in George Washington University.

THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

A THEORY OF PERSONALITY BASED MAINLY ON PSYCHIATRIC EXPERIENCE

BY AARON J. ROSANOFF

Kings Park State Hospital

In recent years a good deal of interest in the subject of personality has arisen among psychiatrists and considerable literature dealing with it has accumulated. To-day the subject is held to be one of fundamental importance; yet, as far as I am aware, no attempt has been made to bring together and correlate the data concerning it which are now available.

It seems to me that the time is ripe for doing this; *i.e.*, that there is now enough material to make possible the formulation of a theory which would endeavor to explain observed facts, raise specific questions, and stimulate and direct further investigation. To do this is the object of this communication.

The term *personality* has been used in different senses. Here it will be used to designate the inborn psychic capacities, traits, and tendencies of individuals. It is, however, in the nature of things that our preoccupation will be perforce more with elements of personality than with personality as a complex.

ABNORMAL TYPES OF PERSONALITY

In psychiatry the starting points for studies of personality have been, naturally, the constitutional neuroses and psychoses; and so the more clearly defined types came to be, (1) antisocial, (2) cyclothymic, (3) autistic, and (4) epileptic personalities.

Antisocial personality, in this connection, is the constitutional basis which underlies hysterical manifestations, malingering, pathological lying and swindling, and some criminal careers. The

essence of it is the predominance of illicit selfish motivations in the behavior of the individual combined with more or less pronounced lack of compunction (1, 2, 3, 4, 5).

Cyclothymic personality is the constitutional basis on which manic-depressive psychoses develop. Kraepelin (6) distinguishes four principal varieties: (a) manic make-up, (b) depressive make-up, (c) irascible make-up, and (d) emotional instability.

Referring to the manic make-up Kraepelin states: "They acquire, as a rule, but scant education, with gaps and unevenness, as they show no perseverance in their studies, are disinclined to make an effort, are distractible in an unusual degree, and seek all sorts of ways to escape from the constraint of a systematic mental culture, in order to carry on instead all possible rapidly changing secondary activities.—The emotional tone of these patients is persistently elated, care-free, self-confident.—Toward others they are overbearing, arbitrary, impatient, insolent, defiant.—They are given for the most part to jests, including self-ridicule, chatting, pastimes, and all manner of pranks. Now and then, however, appear transient moods of anxiety or sadness.—They are approachable, communicative, adapt themselves readily to new situations, but quickly begin to long again for a change.—They are fond of picturesque, showy dress, wear a fez; or neglect their appearance, run around bedraggled and dirty. Their conversation is quick and animated; they talk readily and abundantly, are quick at repartee, never hesitate for an answer, even though the answer might be but a threadbare pretense.—Their writings are verbose, prolix, pompous, full of personal remarks, forced witticisms, offensive invectives.—Many patients join, with quickly weakening zeal, newly appearing movements, become enthusiastic vegetarians, anti-vaccinationists, anti-semites, sportsmen, bathe in wintry cold; others develop into mountebanks, professional buffoons, town characters.—Characteristic for some cases is a planlessness of procedure which shows plainly how little the internal pressure of activity is directed by rational deliberation.—With their environment these patients are often in constant conflict. They mix into everything, overstep their prerogatives, make unauthorized arrangements.—As they prove themselves everywhere useless, these patients generally fall into economic ruin. When their means are exhausted they begin to borrow, manage by means of promissory notes, commit stock-corporation frauds, swindle. Their great hopes for the future, an almost finished invention, hint of an appointment,

acquaintanceship with persons of high position, the prospect of a rich marriage, an assumed title, are made to serve to raise their credit.—The mildest forms of this disturbance lead us toward certain make-ups of personality which are in the domain of the normal. Here we deal with brilliant but unevenly endowed individuals with artistic inclinations. They delight us with their nimbleness of spirit, their versatility, their multiplicity of ideas, their alert open-mindedness and spirit of enterprise, their artistic ability, their kind-heartedness, their gay, sunny disposition.”

Concerning the depressive make-up Kraepelin states: “There exists in these patients from youth a special sensitiveness to the cares, troubles, and disappointments of life. They take all things hard and feel the little unpleasantnesses in every occurrence much more strongly than the elevating and gratifying aspects of unconcerned and happy enjoyment, of unreserved surrender to the future.—Every task stands before them like a mountain; life, all activity is a burden which they usually bear with conscientious self-denial and without the compensation of the pleasure of living, the joy of creating.—They despair at every task, readily become anxious and despondent, feel they are useless in the world, unfit for anything, nervous, ill, fear an attack of some severe disease, especially a mental disease or a brain disease.—They lack self-confidence, decision, seek the advice of others on the slightest occasions.—Owing to their timidity these patients never come to a quick decision. They spend endless time in weighing and considering without accomplishing anything.—Many patients play constantly with suicidal thoughts and are always prepared to give up their life at the next occasion.—Often these patients are harassed by all sorts of nervous troubles. They feel tired, broken up, complain of giddiness and dull pressure in the head, unpleasant sensations in various parts of the body, oppressions, palpitations, tremblings, pulsations, twitchings, vibrations.—The stomach often presents the manifestations of nervous dyspepsia.—Of the greatest significance is the fact that the fundamental state of depression can be quite suddenly interrupted by manic attacks, that it is, indeed, not infrequently the basis on which the clinical picture of ‘periodic mania’ develops. Even more frequently occurs the alternation of manic and depressive attacks.”

Turning to Kraepelin’s description of the irascible make-up, we find: “These patients show from youth an extraordinarily fluctuating emotional equilibrium and are strongly affected by all experiences, often in an unpleasant way.—They are easily offended, hot-

headed, and on trivial occasions become enraged and give way to boundless outbursts of anger.—It comes then to violent scenes with scolding, yelling, and tendency to assaults. One patient in such a fit of rage threw a whole pile of plates on the floor, hurled the burning lamp at her husband, then tried to attack him with the shears.—The emotional coloring is subject to various changes. Ordinarily the patients are, perhaps, serene, self-assertive, ill-controlled; periods, however, intervene, in which they are cross and sullen, also perhaps unhappy, dejected, anxious, cry without cause, express suicidal thoughts, make hypochondriacal complaints, and go to bed.”

Finally, the make-up characterized by emotional instability is described as follows: “It is seen in those persons who constantly swing back and forth between the two opposite poles of emotion, now ‘shouting with joy to heaven,’ now ‘grieved to death.’ To-day lively, sparkling, radiant, full of the joy of life, enterprise, and action, they meet us after a while depressed, listless, dejected, feeling the need of rest, only to show again several months later the former liveliness and elasticity.”

Autistic personality is the constitutional basis on which dementia præcox or schizophrenic psychoses develop. Of this, too, there are a number of varieties which find their clearest manifestations in the clinical groups of dementia præcox. The latter are sufficiently familiar and require no detailed mention here.

Perhaps the most fundamental trait of autistic personality in general is narrowing or reduction of external interests and contacts and preoccupation with inward ruminations. Probably every schizophrenic manifestation is related to this fundamental trait.

To quote Kraepelin again (7): “It was mentioned with very special frequency, particularly in the male sex, that children were mostly concerned who always exhibited a quiet, shy, retiring disposition, made no friendships, lived only for themselves.—Then a smaller group of children, mostly boys, is noticeable, who from childhood up were lazy and restless, disliked work, were inclined to nasty tricks, did not persevere anywhere, and then became vagrants or criminals. Somewhat in contrast to these are those patients, likewise belonging rather more to the male sex, who were conspicuous by docility, good nature, anxious conscientiousness and diligence, and as patterns of goodness held themselves aloof from all childish naughtiness.”

August Hoch’s (8) description is very illuminating: “Persons

who do not have a natural tendency to be open and to get into contact with the environment, who are reticent, seclusive, who cannot adapt themselves to situations, who are hard to influence, often sensitive and stubborn, but the latter more in a passive than an active way. They show little interest in what goes on, often do not participate in the pleasures, cares, and pursuits of those about them; although often sensitive they do not let others know what their conflicts are; they do not unburden their minds, are shy, and have a tendency to live in a world of fancies."

Epileptic personality has not been so well defined in mental terms, *i.e.*, it has not been so sharply distinguished from so-called normal personalities. In practice there is no difficulty in identifying it, at least in the cases in which it is accompanied by the ordinary manifestations of epilepsy. It is possible to distinguish *periodic alterations of mood and consciousness* and, less clearly, *permanent characteristics*.

Such psychic phenomena as aura, loss of consciousness, post-epileptic stupor, delirium, automatism require no description here, as they are well known.

Spratling speaks of transitory periodic irritability (9): "Among the scores of cases I have been privileged to see almost daily for years, I have learned to detect with almost unfailing certainty—through noting temperamental changes alone the moment the patient enters the room and begins to speak—the approach of a convulsion a few hours or even days in advance of the convulsive period. An almost imperceptible change in personality has been wrought. The patient is querulous, fussy, fault-finding, nothing goes right; trifles that ordinarily produce no effect on him now completely engage his attention. His friends ignore him, his family is indifferent to his needs and his condition, his fellow patients are no longer congenial, their attacks disturb him, he cannot endure their jocose remarks, distorting them into expressions of ridicule. Finally these ideas may persist in their growth, looming up larger and larger on the horizon of a morbidly heated mind, until they pass into qualified delusions, all being dependent upon the subtle, pernicious, autocratic influence of the approaching attack, and all completely disappearing, as if by magic, after the attack is over. In some cases, as we have stated, these ill-humor periods begin a day or so only before the fit, in others they come on weeks before, while in still other rare instances they come and go, without the occurrence of a seizure, being, as it were, a long-drawn-out, silently discharging seizure—a fit without a climax."

Of greater interest are the peculiar brief periods of inspiration, avalanche of ideas, and mood of ecstasy. These are familiar to all students of epilepsy, but the best descriptions of them are those based on the subjective experience. Dostoyevsky (10) writes: "There are moments—and it is only a matter of five or six seconds—when you suddenly feel the presence of the eternal harmony. This phenomenon is neither terrestrial nor celestial, but it is an indescribable something, which man, in his mortal body, can scarcely endure—he must either undergo a physical transformation or die. It is a clear and indisputable feeling: all at once, you feel as though you were placed in contact with the whole of nature, and you say, 'Yes! this is true.' When God created the world, He said, at the end of every day of creation, 'Yes! this is true! this is good!'—And it is not tenderness, nor yet joy. You do not forgive anything, because there is nothing to forgive. Neither do you love—oh! this feeling is higher than love! The terrible thing is the frightful clearness with which it manifests itself, and the rapture with which it fills you. If this state were to last more than five seconds, the soul could not endure it, and would have to disappear. During these five seconds, I live a whole human existence, and for that I would give my whole life and not think I was paying too dearly." Somewhat similarly, Flaubert states: "I have sometimes felt in the space of a minute a million thoughts, images, and combinations of all kinds throwing themselves into my brain at once, as it were the lighted squibs of fireworks" (11).

Among the permanent psychic characteristics the following are mentioned as being more or less general: strong, tenacious, unreasoning personal attachments, and, less often, similar prejudices and dislikes; impulsiveness; religious fervor; tendency toward mysticism and with it sometimes credulousness and superstition; heightened feeling of self and craving for self-expression, which may assume superficially a resemblance to motivations of hysterical behavior, but, save in cases of hybridism, should not be confounded with them; striking tenacity of purpose with a lasting patience and meticulous attention to minutiae; finally inconsistencies of conduct, intelligible enough to one who has succeeded in gaining, through experience, an insight into epileptic personality, but often misunderstood by the casual observer for insincerity or hypocrisy; as regards this, Binswanger, for instance, remarks (12): "How astonished is the inexperienced physician, when suddenly and immediately the psalm-singing, submissively friendly patient

blindly attacks another, because he thinks himself insulted by a word or gesture, or because in distributing the food he got a smaller piece."

SO-CALLED NORMAL PERSONALITY

The above descriptions of abnormal types of personality naturally emphasize contrasts with "normal" types, the existence of which is always tacitly implied by the psychiatrist. These contrasts, as all know, are only to a slight extent qualitative, and for the most part quantitative.

Among the traits *qualitatively* distinguishing normal personality are to be mentioned inhibition, emotional control, a superior durability of mind, rational balance, and nervous stability. The results of the lack of these traits in psychopathic individuals, and only secondarily direct observation of them, have enabled us to perceive and evaluate them in normal individuals.

Normal persons are not free in most cases from selfish motivations and anti-social or violent or destructive impulses, but are distinguished mainly by ability to inhibit them; they are, of course, not free from emotion, but seem to possess a controlling mechanism whereby they are protected from excessive emotional manifestations, *i.e.*, at least to the extent preventing interference with steady and purposeful activity.

The very common tendency among epileptics and schizophrenics to suffer early and more or less pronounced mental deterioration is well known; its anatomical basis is brain atrophy which goes hand in hand with the mental deterioration (13). In contrast with this is the great relative durability not only of normal personality but also of the cyclothymic varieties.

Cyclothymic personalities are protected against such pathological manifestations of autistic thinking as hallucinations and delusions by the continuity of their external contacts. It seems that normal personalities are also protected but by a somewhat different mechanism, namely, an influence which makes for rational balance and which is perhaps akin to the inhibition and control securing other psychic functions against pathological excess.

As regards nervous stability—by which is meant here particularly a power of maintaining uniformity and continuity of consciousness and avoiding fainting spells, convulsions, deliria, automatisms, absences, and other epileptic manifestations—this is possessed not only by normal varieties of personality, but also antisocial, cyclothymic, and, to a somewhat lesser degree, autistic.

Turning our attention to *quantitative* contrasts between abnormal and normal types of personality, we find, as the most significant fact of experience, that either between the different abnormal types, or between them and normal types, sharp lines of demarkation cannot be drawn: mixed types are the rule, pure types the exception. Every qualitatively definable trait is subject to quantitative variation and may enter into the personality composition of a given case, no matter how classified as to type, in a greater or lesser degree. Even among the extremely pathological cases segregated in institutions a great many are in most respects normal and require custody or assistance only by reason of some limited, perhaps temporary, psychic disability. Similarly, among so-called normal persons we find, at least in rudimentary form, antisocial tendencies, lability of moods, autistic thinking, and a tendency to become faint and lose consciousness or suffer convulsions under the influence of various physical and psychic causes. The time-honored classification of temperaments into the quick (sanguine, choleric) and the slow (phlegmatic, melancholic) is obviously based largely on contrasts presented by traits indistinguishable, except in degree, from those observed in the psychiatric clinic as belonging, respectively, to cyclothymic and autistic personalities.

Owing to the great importance or even indispensableness for our gregarious mode of existence, *i.e.*, for social adjustment, of the inhibiting and controlling power of normal type of personality it has ranked high in our evaluation. On the other hand, owing to the circumstance that the traits of the so-called abnormal types of personality were first observed in cases which had come to attention by reason of severe social maladjustment, descriptions of them are apt to unduly emphasize their unfavorable aspects.

The fact is that the relative advantages and disadvantages are not so unevenly divided; that for various tasks and situations in life now one group of traits, now another appears most advantageous; and that generally desirable varieties of personality consist rather of fortunate combinations of traits.

Even anti-social traits, within certain limits of manifestation, are not always regarded as undesirable and may be judged to be of biological value; for they undoubtedly underlie a good deal of our prudence, diplomacy, success in commercial and political fields. How much in literary and histrionic art is due to the sensitiveness and power of expression of cyclothymic personality; how much in all pioneering activities to the spirit of enterprise rooted in the same

soil? How much in science and in other fields, in which great concentration of mental energy on special tasks is required, is due to the inclination, peculiar to autistic personality, to exclude every diverting influence, every extraneous interest? How much of all human achievement is due to inspirations, revelations, stubborn patience and determination, such as have been observed in epileptic personalities?

HEREDITARY RELATIONSHIPS OF PERSONALITY

Data for the study of the heredity of personality are scarce. The subject bristles with difficulties and we are on safest ground if we limit ourselves to the consideration of psychiatric material.

Just as in individuals mixed types are the rule, pure types the exception, so in familial groups dissimilar heredity is the rule, similar heredity the exception, especially if normal as well as abnormal types and quantitative as well as qualitative dissimilarities are taken into consideration (14, 15, 16, 17, 18).

This fact, constantly observed, has led to the view, generally held by physicians, that the above described abnormal types of personality and, more particularly, the mental disorders which bring them to medical attention, though sharply distinguished from one another clinically, nevertheless bear to one another some manner of relationship. They are therefore often grouped together under the general designation of *neuropathic constitution*.

Perhaps the most striking feature which the various types of neuropathic constitution have in common is their behavior, in their manner of transmission by heredity, as Mendelian recessives in relation to normal constitution (19, 20, 21, 22).

This fact would hardly justify the conclusion, which some seem to have drawn, that the vast multitude of neuropathic manifestations constitutes a unit character in Mendelism; but rather that a degree of inhibition of such manifestations, which is desirable for social environments, and which is a much more limited affair, probably constitutes, if not a single Mendelian unit, a homogeneous group of such units.

Each of the abnormal types of personality that have been clinically distinguished is probably determined by special factors in heredity, and there is considerable evidence to show that in their blending they bear to one another relationships analogous to those of coat colors in mice and some other such cases known to biology.

Accordingly, to speak, in this connection, of such a simple rela-

tionship as is implied in the conception of dominance and recessiveness is, perhaps, somewhat misleading. It seems more appropriate to use the terms *epistatic* and *hypostatic*, suggested by Bateson (23); the implication being, that certain hereditary factors, while determining certain clinical manifestations, have at the same time the effect of inhibiting manifestations of other factors which are also present.

It is well known that manic-depressive parents often have schizophrenic offspring, while the reverse is very rare (14, 24, 25, 22, 26, 16, 18). This suggests for manic-depressive psychoses an epistatic position in relation to schizophrenic psychoses in the scale of dominance; while in relation to normal personality it probably occupies a hypostatic position—although the last has recently been called in question as far as the excited forms are concerned (21, 27).

Similarly, most of the available evidence seems to show that epilepsy occupies a position which is hypostatic not only in relation to the normal condition, but also to the various constitutional psychoses (16, 28, 29).

In clinical experience one constantly encounters borderline, atypical, transitional, and mixed cases, which, from the point of view of Mendelism, can be explained as instances of imperfection of dominance. It is significant in this connection that the mixed conditions which are met with in the clinic are combinations of traits which, more often than not, occupy contiguous positions in the scale of dominance.

Thus, fainting spells, convulsions, and other epileptic manifestations occur vastly more often in cases of dementia præcox than of manic-depressive psychoses (7, 30, 31).

Similarly, catatonia-like states are more often seen in the course of manic-depressive psychoses (32) than in hysterical or other psychoneurotic cases.

Again, rudimentary psychoneurotic or cyclothymic phenomena are more often seen than schizophrenic or epileptic ones in normal individuals.

INTELLIGENCE. SEXUALITY. OTHER COMPONENTS OF PERSONALITY

The elements of personality thus far discussed may be termed *temperamental*. It need hardly be said that other elements enter into the composition of personality, which are perhaps equally potent in stamping its aspect and in determining the fate of the

individual. A brief discussion of some of these may not be out of place.

What is commonly spoken of as *general intelligence* does not seem to vary qualitatively in relation to temperamental make-up, but a rather significant quantitative correlation seems to exist.

Any degree of intellectual capacity may coexist with either normal, antisocial, cyclothymic, autistic, or epileptic make-up; but the relative frequency of feeble-mindedness seems to increase with descent in the scale of dominance. Thus, for instance, among the first admissions to the New York state hospitals during the fiscal year ending June 30, 1918, there were 976 cases of manic-depressive psychoses, 1,883 of dementia præcox, and 146 of epilepsy. The intellectual make-up was ascertained, either by anamnesis, or by direct examination, or both, in 849, 1,468, and 114 cases, respectively. The proportion found to be of intellectually inferior make-up were, for the manic-depressive cases 6.6 per cent., for dementia præcox 17.4 per cent., and for epilepsy 28.1 per cent. (33).

In the hope of securing more trustworthy data on this subject Binet tests were applied several years ago to a number of cases in the Kings Park State Hospital. Cases of recent onset were selected and only those which were sufficiently free from active psychotic symptoms to be capable of coöperating fully in the tests. Among those tested were 27 cases of manic-depressive psychoses and 53 of dementia præcox. The tests were also applied to 61 normal individuals, for the most part attendants, nurses, and clerks employed at the hospital. The results are given in the following table, which shows the various mental ages in each group and the percentage of cases in each mental age (16).

Clinical Group	Mental Ages, in Years.					
	8	9	10	11	12	13
Normal subjects.....	%	%	%	%	%	%
Manic-depressive subjects.....		7.4	22.3	29.6	29.6	11.1
Dementia præcox subjects.....	7.5	13.2	30.2	18.9	15.1	15.1

Only four cases of epilepsy were tested; of these one showed a mental age of 4 years, one of 10, and the remaining two of 11.

The theoretical import of these facts would seem to be that the germ-plasmic factors of all personality types are all capable of contributing to general intelligence; that the intelligence of an individual is a matter, therefore, of quantitative and not quali-

tative determination; and that the increasing frequency of feeble-mindedness with descent in the scale of dominance is due to the loss of epistatic factors which is not always made up quantitatively by hypostatic ones.

The rôle of *sexuality* in all relations of life is so overwhelming as to render it obvious that any peculiarity in the sexual make-up of an individual must effect a profound modification of his personality, no matter of what general type it may be. All kinds and degrees of variation of sexual make-up may occur in connection with each of the personality types.

The hints of clinical experience, however, are that we have especially to reckon with general eroticism, sadism, masochism, and fetichism in connection with epilepsy; inversions in connection with schizophrenia; and frigidity, perhaps to the point of unconquerable aversion to sexual intercourse, in hysteria.

The almost general auto-erotism of schizophrenia and the indiscriminating promiscuity, including incestuous practices, of feeble-mindedness are hardly to be considered as primary sexual anomalies, but rather as secondary to the fundamental personality defects and as their logical consequences.

Similarly, the homosexual practices commonly observed among sailors, prisoners, etc., are no doubt for the most part environmentally and not constitutionally determined.

At this point perhaps should be mentioned the fact that some traits or manifestations of personality seem to be somewhat *sex-linked*. It is well known that criminality and alcohol and drug addictions are more prevalent in men than in women. The reverse is true of hysteria. In somewhat less marked contrast, manic-depressive psychoses are more frequent in women and dementia præcox in men. Thus, among the first admissions to the New York state hospitals during the fiscal year ending June 30, 1918, there were 3,530 men and 3,267 women. Of these 368 men and 608 women had manic-depressive psychoses; while 985 men and 898 women had dementia præcox (33).

Perhaps the most striking instance of a trait of personality showing sex-linked inheritance is that of *nomadism*, as has been shown by Davenport (27). In the course of psychiatric experience one gains the impression that this trait is in some correlation with various neuropathic manifestations: psychoneuroses, dementia præcox, epilepsy, feeble-mindedness. It may be that the nomadic tendency exists as a component of normal as often as of neuropathic

constitutions, but its release more readily takes place in the latter, *i.e.*, in the absence of the normal inhibiting influence.

Physical factors, particularly such as might be of social import, are obviously capable of becoming components of personality. One's life career, marital and domestic destiny, and habits of daily conduct may be largely determined by the circumstance whether he has a prepossessing appearance, muscular vigor, and robust health, or, on the contrary, an ugly, blemished, or deformed face, weak and awkward musculature, and chronic ill-health.

Here it may be worth the while recording, at least as a distinct impression, that handsome looks are in some degree of positive correlation with cyclothymic personality, particularly where the latter is manifested in degrees approaching or falling within normal limits. The opposite is true of most other neuropathic conditions, but more especially of schizophrenia, epilepsy, and feeble-mindedness. This is probably brought about by sexual selection.

Other traits, such as *mathematical ability* and *musical talent*, may enter as components of personality and affect more or less profoundly the general result, including the whole life course of the individual.

ANALYSIS OF PERSONALITY

Analysis of personality, as of any other complex, involves, in a given case, isolating and identifying its elementary components and making a quantitative estimation of each. If the theory here proposed corresponds in any measure to the nature of things, the task is complicated by the necessity of taking cognizance not only of *manifest* traits, but also of possible *latent* ones. The following is offered as merely a general indication of data available for the study of personality.

Data of Direct Investigation.—A number of outlines have been prepared for guidance in systematic study of personality, although unfortunately no very extensive use has as yet been made of them. The one developed by Hoch and Amsden (34) is inspired, like the present discussion, by psychiatric experience. The suggestions offered by Watson are also valuable, although they arise out of a somewhat more inclusive conception of personality (35).

Methods that are available for the measurement of general intelligence and special abilities will, of course, throw light on corresponding aspects of personality.

The careful observation and detailed recording of striking instances of behavior or such as may be judged to be typical for

the individual under consideration, perhaps in reaction to special environmental situations, which should also be described, is useful not only in the psychiatric clinic, but also wherever one's concern is with the subject of personality.

The direct investigation of personality cannot properly be accomplished in a hurry, at least if something more than surface facts or merely deceptive appearances is to be elicited. Time and effort should be devoted to becoming acquainted with the subject, his affairs, and persons close to him; and in all relations with him the student should carefully cultivate interest, confidence, friendliness, even affection—in medical terms “rapport” or “transference”—and finally such freedom from formal conventional restraints as would enable him to gain an insight, somewhat in the manner of the psychoanalyst, into the subject's deeper lying conflicts and motivations.

Data of Heredity.—Many latent elements of personality could hardly be known to exist or even suspected in the absence of a family history. The understanding of the behavior of many an individual would be improved were it known that under the “normal” overlay of his personality there lie concealed epileptic or autistic components. The important point here is that the latency of these components has reference only to the pathological manifestations by which alone, for the present, they are known and recognized, and that otherwise they are probably by no means without effect upon the general quality of the personality complex.

Ontogenetic Data.—All the personality components of an individual are not present at birth or in infancy, and with growth they do not all make their appearance or reach their full development simultaneously. Every trait has its own ontogeny, and before the final blending takes place there is considerable opportunity for analytic study. In the case of a given trait, the time of its appearance, the intensity of its manifestations, and the permanency of its persistence are probably dependent in part on the quantity or dosage of its germ-plasmic determining factor and in part on the development of other factors occupying an epistatic position in the scale of dominance.

Psychiatrists are amply taught by daily experience the wisdom of taking cognizance of ontogenetic data, and so the taking of *personal history* has become an essential part of their technique of clinical diagnosis. In many cases no other source of ontogenetic data is available, and for certain practical purposes the data thus

secured are sufficient; but for purposes of scientific research such technique will not be chosen as the best that is possible; for, in that connection, nothing short of intensive, systematic, expert observation of many subjects from birth to maturity will suffice.

I trust I shall not be accused of reckless generalization for saying that in the behavior of all normal children are constantly observed phenomena which, as far as adults are concerned, are met with mainly in the psychiatric clinic. It goes without saying, however, that there is such a thing as special colorings derived from adult interests and adult life situations.

Probably for every case of established epilepsy, for instance, there are dozens of cases of light ("inward spasms") and severe seizures in infancy and childhood due to "teething," "worms," "indigestion," "constipation," "a fever," "a cold," "being out in the sun," "playing too hard," "a fright," etc. These occur singly, or in series, or with more or less tendency to recur throughout the years of childhood and are eventually "outgrown." The last may be judged to occur when epistatic factors have reached a certain degree of maturity in ontogenetic development.

Similarly, for every case of fully developed dementia præcox there are, roughly, scores of instances of every possible schizophrenic manifestation in childhood: painful shyness, incoöperation in conversation often amounting to mutism, verbigerations, neologisms, echolalias, stereotypies, mannerisms of all sorts, complete self-abandonment to autistic romance, even hallucinations and delusions ("I am God!"). These, unlike real dementia præcox, run a benign course, being eventually outgrown, *i.e.*, from the standpoint of the theory here proposed, overlaid, like infantile epileptic manifestations, by epistatic factors appearing later in the course of ontogenetic development.

Again, it is not difficult for the psychiatric clinician to recognize in the behavior of many children, perhaps the majority of them, various manic-depressive traits: readiness to cry, screaming with rage, elation and boisterousness, and other manifestations of emotional instability; talkativeness, mobility of attention, distractibility; restless activity, playfulness, pranks; later "madcap adventures" and "youthful enthusiasms" until the sobering down of maturity finally takes place, when the individual ceases to "act like a child."

Finally, as all know, every hysterical manifestation, malingering, lying, sneaking, and other kinds of antisocial behavior are to be

observed not only in "juvenile offenders," but also in many normal children, merely as manifestations of immaturity.

Of the greatest theoretical significance are the unannounced, sometimes radical changes which are often seen in the course of ontogenetic development. A child notably shy, retiring, and quiet, blossoms out into a sociable, lively, laughing, talkative boy, or even into a boisterous, mischievous "holy terror," to subside only when manhood is attained.

This, as a biological phenomenon, is perhaps analogous to the ontogeny of hair color in those cases in which the hair is in early infancy light, almost without pigment, later turns red, and eventually becomes dark reddish brown or even black.

Such changes in temperament, it seems to me, speak somewhat against the theory, proposed by Adolf Meyer, (36), which attributes much of the ultimate result in mental life—particularly in cases of dementia præcox—to unchecked development of vicious mental habits. Much more than is implied in that theory would seem to be constitutionally predetermined.

The facts of ontogeny, then, seem to show that so-called "neuropathic" elements of personality are, in various combinations and in various degrees, regular components of so-called "normal" personality, but that in adult life they are latent as far as their characteristic antisocial, psychotic, or epileptic manifestations are concerned.

Pharmacologic Data.—Here is undoubtedly a vast and fertile field for research both by observation and experiment. The general principle here is that, whatever may be the physical mechanisms which underlie the manifestations of the different types of personality, their functions are unequally affected by certain drugs. The most extensive experience has been had, of course, with alcohol.

The traits belonging to what we have designated normal personality seem to be the most vulnerable; and persons in whom the normal overlay may be judged to be thin are especially susceptible to the action of alcohol, *i.e.*, in them only small doses are required for the uncovering of all kinds of neuropathic manifestations which, in sober condition, they either do not exhibit at all or only in slight degree.

The particular sort of neuropathic manifestations released by alcohol varies in different individuals depending, it may be assumed, on their latent personality components. In the commonest and therefore most familiar types of drunkenness the manifestations

unmistakably belong to the cyclothymic complexes. Less commonly are seen types of so-called pathological drunkenness: delusional type, convulsive type, etc. These are, of course, promptly recovered from, *i.e.*, they disappear upon sobering up.

An interesting type of pathological drunkenness, known as maniacal (a misnomer!) drunkenness, resembles in every detail epileptic delirium: "All of a sudden the drunkard, while still at the saloon-keeper's bar, is seized with an outbreak of furious madness without any apparent cause or provocation; he breaks objects and furniture, becomes noisy, and threatens and attacks those about him.—Almost always numerous psycho-sensory disorders (hallucinations and illusions) are associated with the clouding of consciousness and excitement. The attack terminates in profound sleep. This is followed by almost complete amnesia" (37).

Longer continued overindulgence in alcohol, such as a several days' spree, is followed by graver and more lasting psychoses: acute hallucinosis and paranoid states clearly schizophrenic in nature.

Data of Organic Pathology.—In organic cerebral affections, especially those in which the cortex is more or less diffusely involved, personality generally suffers profound alteration and here again the story repeats itself of the releasing of neuropathic manifestations which vary according to the individual, *i.e.*, depending on his personality components concealed beneath the normal overlay which is the most vulnerable and the first to be destroyed.

The best known case is that of general paralysis. In cases of rapid progress the clinical picture is apt to be dominated by the organic dementing process—memory loss, disorientation, general dulling of intelligence—and it is difficult to discern the finer things that are taking place. But in cases of slow progress, especially cases of the tabetic type, the dissection of personality can often be readily observed.

Quite characteristic in the early stages is the appearance of unwonted antisocial tendencies: thefts, embezzlements, cunning lies, bogus joint-stock projects. In other cases one witnesses an attack for all the world like a manic-depressive psychosis and distinguishable from it only by the physical signs, serological findings, and subsequent course. In some cases early in the disease and in over half of the cases sooner or later are seen convulsions and various other epileptic manifestations.

Data of Senile Involution.—According to all statistics the ages of senile involution are marked by greatly heightened incidence of

mental disorders. Involutional melancholia and other manic-depressive psychoses often appear for the first time in late middle age or in senility; in other cases, appearing in severe form in the involutional period, a history is furnished of slighter mood fluctuations in earlier life. Paranoic conditions unquestionably belonging to the schizophrenias often make their first appearance in middle or old age. Finally is to be mentioned the so-called senile epilepsy in which the constitutional tendency as an etiological factor, though latent throughout the greater part of the life time of the patient, is often nevertheless established by a family history of epilepsy and by a history of infantile convulsions in the individual.

REFERENCES

1. LÉRI, A. *Commotions et Émotions de Guerre*. Paris: Masson et C^{ie}, 1918. Pp. vi + 196.
2. ROSANOFF, A. J. A Study of Hysteria, Based Mainly on Clinical Material Observed in the U. S. Army Hospital for War Neuroses at Plattsburg Barracks, N. Y. *Arch. of Neurol. and Psychiatry*, 1919, 2, No. 4, 419-460.
3. DERCUM, F. X. *Rest, Suggestion, and Other Therapeutic Measures in Nervous and Mental Diseases*. Philadelphia: Blakiston's Sons & Co., 1917. Pp. ix + 395.
4. JONES, A. B. AND LLEWELLYN, L. J. *Malingering or the Simulation of Disease*. London: Wm. Heinemann, 1917. Pp. xxii + 708.
5. BIRNBAUM, K. *Die Psychopathischen Verbrecher*. Berlin: P. Langenscheidt, 1914.
6. KRAEPELIN, E. *Psychiatrie. Ein Lehrbuch für Studierende und Aerzte*. Eighth edition. Leipzig: Johann Ambrosius Barth, 3, 1913. Pp. xiii + 667-1395.
7. KRAEPELIN, E. *Dementia Præcox and Paraphrenia*. (English translation by R. M. Barclay.) Edinburgh: E. & S. Livingstone, 1919. Pp. x + 331.
8. HOCH, A. Constitutional Factors in the Dementia Præcox Group. *Rev. of Neurol. and Psychiatry*, 1910, Aug.
9. SPRATLING, W. P. *Epilepsy and Its Treatment*. Philadelphia: W. B. Saunders & Co., 1904. Pp. 522.
10. DOSTOYEVSKY, F. *The Demons*. (Quoted by C. Lombroso, in *The Man of Genius*. New York: C. Scribner's Sons, 1910.)
11. FLAUBERT, G. *Correspondance*. (Quoted by C. Lombroso, *loc. cit.*)
12. BINSWANGER, O. *Die Epilepsie*. Vienna: Alfred Hölder, 1899. Pp. vi + 502.
13. ROSANOFF, A. J. A Study of Brain Atrophy in Relation to Insanity. *Amer. J. of Insanity*, 1914, 71, 101-132.
14. VORSTER. Ueber die Vererbung endogener Psychosen in Beziehung zur Klassifikation. *Monatsschr. f. Psychiatrie u. Neurol.*, 1901, 9, 161.
15. BERZE, J. *Die hereditären Beziehungen der Dementia Præcox. Beitrag zur Hereditätslehre*. Leipzig: 1910.
16. ROSANOFF, A. J. Dissimilar Heredity in Mental Disease. *Amer. J. of Insanity*, 1913, 70, 1-105.
17. MOORE, A. S. Some Preliminary Observations Concerning the Types of Psychoses Occurring in the Individual Members of Families. *State Hosp. Bulletin*, 1913, 6, 3-93.

18. MYERSON, A. Psychiatric Family Studies. *Amer. J. of Insanity*, 1917, 73, 355-486; also 1918, 74, 497-554.
19. DAVENPORT, C. B., AND WEEKS, D. F. A First Study of Inheritance in Epilepsy. *J. of Nerv. and Ment. Disease*, 1911, 38, 641-670. Reprinted as *Bulletin No. 4, Eugenics Record Office*.
20. ROSANOFF, A. J., AND ORR, F. I. A Study of Heredity in Insanity in the Light of the Mendelian Theory. *Amer. J. of Insanity*, 1911, 68, 221-261. Reprinted as *Bulletin No. 5, Eugenics Record Office*.
21. RÜDIN, E. Einige Wege und Ziele der Familienforschung, mit Rücksicht auf die Psychiatrie. *Zeitsch. f. d. ges. Neurol. u. Psychiatrie*, 1911, 7, 489-585.
22. JOLLY, P. Die Heredität der Psychosen. *Arch. f. Psychiat. u. Nervenkrank.*, 1913, 52, 1-283.
23. BATESON, W. *Mendel's Principles of Heredity*. Cambridge: University Press, 1909. New York: G. P. Putnam's Sons, 1909. Pp. xiv + 396.
24. KRAUSS. Ueber die Vererbung von Geisteskrankheiten. *Allg. Zsch. f. Psychiatrie*, 1903, 60.
25. KRUEGER. *Zsch. f. d. ges. Neurol. u. Psychiatrie*, 1916. (Quoted by Myerson, *loc. cit.*)
26. LUTHER. *Zsch. f. d. ges. Neurol. u. Psychiatrie*, 1914. (Quoted by Myerson, *loc. cit.*)
27. DAVENPORT, C. B. *The Feebly Inhibited.—Nomadism, or the Wandering Impulse, with Special Reference to Heredity.—Inheritance of Temperament*. Washington: Carnegie Institution, 1915. Pp. 158.
28. URQUHART, A. R. *Insanity*. (In *The Treasury of Human Inheritance*. Eugenics Laboratory Memoirs. IX.) London: Dulau & Co., 1909. 61-69.
29. MOTT, F. W. The Inborn Factors of Nervous and Mental Disease. *Brain*, 1911, 34, 73-101.
30. BLEULER, E. *Dementia Præcox oder Gruppe der Schizophrenien*. Leipsic and Vienna: Franz Deuticke, 1911. Pp. xii + 420.
31. SIMON, T. W. The Occurrence of Convulsions in Dementia Præcox, Manic-Depressive Insanity and the Allied Groups. *State Hosp. Bulletin*, 1914, 7, 407-414.
32. KIRBY, G. H. Catatonic Syndrome and Its Relation to Manic-Depressive Insanity. *J. of Nerv. and Ment. Disease*, 1913, 40, 694-704.
33. *Thirtieth Annual Report of the State Hospital Commission*. Albany: J. B. Lyon Co., 1919. Pp. vii + 451.
34. HOCH, A., AND AMSDEN, G. S. A Guide to the Descriptive Study of the Personality, with Special Reference to the Taking of Anamneses of Cases with Psychoses. *State Hosp. Bulletin*, 1913, 6, 344-355.
35. WATSON, J. B. *Psychology from the Standpoint of a Behaviorist*. Philadelphia: J. B. Lippincott Co., 1919. Pp. xiii + 429.
36. MEYER, A. Fundamental Conceptions of Dementia Præcox. *Brit. Med. Jour.*, 1906, Sept. 29, 757-759.
37. ROGUES DE FURSAC, J. Pathological Drunkenness. In *Manual of Psychiatry*, Edited by A. J. Rosanoff, Fifth edition. New York: John Wiley & Sons, 1920. Pp. xv + 684.

HEREDITY OF CONSTITUTIONAL MENTAL DISORDERS

BY CHAS. B. DAVENPORT

Eugenics Record Office, Cold Spring Harbor

Mental disorders are indicated by aberrant mental output, especially in the capacity for learning and for other intellectual processes. In this group may be included also disorders of self control, and the field of temperament. All such aberrant behavior is the individual's reaction to situations presented to him. It is not due merely to the presentations, others, designated normal, react to them in a different fashion. There is something, therefore, peculiar or aberrant in the reacting mechanism. This peculiarity of the reacting mechanism may be due to some gross accident that has befallen it, such as a wound, a poison, or a pathogenic micro-organism. The abnormality of the mechanism may be due to some psychic trauma which it has suffered in its earlier history, or it may be due to some intrauterine conditions which have interfered with normal development, or to some defect in the germ cell which, united in the zygote, initiate and control development. The abnormality may be dependent upon peculiarities of the cytoplasm of the germ cell or of the chromosomes, those minute bodies which are believed to have for their special function the direction of the course of development. Heredity in the narrow sense has to do with the part played by the germ cells and especially its chromotin in directing development.

The attention of mankind has been directed toward heredity because of the striking way in which similar peculiarities tend to be reproduced in different members of a family. This tendency is now understood to be due to the fact that the different members of a family inherit in part at least the same elements of the chromosomes. It must be admitted that it is difficult always to disentangle the effects of heredity, of bad external conditions during early development, and of damage done to the organisms in later life. It is indeed futile to attempt to separate these different factors, simply because they are not separable factors, but interwoven. What effect a mentally disturbing episode of early childhood shall have upon subsequent mental output depends not only upon the nature of the irritant but also upon the ability of the nervous system to withstand such a psychic trauma. Similarly while we readily

admit that alcohol is the immediate cause of the alcoholic psychoses, yet it is obvious that a given quantity of alcohol will have very different effects upon persons having different constitutional make-up of the nervous system. The characteristic symptoms shown are, then, the reaction of the specific nervous mechanism to the particular inciting agent.

With these general remarks, which may serve as a caution against dogmatic statements in respect to the rôle of environment or heredity in mental disorders, we may proceed to consider what conclusions have been reached concerning the rôle played by hereditary, constitutional conditions in such disorders.

Feeble-mindedness.—This term is applied to a great range of mental conditions which have this in common, that there is a defect in the intellectual functions. Feeble-mindedness has been defined as "the state of mental defect existing from birth or from an early age and due to incomplete or abnormal development, in consequence of which the person affected is incapable of performing his duties as a member of society in the position of life to which he is born." That is to say, he is a person who, through congenital mental defect, reacts abnormally to his environment. The feeble-minded are often classified according to the degree, as idiots, imbeciles and morons. The first is used to designate those whose mental age is not over two years. It includes at the lower extreme individuals who are not even good animals, who do not respond to a call with the intelligence of a dog. Very often the extreme lack of intelligence is associated with gross nervous and general developmental defects. There is much evidence that idiocy is frequently the result of severe infection, in consequence of which the development of the organism has not been carried out in normal fashion. Very often it can be shown that the one or both of the parents were syphilitic or saturated with alcohol or drugs. Even so, the possibility of a constitutional weakness which causes the developing organism to be damaged to an especially great degree by his bad environment is not to be overlooked. As a matter of statistics, the great mass of idiots arise from feeble-minded parents. At the other extreme of the feeble-minded series we have the morons, who are usually not characterized by any somatic peculiarities but merely by stupidity. In these cases, and also in a large proportion of the group of imbeciles, we usually find no evidence of infectious diseases or poisons in the parents such as would account for the result. On the other hand, it is exceptional not to find in both parental pedi-

grees of such a child evidence of the presence of feeble-mindedness. The distribution of these other cases of feeble-mindedness is such as to leave little doubt that there are defects in the chromosomal determiners of the zygote from which the defective child has arisen.

The feeble-minded children of a given psychological age, as determined by mental tests, are not all alike, but differ as normal children do. We might expect, therefore, to find that there was not merely one defect, but several, corresponding to each of the mental functions or instincts, that have developed to only a low degree. A study of pedigrees of the feeble-minded, however, leads to the conclusion that the inheritance is much simpler, that there is indeed only a single effective gene missing which is responsible for the result. The large number of pedigrees that have been collected by Goddard (9) and by scores of students of feeble-minded children indicate that when both parents are mentally defective, all of the children will be so also; that if neither of the parents is defective but if they both have close relatives that are, then of their offspring only about one quarter will show the defect; that when one of the parents is defective and the other not, but from a defective family, then only one half of the offspring will be defective. Such analyses as have been made of the pedigrees of the feeble-minded (scientifically insufficient as most of them are) yield results in accordance with these formulæ and support the conclusion that there is a single mendelian factor absent in the case of the ordinary type of feeble-minded. The result seems at first remarkable and almost incredible, but on further consideration it becomes plausible that the germinal defect results in the insufficient production of some hormone upon which the development of the higher functions depends. If this hormone is insufficient, then the intellectual centers develop each with its idiosyncrasies but cease development prematurely at a certain low level. The consequence is that the feeble-minded of one psychological age differ from each other because their fragmentary intellectual capacities differ as they do among normal people.

If hereditary feeble-mindedness depends upon defects in the chromosomes, such defects may well have persisted in the germ plasm for many generations. Although we must concede the probability that mutations are commonly occurring in the nervous mechanism as they do in other bodily organs, still it is probable that many existing cases of mental defect can be traced back to the remote past. In the most extensive pedigrees of the feeble-minded that have been made in this country, like that of the Jukes and of

the Kallikak family, the mental defect has been traced for nine or more generations. If it can thus be traced back 200 years, there is little doubt that in some cases it might be traced, were there sufficient records, through 2,000 years, or even longer. There is good reason for believing that the normal man of the old stone age in Europe would be considered today a moron, if not an imbecile of a high-grade. Today there exists in Australia remnants of a native race, the normal individuals of which are characterized by distinctly lower capacity for mental development than the normal European. In this race, therefore, practically 100 per cent. are today morons. It is probable that in out of the way places in Europe there persist groups of individuals who inherit the mental insufficiency of the old Stone Age. Representatives of such groups have come to America. They have been segregated through the pressure of social environment, they have married each other and their descendants persist among us to this time. It is not improbable, accordingly, that certain of our feeble-minded families have not become such through a secondary loss of the capacity for full mental development but are the survivors among us of a low state of mental development such as characterized the ancestors of all of us.

Mongolian Imbecility.—This is a special form of imbecility whose striking symptoms are reduced stature, modified form of hands, and peculiarity of features, especially the eyes. It has been frequently asserted that there is no evidence of inheritance in the pedigrees of this defect. More careful investigations of pedigrees, however, usually reveal a neurotic condition in the parents on both sides. Herrman (10) has concluded that there is some reason for regarding it as a recessive Mendelian trait.

Amaurotic Family Idiocy.—This comparatively rare congenital condition which is apparently confined to Russian Jews has long been found to run in families. It remained, however, for Brandeis (1) to point out the method of inheritance. From such cases as have been studied, it appears to be a simple Mendelian recessive.

The Epilepsies.—Modern studies of epilepsy indicate clearly that it is a group of diseases that arise from diverse conditions. The classifications of these different conditions has been lately offered by Fischbein (7). The number of classes recognized by him is very great, amounting to one hundred or more. Among all of these, however, there are certain types which are especially common. Such is the dementing type, most frequently found in our public

institutions, which usually first shows itself at about the onset of adolescence and leads to the gradual loss of mental powers. While in some of these classes the evidence of heredity is less clear because the constitutional are less striking than the inciting causes, yet in the typical institutional cases, there seems to be some single defect responsible for the symptoms. An analysis of over a hundred pedigrees of epileptics gathered especially by Dr. David F. Weeks, and analyzed by him is association with the writer, leads to the conclusion that the epileptic tendency is inherited as a simple Mendelian defect (Davenport and Weeks, 6). According to this method of inheritance, therefore, when both parents have the epileptic tendency, then all of the children will also. If both parents, without showing it, carry the determiner for the defect in their germ cells, then one quarter of the children will be epileptic. If one parents be epileptic and the other heterozygous or simplex for it, then half of the children will be epileptic. But if one of the parents is entirely untainted, though the other be epileptic, there is little probability of epilepsy appearing in the children. This study shows a remarkable relation between epilepsy and feeble-mindedness, such that if one parent is epileptic and the other feeble-minded, the resulting children are all either feeble-minded or epileptic. The study reveals also the suggestive fact that a tainted parent who, without showing convulsions himself, produces children with the tendency usually shows certain nervous disorders, especially migraine, and alcoholic, hysteric, or neurotic tendencies. The subsequent study of Flood and Collins (8), based upon a smaller number of cases, gives results which afford at least a partial confirmation of the conclusions of the work referred to above. Among other conclusions are the following: "Feeble-mindedness is also associated with epilepsy and there is some evidence that it is caused by the same defect that caused the epilepsy.

"Fitting the material to the two hypotheses, first that epilepsy is a recessive trait that is inherited only as epilepsy and second, that epilepsy, feeble-mindedness and insanity are due to the same defect which may appear in the form of any one of them, there is no striking evidence in favor of one to the exclusion of the other. The truth probably lies somewhere between the two.

"While we are not in a position to say at present whether every case of epilepsy is inherited or to say in what proportion of cases it is inherited, we can say that in a large proportion of cases there is

some nervous defect on both sides of the family. These defects may be epilepsy, feeble-mindedness, insanity, extreme nervousness, migraine, alcoholism, sexual immorality and lack of moral sense."

Between some of the defects named in the last paragraph and congenital epilepsy there is this in common, that they are periodic. This is at least true of dysomania, of migraine, of certain forms of insanity, of excessive irritability, temperamental explosions and inability to control the sex instinct. This element of periodicity which is so striking in epilepsy has a clear inheritable basis. This inheritable basis has been especially studied in the case of periodic fugues. In this class of cases we have a periodic tendency to leave home and wander away for longer or shorter periods. A study of the method of inheritance of this tendency has been made by the writer upon a considerable mass of material. The result of these studies indicates that we have here to do with a sex-linked trait inherited in the same fashion as hæmophilia or colorblindness. That is, a nomadic male has nomadic relatives among his mother's close male relatives, either mother's brothers or father (Davenport, 4).

For *myoclonic epilepsy* there has been made the most extensive pedigree study that has been carried out with any defect. This is the great work of Lundborg (12) of Uppsala. He demonstrates very clearly that myoclonic epilepsy is a simple recessive Mendelian trait.

Dementia Præcox.—This disorder in which the dementing process seems to develop gradually in an individual of originally normal mentality has a clear constitutional basis. It has indeed long been recognized that from childhood on a future schizophrenic has certain instinctive peculiarities. The method of inheritance of this condition has been investigated by various authors (among others: Rüdin, 14, Cannon and Rosanoff, 2, Rosanoff and Orr, 13, Jolly, 11, Witterman, 15), and the conclusion seems supported that the tendency is inherited as a simple Mendelian recessive. That is, it follows the laws of inheritance that seem to hold for feeble-mindedness and common epilepsy.

Temperament.—In the field of temperament we have to do with matters of self-control or inhibitions rather than of intellect. It is a matter of common observation that temperament and intellect are not closely related, and we have reason for believing that temperamental output depends upon the degree of functioning of internally secreting glands. The term feebly inhibited may be

applied to this group in contrast with the feeble-minded. A study of the inheritance of the tendency to more or less periodic outbreaks of violent temper has been made by the writer (5). This study yields the result that the tendency to temperamental outbursts does not typically skip a generation. In one family it is traced through five generations. In a large proportion of the 66 family history studies, it is traced through three consecutive generations. The trait is, therefore, apparently inherited as a Mendelian dominant. From the mating of an uncontrolled person (who has the tendency simplex) and a normal person, expectation is that 50 per cent. of the children will have the dominant tendency of feeble inhibition. A summation of all such children in the pedigrees studied gives a total of 106 affected among 219 sufficiently described, or close to the 50 per cent. expected on the hypothesis.

A study by the writer of a great number of families in which one or more representatives showed extreme temperamental reactions such as are characteristic of the manic depressive group of psychoses indicated that the over-active tendency is inherited independently of the tendency toward depression. The method of inheritance is somewhat complicated but may be worth explaining here. There is distinguished first the hyperkinetic state, characterized by an elated condition in which the individual is prevailingly busy, restless, ambitious, scheming, original, sociable, talkative, jolly and enthusiastic; in more extreme cases, erratic, changeable, becoming even braggarts, conceited, profane, hypererotic, brutal and liable to fits of violent temper. The lesser degrees of this state may be called nervous, the more developed choleric. Then there is the hypokinetic or depressed state which also comprises two temperaments, the phlegmatic which is characterized by quietness, seriousness, conservativeness, pessimism, and the melancholic temperament in which the subject is incommunicative (often mute) lachrymose, weak and incapable, feels life a burden, often longs for death as a relief. Frequently one finds these two states combined in the same person, exhibiting themselves alternately or sometimes intermingled in a curious fashion. The hypothesis that the study seems to support is that there is in the germ plasm a factor E, which induces the more or less periodic occurrence of an excited condition (or an exceptionally strong reactivity to exciting presentations) and its absence, e, which results in an absence of extreme excitability. There are also the factor C, which makes for normal cheerfulness of mood, and its absence, c, which permits a more or

less periodic depression. Moreover, these factors behave as though in different chromosomes, so that they are inherited independently of each other and may occur in any combination. These two factors may be combined in various ways as indicated by the following zygotic formulæ of the descendants of a mixture of excited and depressed strains:

1. E_2C_2 , Choleric-cheerful.
2. E_2Cc , Choleric-phlegmatic.
3. E_2c_2 , Choleric-melancholic.
4. EeC_2 , Nervous-cheerful.
5. $EeCc$, Nervous-phlegmatic.
6. Eec_2 , Nervous-melancholic.
7. e_2C_2 , Calm-cheerful.
8. e_2Cc , Calm-phlegmatic.
9. e_2c_2 , Calm-melancholic.

The E_2 indicates that the individual has two doses of the exciting factor, Ee one dose, e_2 that the person is without the exciting factor. C_2 indicates that the person has a prevaillingly cheerful disposition, Cc that he has only a single dose of, and c_2 that he is without the factor for cheerfulness, and that he is periodically depressed. An analysis of 146 matings supports the hypothesis fairly well. In relation to the psychoses, it may be mentioned that the condition represented by E_2 is that of a chronic mania, the condition represented by e_2 is that of a chronic melancholic, and the condition represented by E_2e_2 is that of the typical cyclical manic depressive condition. As is well known, the extreme manifestations of excitability or depression are not constantly exhibited. The hypothesis assumes only that they may become exhibited under suitable conditions provided the individual has genetic factors represented by the symbols. That temperament is inherited cannot be doubted. This conclusion is strengthened by the study of identical twins in which the history of changes of mood runs in remarkably parallel fashion. The tendency to suicide is found especially in the depressed state. In this state preparations for it are made with great care and are usually effective. The hyperkinetics also attempt suicide in moment of rashness and absence of inhibition, but owing to insufficient prevision their attempts are often futile.

Huntington's Chorea.—This condition is one primarily of nervous rather than mental import. However, in many cases the patient comes finally to behave in such abnormal fashion that he finds his

way into an institution for the insane. The commonest type of insanity associated with this disease is loss of emotional control. In a few cases, the chorea passes rapidly into dementia without showing the manic-depressive symptoms. This is especially true of older persons. Apparently insanity is inherited in Huntington's chorea and in accordance with the type of the disease as found in those who are not choreic. The chorea itself is inherited as a dominant disease, indeed it was one of the first dominant diseases to be recognized. Since feeble inhibition is a frequent accompaniment of this nervous trait, and since it is inherited as a dominant trait, we can understand how the chorea and the feeble inhibitions are combined in an ancestor and may occur together in later generations. A comparatively recent analysis of Huntington's chorea has been made by Dr. Elizabeth B. Muncey and the author (5).

Pellagra.—This disease is often associated with mental disorder. However, the relation is not a necessary one. Repeatedly families have been found in which the dermal and intestinal symptoms are marked and even severe and in which there are no cases with corresponding nervous or mental symptoms. On the other hand, families are found in which, combined with relatively slight physical symptoms, the mental symptoms are strikingly marked. In other words, there are biotypes in pellagra characterized by severity of one or the other but often not all of the principal symptoms of pellagra, namely, local inflammations of the skin, inflammations of the intestinal tract and nervous and mental disorders (Davenport and Muncey, 5).

Criminality.—The question is often debated as to the inheritance of criminality. Since crime depends primarily upon social factors, more than mental ones, it can well be seen that there is no necessary association between the crime and heredity. It is frequently urged that criminal behavior is indicative of feeble-mindedness and this is a point of view which Goddard (9) has stressed. A consideration of anti-social behavior indicates, however, that it cannot be so simply explained. It is dependent upon a variety of conditions for which the following seems obvious:

1. Ignorance of the mores (or social requirements) merely through lack of opportunity to learn the mores. This condition is found in the merely improperly or insufficiently taught offender.
2. Ignorance of the mores through lack of capacity to understand what society expects. This is characteristic of the feeble-minded offender in the strict sense.

3. Knowledge of the mores accompanied by a social blindness and inability to have the action controlled by a knowledge of what society expects of one because of lack of gregarious, social, or altruistic instinct. Here belong the extreme individualists including the anarchists and the others who say: Why should I govern my actions to meet the expectations of society; what right has society over me, anyway?

4. Knowledge of the mores, with presence of the social instincts, but with inability to meet the expectations of society through insufficient inhibition or self-control. This insufficiency may be a general constitutional and permanent one, or it may be temporary (often more or less periodic) due to abnormal internal secretions or other causes. Here belong, among others, the hyperkinetic, the hysterical and epileptoid offenders.

Consideration of the foregoing categories indicates that the inheritance of criminality will follow according to the cause and type. In seeking to understand inheritable factors in any criminal behavior, we should seek to understand the elements that lie at the basis of their behavior.

Finally a word may be said about the relation of constitutional mental disorders to consanguinity. It is still widely believed that close intermarriage in itself is sufficient to induce such disorders. But experimental breeding of animals has made it more probable that it is not close breeding *per se* which is responsible for the observed result that defective children have often resulted from such consanguineous marriages. The facts of the case seem to be that when both parents belong to the same strain which carries some recessive defect, like that which is responsible for feeble-mindedness, epilepsy, and depression, the inherited taint will reappear in at least one quarter of the children, even if the parents do not show the defects themselves. The rarer the defect in the population as a whole, the more striking will be the apparent consequence of consanguinity when the parents both belong to a stock carrying this rare defect. In such cases, indeed, through the rarity of the defect, the mating of the two individuals both carrying the defect will be very uncommon, unless the two individuals be blood relatives.

BIBLIOGRAPHY

1. BRANDEIS, J. W. 1918. A Note on Amaurotic Family Idiocy. *New York Medical Journal*, Jan. 19, p. 121.
2. CANNON, GERTRUDE, AND A. J. ROSANOFF. 1911. Preliminary Report on a Study of Heredity in Insanity in the Light of the Mendelian Laws. *Journal*

- of *Nervous and Mental Disease*, XXXVIII, 272-9. Reprint, Bulletin No. 3, Eugenics Record Office.
3. DAVENPORT, C. B. 1915. Inheritance of Temperament. Publication No. 236, Carnegie Institution of Washington, pp. 71-158.
 4. DAVENPORT, C. B. 1915a. Nomadism or the Wandering Impulse with Special Reference to Heredity. Publication No. 236, Carnegie Institution of Washington, pp. 1-68.
 5. DAVENPORT, C. B. AND ELIZABETH B. MUNCEY. 1916. Huntington's Chorea in Relation to Heredity and Eugenics. *American Journal of Insanity*, LXXIII, 195-222. Reprinted, Bulletin No. 17, Eugenics Record Office.
 6. DAVENPORT, C. B. AND D. F. WEEKS. 1911. A First Study of Inheritance in Epilepsy. *Journal of Nervous and Mental Disease*, XXXVIII, 641-70. Reprinted, Bulletin No. 4, Eugenics Record Office.
 7. FISCHBEIN, E. C. 1916. A Classification of the Epilepsies. *Medical Record*, September 2. Reprint, 32 pp.
 8. FLOOD, E., AND MARIAN COLLINS. 1913. A Study of Heredity in Epilepsy. *American Journal of Insanity*, LXIX, 585-603. January.
 9. GODDARD, H. H. 1914. Feeble-mindedness: Its Causes and Consequences. New York, Macmillan. 599 pp.
 10. HERRMAN, CHARLES. 1917. The Etiology of Mongolian Imbecility. *Archive of Pediatrics*, XXXIV, July.
 11. JOLLY, P. 1913. Die Heredität der Psychosen. *Arch. f. Psychiatrie u. Nervenkrankheiten*, LII, 1-283.
 12. LUNDBORG, H. 1913. Medizinisch-biologische Familienforschungen, innerhalb eines 2232 köpfigen Bauerngeschlechtes in Schweden (Provinz Blekinge). Jena, Fischer. xvi + 519 + 220 pp. text. Atlas, 50 Tafeln.
 13. ROSANOFF, A. J. AND FLORENCE I. ORR. 1911. A Study of Heredity of Insanity in the Light of Mendelian Theory. *American Journal of Insanity*, LXVIII, 221-61. Reprint, Eugenics Record Office, Bulletin No. 5.
 14. RÜDIN, E. 1911. Einige Wege und Ziele der Familienforschung mit Rücksicht auf der Psychiatrie. *Ztschr. f. d. ges. Neurologie u. Psychiatrie*, VII, 489-585.
 15. WITTERMAN, E. 1913. Psychiatrische Familienforschung. *Ztschr. f. d. ges. Neurologie u. Psychiatrie*, XX, 153-278.

SPECIAL REVIEWS

Die Geisteskrankheiten des Kindesalters einschliesslich des Schwachsinnns und der psychopathischen Konstitutionen. THEODOR ZIEHEN. Berlin: Reuther & Reichard. Part I, 1915; Part II, 1917. Pp. viii + 491.

Statistics of admission rates to institutions for the insane invariably show extremely low figures for ages under fifteen years. For instance, in the New York state hospitals the admissions during one year for all ages under fifteen years were at the rate of 0.6 per 100,000 of the general population; between fifteen and nineteen the rate was 33.9; and it increased sharply with advancing age, the

rate for all ages of sixty-five and over being 160.7. This is to be accounted for by a combination of circumstances which need not be discussed here. The fact, however, of psychoses of children being seldom seen in institutions for the insane has resulted in neglect of their study and to erroneous ideas concerning their prevalence.

The circumstance that psychotic conditions occurring in childhood often have the effect of interfering with intellectual development has led to a too exclusive preoccupation with intelligence ratings and a somewhat indiscriminate branding of almost all cases as feeble-mindedness with the general result of a rather crude and ineffective psychiatric practice in relation to these cases.

The book before us, being a systematic treatise on mental disorders of childhood, may therefore be regarded as a welcome addition to psychiatric literature.

Ziehen has yielded but slightly to Kraepelinian influence. His terminology, classification, and general point of view bring to mind the psychiatry of a passing generation. However, the student should find no difficulty in familiarizing himself with the senses in which Ziehen uses words and in the end gaining an excellent view of the material on which the work is based.

Among dementing psychoses of childhood are mentioned epileptic deterioration; general paralysis, occurring on the basis of congenital syphilis, seen in one case at the early age of six years; and dementia præcox, a typical case of which Ziehen observed at the age of seven years. Every variety of manic-depressive disturbance is mentioned as occurring in children of school age; also hysterical, psychasthenic, and other psychoneurotic conditions.

Of great interest is the group of psychopathic constitutions, among which are mentioned hysterical, neurasthenic, depressive, hyperthymic, paranoid, obsessive, and some other types. The prognosis is quite unlike that of corresponding conditions in adults: they may be recovered from, or they may remain stationary, or they may lead to a fully developed psychosis.

Four possibilities of combination are discussed: (a) simple psychopathic constitution, (b) feeble-mindedness + psychopathic constitution, (c) psychopathic constitution + fully developed psychosis, (d) feeble-mindedness + psychopathic constitution + fully developed psychosis.

A. J. ROSANOFF

KINGS PARK STATE HOSPITAL

The Problem of the Nervous Child. ELIDA EVANS. New York: Dodd, Mead & Co., 1920. Pp. viii + 299.

Dr. C. G. Jung writes an introduction to this book in which we read: "This book, as the reader can see on almost every page, is the fruit of an extended work in the field of neuroses and abnormal characters. Despite the fact that there are numbers of books on education, there are very few that occupy themselves with a child's most intimate problems in such a careful and painstaking way. . . . The physician should be particularly indebted to the author, as her book will be a valuable coöperation in the fight against the widespread evil of neuroses in adults. More and more the neurologist of to-day realizes the fact that the origin of the nervousness of his patients is very rarely of recent date, but that it traces back to the early impressions and developments in childhood. There lies the source of many later nervous diseases. . . . Mrs. Evans lays much stress on the parent's mental attitude and its importance for the child's psychology."

Among the chapter headings are: The Development of Repression. Symbolic Thought. Defence Reactions. The Parent Complex. Buried Emotions. Muscle Erotism. The Tyrant Child. Teaching of Right and Wrong.

On the title page is quoted an ancient maxim: "He who reads to criticize seeks only to hide his own defects, but he who reads for understanding will find the truth." The reviewer can take a hint and will be careful.

The author advises against a discipline by force and compulsion in the bringing up of children: "The only discipline worth having is a natural one got by interest and habit. We require order and attention from children, and demand that higher discipline which is habitual and has become so by the operations of interest. Sincere endeavor and honesty of purpose can be relied upon only under conditions that favor their continuation. Force or compulsion of any kind, however necessary it may be, blunts honesty, dulls the zeal of the most whole-hearted efforts, and, if it comes with too much strength, will spoil all."

A. J. ROSANOFF

KINGS PARK STATE HOSPITAL

THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

INTROSPECTION AND GENERAL METHODS

BY KARL M. DALLENBACH

Cornell University

What is introspection? Pepper (9) in his article of that title takes up the answer systematically. He begins his paper by considering the influences which have tended to differentiate introspection from the method of the objective sciences; and then takes up the methods historically showing; first, that introspection is the older, indeed, "That the objective method developed out of introspection:" and secondly, that there is no qualitative difference between them. The latter is his thesis, which he develops (1) by the exposition and criticism of Titchener's analysis of introspection, which he, in opposition to Titchener, shows to be equally applicable to the objective methods; and (2) by the consideration of the kinds of processes studied, which furnishes him with a cue for the differentiation, which "is simply this, the objective data are picked, whereas introspective data are anything that comes along." Following this lead, he finds that in "a thoroughly developed objective science nothing is acceptable but visual data," whereas "the introspective method will accept any kind of experiences whatsoever as fit material for its processes." His conclusion is: "the distinction between the objective and introspective methods resides in the kind of processes described."

Of his thesis, that there is no qualitative difference between the two methods, there is no criticism; but not so of the arguments advanced in favor of his conclusion. They show a complete misunderstanding of the subject. His criticism of Titchener reveals a like condition; it is valid only in so far as it rests upon his exposition of Titchener which is garbled beyond recognition.

After raising and meeting the objections against introspection brought forward by certain behaviorists, Laird (7) arrives at the conclusion that "it seems both legitimate and necessary to assume that introspection has the same general characteristics as any other mental process by means of which we are able to apprehend the truth of fact." He then comes to the thesis of his paper which is that introspection, which is a "kind of cognition," ought to be regarded as a legitimate method of apprehending the mental phenomena "in spite of the numerous objections to this view which are either expressed or implied in contemporary psychology and philosophy."

The objections usually raised against introspection are classified and discussed under three heads: (1) its possibility, (2) its fallibility, and (3) its necessity. Laird's conclusions regarding these questions are: (1) that it is possible; that "there is no intrinsic absurdity in supposing that introspection is a process of direct cognitive acquaintance with our own minds;" (2) that it is not necessarily fallible; "Nothing can be transformed in any sense whatever simply owing to the fact that it is known," and (3) that it is necessary if we are to know the mind for "... introspection is the only means of direct acquaintance with the mind," because none of "... the characteristic of consciousness can be discovered by other than introspective methods."

After giving a brief history of psychology, Lalande (8) considers next the province, the objects, and the methods. The province of psychology is discussed under four headings: "(1) *Psychologie de réaction*; (2) *Psychologie de conscience ou de sympathie*; (3) *Psychologie réflexive et critique*; and (4) *Psychologie ontologique*."

Under methods, he takes up the introspective, the comparative, and that of the laboratory. The objections to introspection, he finds, "*sont beaucoup plus théoriques que pratiques*," and "*elles ne détruisent pas la possibilité de l'introspection*." In order to insure greater accuracy in introspection Lalande lays down five precautions: (1) the observed facts should be recorded as soon as possible; (2) many observations should be made in order that general results may be distinguished from individual; (3) the questionnaire and interrogatory methods do not give the psychological representations or the reasons which produced the subjects' responses, but simply crude results; (4) first-hand knowledge of the phenomena described is very useful and perhaps indispensable for a correct interpretation of the results; and (5) since auto-suggestion,

even with the most critical minds, is extremely easy, the reports should be surrounded by such conditions that the observers are unaware of the expected results. A separate chapter is devoted to the introspection employed in experimental work.

Lalande next treats the comparative methods, which he discusses under the following headings: (1) the pathological and psycho-analytical method; (2) the sociological and genetic methods; and (3) the methods of animal psychology. After which the most common of the laboratory and statistical methods are mentioned, and the article is concluded by a discussion of terminology.

Bourdon, in a short article (4), has attempted to reopen the controversy which for many years centered about Fechner's formulation of Weber's law. After pointing out the well known fact that Fechner's formulation differed from Weber's, he turns to his thesis, which is to show that the distinction and opposition of sensation and stimulus is an error. Both are alike; they are one and the same thing. He points in proof of this to the fact that "*Le psychologue et le physicien opèrent . . . incontestablement, sur les mêmes phénomènes et procèdent essentiellement de la même manière.*" In order to establish this argument, he reviews the traditional experiments—the shadow experiments and the lifted weight experiments—and shows that the psychologist in each and every one of them is judging the same phenomena and judging them essentially in the same way as the physicist. His conclusions therefore are that "*La loi de Weber ne doit pas être formulée de telle manière qu'elle implique une opposition de la sensation et de l'excitant;*" that "*La loi de Fechner doit être rejetée,*" for "*Fechner a mesuré, sous le nom de sensations et d'excitants, les mêmes phénomènes;*" and that "*Les sensations, en tant qu'opposées aux excitants, sont des fictions.*"

This article might well have appeared during the heat of the historical controversy, but it is difficult to understand why any one conversant with the psychophysics of the present day should take such a position.

The object of Thomson's (12) paper is "to show how the Constant or Fechner-Müller-Urban process of calculating thresholds can be deduced from first principles." He, in his opening paragraph, summarizes the article as follows: "The historical development of the process is first traced, and then contrasted with direct deduction. The latter throws into clearer relief the nature of the assumptions and approximations made, and justifies Urban's, as

against Müller's, Table of Weights." The article is apparently an excerpt from the paper with which Thomson won the prize of \$100 offered in 1914 and awarded in 1919 for the best paper on the Availability of Pearson's Formulæ for Psychophysics.

Johnson (6) publishes a note on Dunlap's method of determining the mean variation, in which he calls attention to a misprint in the original article of a *plus* for a *minus* sign in one of the formulae; points out that not only the application but also the method itself was developed by Dunlap; and adds another rule to the two given by Dunlap.

Boring has contributed three articles (1, 2, 3) to the general subject of statistical treatment of data. The first of these (1), "Mathematical *vs.* scientific significance," deals with the "apparent inconsistency between scientific intuition and mathematical result." After briefly reviewing the customary methods of determining the "significance" and "probability of difference," he mentions the common experience of those working with human data that "these methods frequently give values that are, on the basis of professional opinion, too high." This particular attitude is, he maintains, not due to the unreliability of professional opinion, but to the fact that the samples from which the "significance" is computed, even with the best methods of selecting the "unselected data," are frequently not representative of the total group. So the competent man, cognizant of this, "very often discards his mathematical results because in his judgment the mathematically 'significant' difference is nevertheless not large compared with what he believes is the discrepancy between his samples and the larger groups which they represent." All of which merely emphasizes the point with which Boring is concerned, namely that "statistical ability divorced from scientific intimacy leads nowhere."

In his second article (2) on "The logic of the normal law of error in mental measurement," which he tells us was the outgrowth of certain perplexing questions that arose in the Surgeon General's Office U. S. A. in connection with the ratings of recruits in the Army intelligence tests, Boring examines, first, the *Nature of probability*, considering it both historically and logically; and then the *Rôle of the Law of Error*, which he regards as "both an inspiration and a limitation in statistical measurement." This, too, he treats historically, considering its formulation by Laplace, its development by Gauss, its uncritical extension by Quetelet, its *a priori* application by Galton and the English school of biometricians,

the reaction against it lead by Lexis and Westergaard in Germany and to a lesser degree by Galton and Pearson in England; and he thus comes down to the present, where he considers its naïve and oftentimes unwarranted acceptance. A rather flagrant case is cited, and criticized in his third article (3) which is on the "A priori use of the Gaussian Law."

It is against the blind acceptance of the normal law, the Gaussian fetish, that he inveighs, and the sole purpose of this part of the second article is to remind the reader that there is no "magic to the normal law," and that there is no a priori reason for expecting it, but that, quite on the contrary, "we have considerable reason to expect not to find it, since the form of distribution depends on the unit of measurement, and we have arbitrarily chosen one of a possible infinite number of units."

After mentioning in illustration two experiments in which this problem arose,—in one the limitation of the normal curve was recognized and the observed facts were adhered to, and in the other there was a naïve acceptance of the law and a calibration of the material affected by reference to it,—he proceeds to show that belief in the universality of the normal law is due to analogy, which to a certain extent is justifiable in (1) games of chance and (2) digital expansion of numbers, where within each universe the same scale of units is throughout employed. In the distribution of (3) physical measurements, (4) mental measurements, and (5) psychophysical judgments the predication of the normal law is entirely another matter. With (3) the physical measurements the generalization is 'approximately' correct, "for a certain amount of alteration of the scale still leaves a sensibly normal curve;" but in (4) mental measurement, where a unit is still wanting, "we are very far . . . from a general conclusion that intelligence is normally distributed, and still farther . . . from stating that mental abilities follow the normal law." With (5) psychophysical judgments the generalization is permissible, when the scale and the judgments are related, as in the cases when the reports are judgments of stimulus, but not in "introspective" psychophysics where the judgments are given in terms of sensation, and are thus in no way related to the physical scale of units chosen.

For work in mental measurement there are four logical possibilities: (1) The a priori determination of the form of distribution,—a popular course, but without sanction and to be resisted; (2) the determination of the distribution from the psychological unit,—but

no applicable psychological unit has as yet been found; (3) in lieu of this, the determination of the distribution by some arbitrary "physical unit" such as year (mental age), second (time-measure), item (task test), gram (lifted weights), etc.,— but a physical unit is not a mental unit and can not be applied psychologically; and (4) the determination of the rank-orders of our psychological quantities,—the only procedure which at present is justified, since no unit is presupposed, and though the results are less intricate than those obtained by any of the other alternatives, a picture is represented by the serial constants "which, though rough, truly represents the rough material which they describe."

This series of papers can be read with profit by every student of statistical methods, particularly those working in the applied fields, in the standarization of mental tests, etc., for it is they who most frequently succumb to the "Gaussian fetish."

Another appeal to first principles in mental tests is made by Ruml (11), in an excellent article on "The Need for an Examination of Certain Hypotheses in Mental Tests." Deploing the fact that little of theoretical value has come from the work in mental tests, he calls into question three of the fundamental hypotheses which serve as the basis for all testing work.

He questions, first, the belief that general intelligence, even in quantitative terms, can be expressed as a linear or one-dimensional function; secondly, the supposition of linear regressions between test performance and general intelligence; and thirdly, the assumption of a static intelligence level, an assumption which "is necessary to mental test work as it is now conceived."

His explanation of the failure of theory to keep abreast of practice is: (1) That it is due to the historical derivation of mental tests; (2) that it is due to the inertia of thinking; (3) that it is due to bias, which may be attributed "to the nature of the terms in which the results have been expressed," and to the type of analysis "which our limited and frequently misused statistical technique makes possible"; and (4) that it is due to a willingness "to accept statistical hypotheses as applied to intelligence simply to have statistical technique available for use."

Herring (5), in an article which is a continuation of an earlier work, explains the method and technique that he employed in the development of his scale to measure abilities in scientific thinking.

The paper is divided into six parts. In Part I. he sets forth the principle under which he works, "that mental abilities are

distributed as are physical traits," *i.e.*, they are distributed according to the probability curve, and the assumptions made under it, which are, "first, the distribution of the abilities to be studied is normal; and second, the variability of each large randomly selected group of pupils is approximately the same as that of any other." In Part II, in order to establish the validity of his method, he considers the probability curve, explains the P. E. and his use of it as a unit of measure; and defines the terms and relations which he uses. In Parts III, IV, V, and VI the steps employed in the derivation of the scale are completely described.

Herring's exposition is very clear and definite. It is regrettable, however, that he did not spend more thought upon fundamental considerations. As it is, the article is a good example of the kind of work criticized by Boring and Ruml. The hypotheses upon which he constructs his scale are naïvely accepted as if incontrovertibly established.

Thurstone, in the exposition of his examination for College entrance (14), discusses the methods of evaluating the tests. His plea is for practicality, and to this end he discards the method of multiple correlation as a means of analysis and employs in its stead the method of "critical scores." This method consists "simply in plotting a scatter diagram for each test, showing relation between scholastic attainment and mental test score for each individual. An upper critical score is selected such that all who score above it are above the average in scholastic attainment. A lower critical score is selected such that all who score below it are below the average in scholastic attainment. . . . When the tests are combined . . . the median percentile rank is corrected by adding five points for each test in which the subject is above the upper critical score and deducting five points for each test in which the subject is below the lower critical score." The question that automatically rises at this point is: why five? Thurston offers no explanation for his selection of this value. It seems, however, to be satisfactory. The chief advantages of the method are: (1) it is more controllable than the method of multiple correlation for establishing diagnostically significant criteria; (2) it is easily applied; and (3) it emphasizes "prognosis with respect to each individual student rather than the abstract statement of relationship between the variables concerned."

Thurstone's plea touched a sympathetic chord in Pressey, who in a note of appreciation (10) offers three suggestions which would

further "the consideration of the practical problems of individual diagnosis in evaluating mental tests." The first deals with the method of evaluating the tests, and the second and third with the form in which the findings of the examination should be reported.

Another article which questions the tenets of technological psychology is published by Thorndike (13). It is on the constant error in psychological ratings.

Thorndike finds from a review of number of studies on ratings—studies made of employes in two large industrial corporations, of cadets in the aviation corps, of officers in the army, and of school teachers—that there is a "constant error toward suffusing ratings of special features with a halo belonging to the individual." He arrives at this judgment because the correlations between the different traits estimated "are too high and too even." "Obviously a halo of general merit is extended to influence the rating for the special ability, of vice versa."

As a consequence of this study Thorndike "has become convinced that even a very capable foreman, employer, teacher, or department head is unable to treat an individual as a compound of separate qualities, and to assign a magnitude to each of these in independence of the others." Therefore, "science seems to demand that, in all work on ratings for qualities, the observer should report the evidence, not a rating, and the rating should be given on the evidence to each quality separately without knowledge of the evidence concerning any other quality in the same individual."

REFERENCES

1. BORING, E. G. Mathematical *vs.* Scientific Significance. *PSYCH. BULL.*, 16, 1919, 335-338.
2. BORING, E. G. The Logic of the Normal Law of Error in Mental Measurement, *Amer. J. of Psychol.*, 31, 1920, 1-33.
3. BORING, E. G. A Priori Use of the Gaussian Law. *Science*, N.S., 52, 1920, 129-130.
4. BOURDON, B. La loi de Weber et celle de Fechner. *Rev. phil.*, 88, 1919, 119-121.
5. HERRING, J. P. Derivation of a Scale to Measure Abilities in Scientific Thinking. *J. of Educ. Psychol.*, 10, 1919, 417-432.
6. JOHNSON, B. Dunlap's Method for the Mean Variation. *Psychobiol.*, 1, 1918, 325-326.
7. LAIRD, J. Introspection. *Mind*, N.S., 28, 1919, 385-406.
8. LALANDE, Q. La psychologie, ses divers objets et ses methodes. *Rev. Phil.*, 87, 1919, 177-221.
9. PEPPER, S. C. What is Introspection? *Amer. J. of Psychol.*, 29, 1918, 208-213.
10. PRESSEY, S. L. Suggestions with Regard to Professor Thurstone's "Method of Critical Scores." *J. of Educ. Psychol.*, 10, 1919, 517-520.

11. RUMI, B. The Need for an Examination of Certain Hypotheses in Mental Tests. *J. of Philos., Psychol., &c.*, 17, 1920, 57-61.
12. THOMSON, G. H. A Direct Deduction of the Constant Process Used in the Method of Right and Wrong Cases. *Psychol. Rev.*, 26, 1919, 454-464.
13. THORNDIKE, E. L. A Constant Error in Psychological Ratings. *J. of Appl. Psychol.*, 4, 1920, 25-29.
14. THURSTONE, L. L. Tests for College Freshmen. *J. of Educ. Psychol.*, 10, 1919, 129-142.

WORK, FATIGUE AND INHIBITION

BY F. C. DOCKERAY

Ohio Wesleyan University

The interest in experimental investigation in this field is usually about equally divided between psychologists and physiologists. During the past three years, covered by this review, more attention seems to have been devoted to work and fatigue by the physiologists, due apparently quite largely to the demands of industry during a time when war conditions were putting the stress upon physical efficiency. It may also be true that the psychologist has felt the apparent futility of psychological investigation with the present methods. However, there have been some creditable investigations in the psychology of work and fatigue.

The influence of various degrees of knowledge of results during physical work has been investigated by Arps (3, 4). A Bergstrom ergograph was used. Three subjects, after long training, performed four "known" and four "unknown" series. A series consisted of eleven periods. Rests were introduced between every ten lifts, ranging from 0 to 10 seconds. In addition to the objective records, the introspective reports of the subjects were regularly recorded. It was found that both the absolute amount and the rate of work was greater with knowledge of results than without knowledge. But, as the experiments progressed, the differences were considerably reduced. This is assumed, on the basis of the introspective reports, to be due to experience and visual and kinæsthetic imagery. Habituation to the maximum volume of effort under the two conditions reduce to the minimum the efficiency difference. That there is still greater efficiency with complete knowledge is explained on the basis of a reënforcement of the neuro-muscular chain by the afferent channels from the eyes. When the work reaches the point of exhaustion a peculiar phenomenon of recovery appears, which can not be identified with the phenomena of fatigue. They are explained as more likely due to a functional grouping of neurones connected with the group of muscles involved.

The graphic recording of motor adjustments has received attention from various quarters. Morgan (31) required his subjects

to lift weights by pulling a rope, while the time was recorded in hundredths of a second. In the first series they were required to pull at their maximum speed and in the second series they were to attempt to pull at a speed that would equalize the pull according to the weight used. He concludes that the experiment is inadequate to answer the question as to whether one can control the force independently of time and extent of movement. Levick (26, 27) recorded the response to a single stimulus, a constant current, by means of a tambour transmission myograph and found departures from the normal which he claims can not be seen without such a method. His observations were made on human subjects. A muscle, when stimulated at various intensities, responds with contractures of various intensities, but of equal duration, whether the stimulus is long or short. Impairment of the motor nerve caused a lengthening of the response. Galleotti (11) and Gemelli (13) report briefly their work on the perception and control of muscular movement with the idea of its application to aviation. Galleotti required his subjects, blindfolded, to hold a lever in a specified position while a weight suspended from the lever was varied from two to twelve kilograms. The movements of the lever were recorded on a kymograph. The results are summarized as follows: (1) Excellent curve, indicating excellent aptitude. The curve remains in the middle zone of the tracing. (2) Mediocre curve, ascending and descending with not very high nor uniform variations. (3) Poor curves, which indicate inaptitude rightly to regulate the muscular activity, deformed with great indentations and jumps. In Gemelli's experiments the subject was required to move the lever against a fixed resistance. The time required for the movement and the accuracy of judgment of effort required were taken as a measure not of his motor ability, but of his attention ability. The success in the application of these results to aviation pilots apparently has not yet been published.

Robach (33) has presented an extensive analysis of the interference of voluntary impulses. His problem was to investigate the phenomena, conscious and unconscious, resulting from a condition of rapidly alternating impulses. Green dots and red crosses were exposed at a constantly increasing or decreasing rate. The subject was required to tap twice on one key for one and twice on another key for the other. A series required slightly over three minutes. The objective and introspective records indicated that the primary determining tendency was the direction of least effort.

More omissions and fewer additions were made on the more difficult key. Additions following omissions were explained as due to a secondary tendency of an attempt to carry out instructions. Rhythm was expressed by (a) seemingly automatic repetition, (b) repetition of the same mistakes, (c) creating spontaneous rhythm and (d) by stopping on odd numbers. Grouping of mistakes seemed due to attention being fixed on one mistake. An attempt is made by the author to apply the results to education and ethics, the idea being that it may be possible to find dynamogenic and inhibitive types.

Bethe (8) has observed the voluntary control of antagonistic muscles. The observations were made on soldiers with arms amputated midway between two joints. Hooks were attached to the flexors and extensors. At first contraction of one set was accompanied by relaxation of the other in spite of the voluntary effort of the subject. By practice, however, this relaxation was partially overcome.

Another investigation of mental fatigue in school children has been made by the use of addition. Garth (12) tested over 700 school children in the third and fourth and the seventh and eighth grades. Each group added for two minute periods, the former group for a total of twenty-eight minutes, and the latter for forty-two minutes. The results vary from zero to five per cent. decrease in efficiency in the final period. An analysis is made of variability, practice effects and related phenomena. Thorndike (36) distinguishes between the curve of work and the curve of "satisfyingness." Twenty-nine adults worked two hours and five, four hours, grading printed compositions. The speed and accuracy of the work were recorded by twenty minute periods. The subjects also recorded at the end of each period on a basis of 0 to 10 their degree of "satisfyingness" or feeling of fatigue. The results indicate that, though speed and accuracy are very little affected, "satisfyingness" has gradually decreased in a marked degree throughout the period. Berliner (7) reports the influence of the day's work upon visual imagery. Her subjects were shown a picture for five seconds. Then, after sitting with eyes closed for thirty seconds, they attempted to recall a visual image of the picture. The time of recall and duration of the image were recorded on a kymograph. The duration of the image was greater in the morning. The effect of mental work on physical efficiency is briefly presented by Zondek (44). Writing for a given period

constituted the so-called mental work. By means of a Weber ergograph, the leg muscles were shown to be fatigued. It was assumed that fatigue products generated in the brain, affected the muscles by way of the blood stream. Unfortunately no account seems to have been taken of muscular contraction or change in circulation during the writing.

Ryan and Gordon (34) have attempted to find better methods of measuring fatigue quantitatively. Visual acuity, copying and the systolic and diastolic blood pressures proved negative. The vascular skin reaction, or the observation of the duration of the appearance of the white line produced by stroking the skin with a blunt point was used. Physical exercise decreased fading time and rest increased it.

Tonus and tetanus are believed by Hoffmann (19) to be the same. The tonus reflexes apparently are not susceptible to fatigue. After greatly fatiguing the extensors of the foot by repeated standing on tip toe, the posterior tibial nerve was stimulated by the induction current. A series of reflex action currents were obtained which were identical to those of the fresh muscle, indicating that the reflex centers were not fatigued. He concludes that it is probable the nerve end organs of the tendon reflex, probably the sensory ending in the muscle, are as little susceptible to fatigue as the reflex arc in the spinal cord. Marni (29), working with the synapse of Mauthner, found the cell body smaller after slight over-activity, but shrunken with exhaustion. The Nissl bodies were in a state of chromatolysis. The synapse showed a number of amoeboid glia cells, showing that catabolism processes occur in the synapse as the effect of pathological nutritive conditions in fatigue.

A number of experiments with the chemical products of fatigue tend to confirm the earlier results of Lee and Burridge and extend the results regarding the counter effect of adrenalin. On the other hand Lee and Aronovitch (24) are lead to believe Weichardt's theory of fatigue toxin can not be confirmed. When the juice pressed from a fatigued animal was perfused into a normal animal or an excised muscle, the latter presented all the symptoms of fatigue, but the same effects were produced when the juice from a normal animal was used. Scott (35) is of the same opinion, suggesting that substances carrying H ions are the causal agents of fatigue. Certain products of protein disintegration may also produce fatigue symptoms. Gunzberg (18) observed the gastrocnemius of the frog perfused with Ringer's solution. Bubbling oxygen through the

solution prolonged the curve of work. The use of CO_2 had the opposite effect. He explains the staircase effect as due to the metabolic process necessary for securing sufficient concentration of lactic acid. Gruber and Kretschmer (15) and Guglielmetti (17) followed the perfusion of lactic acid and acid potassium phosphate with a perfusion of adrenolin. Marked recovery was manifested in nearly every case. Gruber (16) found that epinepherin counteracted fatigue produced by acid sodium phosphate, but in all cases vaso-constriction was so great as to cause almost complete cessation of the passage of the perfusion fluid through the muscle. Wahl's results (42) indicate that muscular fatigue raises the creatinine output.

Dawson (10) studied his own cardio-vascular reactions during physical exercise and fatigue. He found that training decreased the pulse in rest and increased the diurnal variations in systolic and pulse pressures. The feeling of distress during exercise had no relation to the heart rate and blood pressure at the cessation of the exercise. When distress followed the exercise, it had no relation to the blood pressure, but the heart rate was greatly decreased. Young, Breinl, Harris and Osborne (43) compared the effects of light and prolonged exercise with hot room experiments. The results indicated that the exercise and humid heat cause a rise in blood pressure, pulse rate and rectal temperature. Burnham (9) reviews the literature on optimum humidity investigations. Viale (39) attributes the troubles of temperature regulation during exercise to exhaustion of water in the tissues. Mendenhall (30) fatigued frogs by compulsory exercise and measured the threshold of irritability of the heart, and found that with extreme fatigue there is first a decrease in irritability followed by a rise. Moderate fatigue caused a marked rise.

Respiration during exercise on a bicycle ergometer was studied by Amar (2). He used a valve respirometer of his own invention. The curve of pulmonary ventilation rose during exercise and reached its maximum in three minutes and then maintained a constant level. On cessation of work the curve descended to normal as quickly as it rose. Krogh and Lindhardt (22) tested respiration before and after the exercise on the bicycle ergometer. The oxygen deficit caused by the lagging behind of absorption in the first minutes of work was not compensated for during the work, but could be measured when work ceased.

Benedict and his associates (5) reduced the diet of college men

and noted their mental and physical efficiency over a period of three weeks. No adequate tests were used, but it is reported that the diet did not interfere with college work. Similar data were gathered by Krogh (21) concerning fat and carbohydrate diets.

Benedict and Johnson (6) and Longworthy and Baratt (23) conducted experiments in respiration chambers to determine the energy loss of young women during light household work. In the former experiment forty persons were used at one time. The increment in heat production during reading, standing, hemming, singing, dusting and sweeping was increased regularly in the order of the work named. Similar results were obtained in the latter experiments.

While the work in these experiments was of a somewhat make-believe sort, Waller and de Decker (40, 41) measured the energy loss in tailors and dock laborers at their regular work. The output of CO_2 was determined every hour throughout the day and in the case of one dock laborer the tests were continued for a week. Stated in terms of calories per square meter of body surface, the dock laborer produced 170 calories and the tailors averaged 32.4 calories per hour. The curve of production for the dock laborer increased during the morning and afternoon, the increase being greater in the afternoon.

The war industries have been the occasion for several investigations of efficiency involving fatigue and health, particularly in this country and England. Vernon (38) analyzed 50,000 accidents in munitions factories in England. He concludes that the fatigue of a twelve-hour day may increase the accidents among women workers two and a half times above the ten-hour-day level. Among men no difference was shown. A similar analysis (37) of the effect of a long work day on production showed that a reduction of hours increased not only their relative production, but their gross production. This was true of both men and women workers. Observations of Amar (1) lead him to estimate the physical work of women at forty per cent. of that of men. That her curve of endurance is low and irregular he assumes to be due to her intermittent cerebral activity. The metabolism of female munitions workers and the demands of the various types of factory work were studied by Greenwood, Hodson and Tebb (14) and Rosenheim (32). The various tasks in the munitions factory were divided into four classes and the required number of calories per hour determined. There was considerable variation in the results.

Kent (20) and Lee (25) have investigated industrial fatigue under war conditions in this country. Kent tested complex reaction times, acuity of vision and hearing and blood pressure. Close observations of workers were also made. Overtime proved inefficient. Application to work fell off markedly as the day progressed, particularly in the afternoon. Monday, following a day of rest, showed no fatigue. Lee investigated munitions factories "from the physiological standpoint" though he does not make clear, in this report, just what this method is. The curve of output was found to vary with the character of the work. Where close attention and exact muscular coördination, the output curve of the individual during the first period resembles that of a single excised muscle. In a markedly muscular operation there seems to be a steady fall from the first. In some cases ten minute rest periods were advised. The output was uniform from day to day and week to week. It was believed that the men never reached their physiological limit. Lord (28) believes that efficiency lies in the mental attitude. Worry and fatigue are more or less confused.

REFERENCES

1. AMAR, J. Les lois du travail féminin et l'activité cérébral. *Compt. rend.*, 1918, 167, 560-2, 788-91.
2. AMAR, J. La courbe de ventilation pulmonaire. *Compt. rend.*, 1919, 168, 828-30.
3. ARPS, G. F. A Preliminary Report on "Work with Knowledge and Work without Knowledge." *Psychol. Rev.*, 1917, 24, 449-455.
4. ARPS, G. F. Work with Knowledge of Results versus Work without Knowledge of Results. *Psychol. Mono.*, 1920, 28 (No. 125) pp. 41.
5. BENEDICT, MILES, ROTH & SMITH. Effects of Prolonged Reduced Diet on the Basal Metabolism, Nitrogen Excretion, Neuro-muscular Processes, Mental Condition and Work Efficiency of Twenty-five College Men. *Proc. Nat. Acad. Sc.*, 1918, 4, 149.
6. BENEDICT, F. G., & JOHNSON, A. The Energy Loss of Young Women During the Muscular Activity of Light Household Work. *Proc. Amer. Phil. Soc.*, 1919, 58, 89-96.
7. BERLINER, A. The Influence of Mental Work on the Visual Memory Image. *Amer. J. of Psychol.*, 1918, 29, 355-370.
8. BETHE, A. Beitrage zum Problem der willkurlich beweglichen Prothesen. *Munch. Med. Woch.*, 1916, 45.
9. BURNHAM, W. H. The Optimum Humidity for Mental Work. *Ped. Sem.*, 1919, 26, 311-29.
10. DAWSON, P. M. The Effect of Physical Training and Practice on the Pulse Rate and Blood Pressures During Activity and During Rest. *Amer. J. of Physiol.*, 1919, 50, 443-79.
11. GALLEOTTI, G. *Recherche biologiche sull' aviazione*, Tipografia Nazionale Bertero, Bertero, Rome., 1919, p. 143 f.
12. GARTH, T. R. Mental Fatigue. *Arch. of Psychol.*, 1918, 26, (No. 41).

13. GEMELLI, A. *Recherche biologique sull' aviazione*, Tipografia Nazionale Bertero, Rome, 1919, p. 58 f.
14. GREENWOOD, M., HODSON, C., & TEBB, A. E. Report on the Metabolism of Female Munitions Workers. *Proc. Roy. Soc., Pt. B.*, 1919, **91**, 62-82.
15. GRUBER, C. M., & KRETSCHMER, O. S., The Effect of Adrenalin upon the Fatigue Produced by the Injection of the Fatigue Products, Lactic Acid and Acid Potassium Phosphate. *Amer. J. of Physiol.*, 1918, **47**, 178-184.
16. GRUBER, C. M. The Antagonistic Action of Epinephrin to the Fatigue Produced by the Perfusion of Acid Sodium Phosphate. *Amer. J. of Physiol.*, 1919, **47**, 185-8.
17. GUGLIEMETTI, J. The Effect of Adrenalin on Muscular Fatigue in *Leptodactylus Ocellatus* (L. gir) and in *Bufo Marinus*. *Qt. J. Exp. Physiol.*, 1919, **12**, 139-51.
18. GUNZBERG, I. A propos de "l'escalier" dans les courbes du travail musculaire. *Arch. Néerl. de physiol.*, 1918, **2**, 664-8.
19. HOFFMANN, P. Ueber die relative Uermüdbarkeit der Sehnenreflexe. *Zeit Biol.*, 1919, **69**, 517-28.
20. KENT, A. F. S. Industrial Fatigue and Efficiency. *Engineer*, 1917, **124**, 331-2.
21. KROGH, A. Energy Exchange in Man. *J. of Physiol.*, 1919, **52**, lxxiv.
22. KROGH, A., & LINDHARD, J. The Changes in Respiration at the Transition from Work to Rest. *J. of Physiol.*, 1920, **53**, 431-9.
23. LANGWORTHY, C. F., & BARATT, H. G. Energy Expenditure in Household Tasks. *Amer. J. of Physiol.*, 1920, **52**, 400-408.
24. LEE, F. S., & ARONOVITCH B. On Weichardt's So-called "Fatigue Toxin." *Amer. J. of Physiol.*, 1918, **45**, 537.
25. LEE, F. S. Some Phases of Industrial Fatigue. *Amer. J. of Physiol.*, 1918, **45**, 535-6.
26. LEVICK, G. M. The Adjustment of Response to Nerve Stimulus in Voluntary Muscles. *Brit. Med. Jour.*, 1919, **1**, 369-71.
27. LEVICK, G. M. Graphic Records of Muscle Reactions in Man. *Lancet*, 1918, **1**, 705.
28. LORD, C. B. The Cause of Industrial Fatigue. *Indus. Manag.*, 1918, **55**, 310-11.
29. MARNI, K. The Effect of Overactivity on the Structure of the Synapse. *Jour. Comp. Neur.*, 1919, **30**, No. 3.
30. MENDENHALL, W. L. The Effect of Fatigue upon the Heart and Cardioskeletal Quotient. *Amer. J. of Physiol.*, 1919, **48**, 13-21.
31. MORGAN, J. B. The Speed and Accuracy of Motor Adjustments. *J. of Exp. Psychol.*, 1917, **2**, 225-48.
32. ROSENHEIM, O. A Preliminary Study of the Energy Expenditure and Food Requirements of Women Workers. *Proc. Roy. Soc., Pt. B.*, 1919, **91**, 44-61.
33. ROBACK, A. R. The Interference of Will Impulses. *Psychol. Mono.*, 1918, **25** (No. 111).
34. RYAN, A. H., & GORDON, J. H. The Quantitative Measurement of Fatigue. *Amer. J. of Physiol.*, 1918, **45**, 537-8.
35. SCOTT, E. L. Fatigue Products. *Amer. J. Pub. Health*, 1918, **8**, 735.
36. THORNDIKE, E. L. The Curve of Work and the Curve of Satisfyingness. *J. of App. Psychol.*, 1917, **1**, 265-7.
37. VERNON, H. M. The Health of Munition Workers in England. *Sci.*, 1917, **46**, 353-4.
38. VERNON, H. M. *Causation of Industrial Accidents*. Ministry of Munitions, Health of Munitions Workers Com. Mem. No. 21, 1918, pp. 46.

39. VIALE, G. Sur les troubles de thermo-regulation dans la fatigue. *Arch. ital. de biol.*, 1918, 68, 171-6.
40. WALLER, A. D. Reports on the Relation between Muscular Work and CO₂. *J. of Physiol.*, 1919, 52, 47-73.
41. WALLER, A. D., & DE DECKER, G. The Physiological Cost of Tailor's Work, Measured by CO₂ and Expressed in Calories. *J. of Physiol.*, 1920, 53, 73-74.
42. WAHL, M. Créatine et créatinine. *Arch. de med. exp.*, 1918, 28, 103-54.
43. YOUNG, W. J., BREINL, A., HARRIS, J. J., & OSBORNE, W. A. The Effects of Exercise and Humid Heat upon Pulse Rate, Blood Pressure, Body Temperature and Blood Concentration. *Pro. Roy. Soc.*, 91-B, 1920, 111-126.
44. ZONDEK. Die ermüdende Einfluss von rein psychischer, affectloser Arbeit auf den peripheren Teil der Muskularbeit. *Arch. f. Anat. u. Physiol.*, 1916, 360-366.

REACTION TIME

BY V. A. C. HENMON

The University of Wisconsin

Gatewood (2) investigated the speed and accuracy of the reactions of the fingers of the two hands in response to visual stimuli. Following an historical summary, the bearings of the results on development of technique in the playing of musical instruments are discussed. Individual differences are marked, both in speed and accuracy. The effect of practise, instead of resulting in a uniform increase with each finger, is to equalize the reactions of the several fingers. Reactions of fingers on the right hand (in right-handed persons) are on the average faster than those on the left hand, while differences in accuracy are slight. The effect of combining reactions is to increase speed and accuracy. Two-finger reactions, at least where there is a double stimulation, are faster and more accurate than single-finger reactions. Two-hand combinations give faster reactions than combinations in which both fingers are on the same hand.

Braendle (1), of the Cambridge Psychological Laboratory, describes a new voice reaction key that may be used with the Hipp chronoscope. For the description and diagrams reference must be made to the original paper.

REFERENCES

1. BRAENDLE, E. W. A Voice Reaction Key. *Brit. J. of Psychol.*, 10, 1920, 312-314.
2. GATEWOOD, E. L. Individual Differences in Finger Reactions. *Psychol. Monographs*, 28, 4, 1920, 1-43.

ESTHETICS

BY RUDOLF PINTNER

Ohio State University

Hartman (9) presents a systematic treatise covering the whole field of æsthetics, and in particular raises the question as to what, to the discriminating individual, constitute the elements of interest in painting, music, or poetry. The author's endeavor, according to his statement, is not to increase art appreciation. He sets himself the much more ambitious task of attempting to "correct the methods so long in vogue for determining the substance, origin and value of art." The book is written in a controversial spirit, showing little patience with the psychological studies bordering upon æsthetics. Instead of trying to evaluate them for what they are worth, he tends to blame them for not going further. He deals critically with the hedonistic, expression, and experimental theories of art, as well as with the nature, origin, and value of art, the relation of art to truth and to morality, and similar topics. The three concluding chapters of the book deal with the author's theory of art, which he calls the empirical theory, as applied to painting, poetry, and music.

In a long theoretical treatise, Hamann (8) discusses the fundamental basis of æsthetics, dealing at length with the methods of æsthetics. Another theoretical article covering the general field of æsthetics is that of Bullough (3), in which special attention is paid to the specific problems of psychology. This is a study of the conditions of mind in which we call certain things beautiful. He pleads for a more intensive study of the artist himself as well as of the objects of art, and he calls attention to the need of comparative æsthetics, by means of which we could check up our European theories against the art of nations that have been uninfluenced by European civilization, *e.g.*, China.

Two other theoretical articles are contributed by Lethaby (14) and by Dunlap (5). Lethaby discusses in a popular way the question of what is beautiful, and brings it into close relationship with practical life. He opposes the Aristotelian conception of Fine Art as being free of utility. "Art is service before it is delight; it is labor as well as emotion; it is substance as well as expression." "Art has everywhere developed from what were supposed to be

utilitarian purposes." "Art is complete and noble workmanship." Dunlap does not attempt such a wide scope but limits himself to a discussion of the significance of human beauty for the race. This leads to a very interesting discussion of the negative and positive characteristics of the beauty of the human body, taking up such details as bodily proportions, the features, hair, complexion, and so forth, and leading to the conclusion that beauty is "the sign and the expression of the potentiality of the individual"—what he is capable of doing for the species. Prettiness is differentiated from beauty by the possession of a few characters of beauty which, however, promise little for the stamina of the race. Real beauty is, therefore, something vitally important for the human race.

Four experimental studies dealing primarily with pictures are reported. Otis (15) investigates the conditions that favor the apperception of the manifold in a unit, since "the inner agreement of meaning in the manifold is essential for the beautiful object." Tachistoscopic presentation of small cardboard forms in different arrangements is the method of procedure. The factors studied are size, contiguity, color, and the like. Cattell, Glascock and Washburn (4) had various groups arrange in order of "desire for ownership" 36 Cosmos prints ranging from the sentimentally popular to the technically great. The group of students having artistic training, and the group without artistic training but with interest in art, both correlated about $+ .4$ with the order of the pictures arranged by experts. The group of students with no training or interest in art correlated $- .11$.

The next two studies deal with children. Berliner (2) had groups of children in grades 3 to 8 rank 16 picture postcards. She finds that the ranking order is to a high degree the same for all grades and for both sexes. The correlation of the order for children with the order for university students is, however, negative. She, therefore, concludes that there is a distinct break in æsthetic preference between the elementary school and college. This, she maintains, is not due to social standing but to age, in spite of the fact that the children were all inmates of an orphan asylum, and that she had no control group of children in a school of high social standing. Pintner (16) had 178 children, ages 6 to 14, and 83 adults rank pictures in order of preference. The six pictures were six different executions of the same theme, ranging from very good to very poor. He found that conformity to æsthetic standards develops early and increases gradually with age. He found no

such sharp break as reported by Berliner, although it is to be remembered that Berliner had pictures of different subjects, whereas Pintner's pictures were all of the same theme.

Dealing more specifically with music, there are seven titles. Lee (13) deals in a popular way with what music does in the mind of the hearer. He studies this by the questionnaire method, but does not present his results statistically. He finds, of course, that some listen to the music specifically and others remain more passive and let the mind wander, and he might have added that these two modes of response, as he calls them, shade off into one another, according to the mood of the observer and the type of music presented. Feldkeller (6) deals with somewhat the same problem but in a more subjective manner. He emphasizes the participation of the intellectual processes in the enjoyment of the best music. He draws a comparison between the style of music and the prevailing type type of thought and philosophy of the period. His article is a protest against the over-emphasis of *empfindung* and feeling in æsthetic enjoyment.

Beaunis (1) discusses the emotional element in music. He deals with the emotional effects of rhythm, duration, intensity, pitch, timbre, and the general sympathetic vibration of the body. Musical emotion is conditioned by three factors (1) the particular mentality of the listener; (2) the auditory sensations (æsthetic element); (3) the organo-muscular and tactile sensations (passionate element).

Seashore's (20) book is by far the most important contribution to the psychology of music during the last few years. It is, furthermore, a very distinct contribution to vocational psychology. It sums up, in practical form, much of Seashore's work. This brief notice must suffice here, as it has already been reviewed at length.¹ Pond's (17) study is a detailed account of the particular difficulties involved in the study of the French horn, and his chief conclusion is that "improvement in the technique of instrumental music may thus result from an efficient employment of the method of introspective analysis."

The effect of different kinds of music on the heart and blood pressure is investigated experimentally by Hyde and Scalapino (10) in a short preliminary article. The minor tones of a symphony increased pulse rate and decreased blood pressure. The Toreador Song had a stimulating effect upon the circulation by increasing

¹ PSYCHOLOGICAL BULLETIN, Vol. 16, No. 10, October, 1919, pp. 352-355.

blood pressure and pulse rate. "It is possible that a careful selection of music may be a beneficial aid in the treatment of nervous disturbances." Finally Thomas (21) in a short note contributes nine native songs from southern Nigeria recorded in our musical notation along with a record of the rise and fall of the tones in the spoken words. He finds from the examples recorded hardly any connection between melody and tone.

Of articles dealing with literature, we have two. Reicke (19) gives a description of the soul of the poet and author. He discusses the type and power of the imagination, the increased sensitivity of the sense organs, the presence of different kinds of imagery, and supports his arguments by numerous examples in prose and verse. Jelliffe and Brink (12) analyze from the psychoanalyst's point of view the use of the dream made by Barrie in his play "Dear Brutus." Dreams reveal our unknown desires and so "Barrie draws the curtain from the desires in their nakedness." But he also introduces Lob into the play, so that he, as the dream itself does according to the psycho-analyst, may arouse the mind to its own best possibilities. The authors thus interpret Barrie's play from the point of view of modern psychoanalysis.

Among miscellaneous articles touching on Aesthetics, we find Geiger's (7) estimate of the work of the late Theodor Lipps. He attempts to sum up the salient points in Lipp's work and to place it with reference to philosophy and psychology. Jelliffe (11) interprets art as a therapeutic agent both for the artist and the spectator. In Freudian terms it may be a harmless discharge of repressions or a sublimation on a very high level. There is also a symbolic interpretation of the colors and of the subjects chosen by the artist. Read (18) in a short note, written during the war, refers to the possibility of using the suitable personnel in the British armies to take note of all works of art in occupied countries, and in this connection he is thinking largely of the opportunities for such with reference to primitive or ancient art in Palestine, Mesopotamia, Egypt, and East Africa.

REFERENCES

1. BEAUNIS, B. L'emotion musicale. *Rev. Phil.*, 1918, 86, 353-369.
2. BERLINER, A. Aesthetic judgments of school children. *J. of Appl. Psychol.*, 1918, 2, 229-242.
3. BULLOUGH, E. The relation of aesthetics to psychology. *Brit. J. of Psychol.*, 1919, 10, 43-50.
4. CATTILL, J., GLASCOCK, J., & WASHBURN, M. F. Experiments on a possible test of aesthetic judgment in pictures. (Minor Stud. fr. Psychol. Lab. Vassar College). *Amer. J. of Psychol.*, 1918, 29, 333-336.

5. DUNLAP, K. The significance of beauty. *Psychol. Rev.*, 1918, 25, 191-213.
6. FELDKELLER, P. Der Anteil des Denkens am musikalischen Kunstgenuss. *Zsch. f. Aesth.*, 1915, 10, 161-190, 267-289.
7. GEIGER, M. Zur Erinnerung an Theodor Lipps. *Zsch. f. Aesth.*, 1915, 10, 68-73.
8. HAMANN, R. Zur Begründung der Aesthetik. *Zsch. f. Aesth.*, 1915, 10, 115-160.
9. HARTMAN, H. G. *Aesthetics: a critical theory of art*. Columbus: R. G. Adams & Co., 1919. pp. 250.
10. HYDE, I. H., & SCALAPINO, W. The influence of music upon electrocardiograms and blood pressure. *Amer. J. of Physiol.*, 1918, 46, 35-38.
11. JELLIFFE, S. E. Modern art and mass psychotherapy. *Bost. Med. & Surg. J.*, 1918, 179, 609-613.
12. JELLIFFE, S. E., & BRINK, L. "Dear Brutus:" the dramatist's use of the dream. *N. Y. Med. J.*, 1919, 109, 577-583.
13. LEE, V. Varieties of musical experience. *North Amer. Rev.*, 1918, 207, 748-757.
14. LETHABY, W. R. What shall we call beautiful? A practical view of aesthetics. *Hibbert J.*, 1918, 16, 443-454.
15. OTIS, M. Aesthetic Unity. An Investigation into the Conditions that Favor the Apperception of a Manifold as a Unit. *Amer. J. of Psychol.*, 1918, 29, 291-315.
16. PINTNER, R. Aesthetic Appreciation of Pictures by Children. *Ped. Sem.*, 1918, 25, 216-218.
17. POND, S. E. A Contribution to the Study of Instrumental Music. *J. of Appl. Psychol.*, 1918, 2, 52-66.
18. READ, C. M. The Registration of Works of Art in Occupied Countries. *Man*, 1918, 18, 73.
19. REICKE, I. Das Dichten in psychologischer Betrachtung. *Zsch. f. Aesth.*, 1915, 10, 290-345.
20. SEASHORE, C. E. *The Psychology of Musical Talent*. Boston: Silver Burdette, 1919, pp. xvi + 288.
21. THOMAS, N. W. Tone and Melody. *Man*, 1917, 17, 98-99.

THE APPLICATIONS OF PSYCHOLOGY TO INDUSTRY

BY HENRY C. LINK

United States Rubber Company

Psychology as applied to industry is today on the defensive, partly because industry has expected quick, concrete returns, whereas psychology could offer only piecemeal, tentative conclusions; partly because psychologists have approached industrial problems with an assurance which they were unable to realize in actual practise. On the part of business men there has been a failure to appreciate the necessary refinements of the psychological methods. On the part of psychologists there has been a failure to understand the intricacies of industry. There have been many application.

of psychology *to* industry, but not so many *in* industry. For this reason, the literature of the past two years is rather meager in proportion to the expectations that have been aroused. Probably it is still too early to expect published results from those who have entered the field of industrial psychology since the war. On the other hand, some of the most significant results published have been achieved by men who are not professional psychologists. In general, it may be said that industrial psychology is passing through a period of sophistication which is limiting the science in some directions but extending it in certain other directions. An encouraging development which promises much for the future is the establishment in many schools of business administration and other technical schools, of departments of applied psychology.

General Literature.—A revised edition of Muscio's *Lectures on Industrial Psychology* (25) is notable for the prophetic emphasis which it gives to the attitude of trade-unions toward applied psychology. This is a factor which American psychologists will probably come to regard with increasing seriousness. The book is also valuable for its intelligent discussion of applied psychology in its relation to various phases of scientific management. Aside from this, it suggests ways in which psychology *may* accomplish results in industry rather than results already achieved. Meyers (21, 22) and Frost (11) also point out ways in which psychology has been or should be applied to industry. What should be is often far from what can be; and if, as Frost claims, industry demands a race psychology which will contribute to the solution of racial difficulties, it will probably be disappointed for some time to come. Meyers short book outlines a program which is not so ambitious but which indicates nevertheless a considerable faith in the future of psychology as applied in industry and in other fields.

A distinctive contribution to the speculative literature of industrial psychology is made from the psychiatric point of view by Southard (36, 37, 38). His theme is that industry is ripe for the industrial psychiatrist. He develops this theme rather by an eloquent elaboration of industrial woes than by a statement of what the psychiatrist can actually do. His most striking example is drawn from a study by Ball (2) in which the latter says: "According to the records, every one of the strikers had something wrong with him from a nervous or mental standpoint (nearly all having a psychopathic history); it was noted that with three exceptions the 'strikers' cited as agitators were among those grading the highest

on the intelligence scale used." From a totally different but still highly relevant point of view, Brierly (4) analyzes the reasons for a prevailing suspicion on the part of employees toward psychologists. The underlying cause for this suspicion is the association of the psychologist with the tendency in industry to mechanize the worker, to warp his balanced development. "Is it psychologically possible," she asks, "to have docile, extremely controlled workers in industry, who are yet free, intelligent, and responsible members of a democracy outside of it?" In view of the dangers implied by this condition, Brierly sounds a timely warning against a tendency of psychologists to allow the immediate, practical needs of industry to dominate their outlook and so diminish their scientific autonomy.

In view of this warning, psychologists may well read with tolerance the opinions of Tead (39) and Marot (20). The description of the instincts in industry by the former may not be sound from a psychological point of view, but it will nevertheless give to the psychologist very valuable information about industrial conditions. The same may be said of Marot's intensely interesting little volume which describes industry as increasingly mechanizing the worker and destroying his creative instincts. (The creative instinct or impulse is bearing a pretty heavy load in current industrial literature.) In general, it may be said that the psycholanalytical viewpoint, even if crudely applied, is a valuable check to the more coldly objective attitude which characterizes the 'test' method. The essays of Carleton Parker (27) are, of course, the notable contribution to this point of view, combining as they do, in an admirable degree, actual contact with industrial conditions and psycho-economic speculation.

Interest in Work.—Closely related to this aspect of industrial psychology is the question of interest in work. From the psycho-analytical point of view, interest depends naturally upon the satisfaction of wishes, instincts, etc. Kitson (16) however, shows that interest in a thing may be developed by means of extending information about it, and he applies this principle to certain concrete industrial problems. Wolf (46) makes a very valuable and suggestive contribution to this problem. By providing workers with graphic charts describing the elements of their task, he aroused their interest to a remarkable degree and greatly increased their output. There is a large field for psychological experimentation here which has been practically untouched by industrial psychologists, though the principles involved are fairly definite parts of psychological dogma.

Army Tests.—So much has been written about the army tests that it is unnecessary to review them in detail here. The manual on Mental Tests prepared by Yoakum and Yerkes (47) will prove of inestimable value to every psychologist who is interested in mental examination, whether in industry or elsewhere. It is crammed with excellent tests and devices. The tests requiring little or no language ability are particularly significant for industrial use. The reviewer has seen the manuscript of Chapman's (9) forthcoming book on Army Trade Tests which is a companion piece to the one just mentioned and gives extremely valuable information about the details according to which trade tests are developed and applied. Toops and Pintner (28) point out a positive correlation between degrees of education and degrees of trade ability. Robinson (31) points out certain factors underlying the construction of trade tests. Chapman and Toops (8) show a successful application of the written trade test. Bingham's (3) account of the army personnel work ends by calling attention to the importance of job-specifications in industry, a condition which is being recognized with increasing vividness.

Employment.—The bulk of recent literature deals with problems of employment. The most comprehensive account of what is actually being done in industries in this field is given in two reports (1, 30) based on investigations made by a committee of the National Association of Corporation Schools. These investigations extended to over two hundred of the largest corporations in the United States and brought to light some very interesting and valuable information about the manner in which psychology was being applied under different industrial conditions. An extensive application of tests in a rubber tire company is described by Burt (5). The account is particularly valuable because it combines a mastery of applied technique with the actual experiences of the psychologist in putting his technique into effect. Burt briefly mentions many problems which are characteristic of an attempt to develop employment tests and put them into effective operation in an employment office. An account of psychology as applied to various phases of employment is given by Link (19). This book describes the actual establishment, including rating scales, training schools, individual activity records, job-specifications, and occupational tests, of a comprehensive employment technique in a large manufacturing concern.

Thurstone (42) describes the results of an experiment with 165 drafted men who registered for a night course in radio-telegraphy.

The tests given were compared with a daily progress report based on the subjects' receiving ability. Two tests in particular, an ingenious rhythm test modelled after the rhythms found in telegraphic sending and receiving, and an opposites test, gave significant correlations. The writer states that "the general intelligence tests are not as valuable for diagnosing ability to learn telegraphy as for general intelligence." Also that years of schooling have no apparent connection with ability to learn telegraphy, though schooling is a good criterion for the selection of wireless repair men. An interesting experiment with clerical workers by Carney (6) led him to conclude that highly specialized tasks may require particular ability which is discoverable only by tests designed for that purpose. For such tasks general intelligence tests are increasingly useful the higher in the organization scale these are applied. Thurstone (41) devised and standardized a clerical examination which was given to 100 employees of a large insurance company, the results being compared with the grade of office work in which the subjects were engaged. Insufficient data regarding the manner in which the correlations given were obtained make it impossible to evaluate this experiment. It may be said that underlying the use of such a standardized clerical test is the assumption that there is such a thing as general clerical ability. Whether this is true or not, it is a fact that the subdivision of clerical work in industry has been such that an employment office is constantly on the lookout for special rather than general clerical ability. Where job specifications for clerical work have been made, it has generally been revealed that the simple term *clerk* is a very general class name loosely applied to a considerable range of work involving many special abilities in widely varying degrees. No general clerical examination can do justice to this situation. Flanders (10) found no significant correlation between the general intelligence of express clerks and their degree of success. Some interesting problems in the learning process of typists are described by Chapman (7). A comparison between tests given by Toops and Pintner (28) to unemployed men with the grades at which the men left school leads to conclusions which would be expected. A set of tables to facilitate the computation of coefficients of correlation by the rank difference method prepared by the Scott Company (32) is a valuable convenience.

Rating Scale.—Rating scales are used by as many as, and probably by more industries than, use psychological tests. The investigation upon which this statement is based (1) gives an account of

various types of scales now in use, and some of the results which have been obtained. The term "rating scale" is called a misnomer, since it implies qualities of accuracy which the scale obviously does not have. The term "opinion record" is suggested instead. It is now generally agreed that the value of the rating scale is educational rather than diagnostic. Thorndike (40) nicely describes the constant error which affects all ratings by the term "aura." The probable effects of the aura are described in another way by Kitson (15) who shows that the use of two very dissimilar scales by the same people produced almost identical results. Kitson suggests a more careful analysis of the rating technique than has been made. A unique method of mutual rating is described by Shelton (33). All ratings are made by secret ballot, and every individual is rated both by his inferiors and superiors. This fascinating paper raises some very important questions, both from the point of view of psychological technique and industrial management.

Fatigue in Industry.—In a very fine monograph on the problem of fatigue, Spaeth (35) estimates the value of psychological fatigue studies to date as nil. Spaeth (34) also calls attention to the fact that the term fatigue as generally used by psychologists and physiologists has no practical value. A study made by Wyatt and Weston (45) in a cotton mill, covering a period of four weeks, with only four operators, shows the extreme intricacy which characterizes a fatigue study under industrial conditions. It was found that contingent factors were so numerous as to make it practically impossible to isolate any fatigue factor. In spite of the fact that the test used resembled the actual operation of winding to a very minute degree, it took three weeks before the effects of practice became negligible, and at the end of four weeks when the experiment came to a close these effects had not entirely disappeared. Finally, it was concluded that it was impossible to determine by the test used, the amount of fatigue produced in any individual by the industrial conditions under consideration. One of the features of this study was a diary in which each subject kept a record of the events of the entire day. A fatigue study made by Link (17) in which three tests were given five times a day for three weeks to 40 girls engaged in the visual inspection of shells gave results that could not be interpreted in any consistent manner. The most obvious result was the persistence of variations due to the learning process even at the end of three weeks. Later, the hourly pro-

duction or output of the same 40 girls was studied every day for a period of 3 weeks. The resulting composite production curve differs radically from the conventional fatigue curve for work of this nature. Production increased throughout the morning reaching its height shortly before noon. Directly after the luncheon hour production, instead of starting with an increase, started with a very marked drop. However, it gradually increased reaching the highest point for the day at 5:30 P.M. (Circumstances in connection with this study made it possible to obtain figures which showed that a group of 40 shell inspectors performed 3.6 per cent. more work per hour while working 10 hours a day than they did while working only 8.6 hours.) Muscio (25) adds to the evidence a study which shows that the value of fatigue tests is doubtful because the degree of fatigue present when the tests are applied is unobtainable. His results corroborate those obtained by Link in that they afford no evidence that fatigue, as judged by diminished capacity for work, is progressive throughout a day's work. Muscio's conclusion that the output of working subjects at any given time must be compared with that of resting subjects at the same time complicates the problem still further.

In this connection the importance of the work done by F. B. and L. M. Gilbreth (12) is not sufficiently recognized by psychologists. These investigators are not concerned with the theoretical problem of fatigue but with the practical steps which may be taken to reduce it. Acting on the general principle that all lost or unnecessary motion is a waste of energy, they have devised a beautiful technique for recording the movements which characterize individuals in certain situations, and subsequently eliminating those movements which are superfluous. This is one way of applying a technique to industry even though it may not be psychological in the conventional sense of the term. As a matter of fact, the Gilbreths are the ideal behaviorists. Unlike Watson, they do not even have to exert themselves to eliminate the terminology which introspective psychology has given rise to. They are concerned merely with movement, that is, the response of an organism to a certain set of occupational stimuli. Watson, in discussing the fatigue concept, (44), recommends that it be eliminated because it is no longer serviceable. He asserts that the psychological division of work into mental and physical has brought the psychology of fatigue to a helpless position. The Gilbreths, true to their technique, have never even concerned themselves with the psychophysical concept

of fatigue. Nevertheless, they have probably done more than anyone else to eliminate waste motion.

Psychology and Rate Setting by Time Study.—A new application of psychology to industry is suggested by Link (17) in connection with the prevalent method of setting tasks in industry. The procedure of setting a task for a group of workers is one of the most common and one of the most important problems in industry. In spite of attempts to reduce this procedure to a scientific basis by means of stop watch studies and a certain statistical treatment, it still remains largely rule-of-thumb. More than that, the so-called time-study method often contains elements which are not only scientifically unsound, but contrary to the dictates of common sense. This is exactly the type of problem which the psychologist should be able to handle, and offers a field for some original and very valuable contributions. Here are a few of the questions which are to be answered: In setting a task for a group of, let us say, fifty operators, how many individuals should a preliminary study be based on in order to arrive at a satisfactory task rate? How should the individuals chosen for the study be selected? How long should their work be observed? How far above the average ability should the task be set? What allowance should be made for practise and fatigue? These are only a few of the questions which have so far been left to guess work or personal opinion under scientific management. Underlying the whole problem of setting tasks is the problem of the *one best way*. Here again the most valuable work has been done by investigators who are not professional psychologists, notably the Gilbreths (13).

Industrial Psychology in Germany.—There has recently appeared in Germany a new Journal called, *Practische Psychologie*, edited by Dr. W. Moede (23, 24) and Dr. C. Piorkowski (29) of the Charlottenberg Advanced School. The first two numbers are given particularly to the description of new apparatus which has been developed for the examination of machine tool apprentices. This apparatus is designed specifically to meet various trade requirements and seems by far the best devised thus far for distinctly industrial applications. As yet, the actual work of testing this apparatus has not been extensively carried out, though initial steps of a very extensive program are already described (24). Tremendous importance is attached to the possibilities of this work by Schlessinger (32), in the first article of this new journal, even to the extent of regarding it as one of the chief cornerstones of a new and

greater Germany. The vocational viewpoint seems to dominate this group whereas American psychologists have certainly drifted away from the vocational approach. Still, Tramm (43) has an extremely interesting and practical study describing the systematic training of street car motormen according to the methods of applied psychology. The apparent energy and thoroughness with which this group is attacking its problems, promises some very fruitful results.

Other Applications.—The application of psychology to advertising and aviation, both of which are in a sense industrial, have been passed over here because of the fact that they are distinct fields requiring a special treatment which the scope of this review does not permit.

Popular Literature.—Applied psychology has reached the stage where it is proving valuable material for the pseudo-scientific pot-boiler. The mass of stuff written in this vein cannot be reviewed here. Probably this literature has done more good than harm, though for the present it has resulted in associating applied psychology in the minds of the public, including the industrial public, with character analysis, hand-writing interpretation, phrenology, and mental slide-rule reading. "*Measure your mind*" is the most common headline for magazine articles requiring a *punch*. Psychologists themselves are partly to blame for this, not so much because of the kind of publicity they have invited as because of the deceptive simplicity with which they have described or captioned their work. But by far the most important reason for the popular misunderstanding of psychology is the character of psychology itself. The applied psychologist, under the rapid fire questioning of people interested in his work, cannot avoid realizing how extremely vague and subjective the body of psychological doctrine really is. Such words, for example, as memory, judgment, determination or will power, mental, reason, perception, association, intelligence, concentration, etc., are all common, everyday terms which psychology has not yet loaded with a distinct, scientific content. Instead of being an aid, they are a great hindrance to applied psychology: in the first place, because they tend to give the student of psychology a misleading idea about the simplicity of mental traits; in the second place, because the applied psychologist is expected by industry to explain the very specific results of his experiments in terms of these vague psychological generalities. For instance, imagine a psychologist trying to measure an indivi-

dual's degree of concentration! The layman understands with difficulty that concentration is an abstract, descriptive term covering a wide variety of phenomena; that the psychologist can only measure the quality of an individual's response to tests *a, b, c, or d*; and that the inferences which he may draw from these measurements are very limited indeed.

In view of these facts, Watson's (44) treatment of the traditional psychological concepts may be considered one of the most important of recent contributions to the literature of applied psychology, whether in industry or elsewhere. His treatment of the fatigue concept has already been mentioned, and is typical of his treatment of other conventional psychological terms, many of which he drops entirely because of their hindrance to his attempts to reduce psychological phenomena to definite, objective terms. Naturally, this course involves initial clumsiness and inconvenience, but as far as applied psychology in industry is concerned, these inconveniences have long been felt. What is needed is a logical, clear-cut, point of view in order that the present chaos may be finally reduced to a body of consistent and objective psychological data. Watson's work is, in fact, the conscious methodology which practically all recent literature on industrial psychology has more or less explicitly implied.

REFERENCES

1. Application of Psychological Tests and Rating Scales in Industry. *Nat. Ass. of Corporation Schools*. Eighth Annual Proceedings, New York, 1920.
2. BALL, J. D. The Correlation of Neurology, Psychiatry, Psychology, and General Medicine as Scientific Aids to Industrial Efficiency. *Insanity*, 1919, 75, 4.
3. BINGHAM, W. V. Army Personnel Work. *J. of Appl. Psychol.*, 1919, 3, 1-12.
4. BRIERLY, S. B. The Present Attitude of Employees to Industrial Psychology. *Brit. J. of Psychol.*, 1920, 10, 210-227.
5. BURTT, H. E. Employment Psychology in the Rubber Industry. *J. of Appl. Psychol.*, 1920, 4, 1-18.
6. CARNEY, C. S. Some Experiments with Mental Tests as an Aid in the Selection and Placement of Clerical Workers in a Large Factory. *Bull. of the Extension Div., Indiana University*, 1919, 5, 60-74.
7. CHAPMAN, J. C. The Learning curve in Typewriting. *J. of Appl. Psychol.*, 1919, 3, 252-268.
8. CHAPMAN, J. C., & TOOPS, H. A. A Written Trade Test; Multiple Choice Method. *J. of Appl. Psychol.*, 1919, 3, 358-366.
9. CHAPMAN, J. C. *Army Trade Tests*. New York, Henry Holt, 1920.
10. FLANDERS, K. J. Mental Tests of a Group of Employed Men showing Correlations with Estimate Furnished by Employer. *J. of Appl. Psychol.*, 1918, 2, 197-206.
11. FROST, E. P. What Industry Wants and Does Not Want From the Psychologist. *J. of Appl. Psychol.*, 4, 1920, 18-25.

12. GILBRETH, F. B., & L. M. *Fatigue Study*. New York, Macmillan, 1919. Pp. xii + 175.
13. GILBRETH, F. B., & L. M. *Applied Motion Study*. New York, Sturgis & Walton, 1917. Pp. xl + 220.
14. KITSON, H. D. Vocational Guidance and the Theory of Probability. *School Rev.*, 1920, 2, 143-149.
15. KITSON, H. D. Comparison Between Two Scales for the Estimation of Intelligence. *J. of App. Psychol.*, 1919, 3, 310-317.
16. KITSON, H. D. Economic Implications in the Psychological Doctrine of Interest. *J. of Polit. Econ.*, 1920, 4, 332-336.
17. LINK, H. C. A Practical Study in Industrial Fatigue. *J. of Ind. Hygiene*, 1919, 1, 233-238.
18. LINK, H. C. A New Application of Psychology To Industry. *J. of Appl. Psychol.*, 1920, 4, 245-249.
19. LINK, H. C. *Employment Psychology*. New York; Macmillan, 1919. Pp. xii + 440.
20. MAROT, H. *Creative Impulse in Industry*. New York: E. P. Dutton, 1919. Pp. xiii + 146.
21. MEYERS, C. S. *Present Day Applications of Psychology with Special Reference to Industry, Education, and Nervous Breakdowns*. London: Methuen and Co. Ltd. Pp. xi + 180.
22. MEYERS, C. S. Psychology and Industry. *Brit. J. of Psychol.*, 1920, 10, 177-180.
23. MOEDE, W. Psychological Technique in the Vocational Guidance of Industrial Apprentices. *Praktische Psychologie*, 1919, 1.
24. MOEDE, W. Die Psycho-Technische Arbeits-Studie. *Praktische Psychologie*, 1919, 1.
25. MUSCIO, B. *Lectures on Industrial Psychology*. New York: E. P. Dutton, 1920. Pp. iii + 300.
26. MUSCIO, B. Fluctuations in Mental Efficiency. *Brit. J. of Psychol.*, 1920, 10, 317-344.
27. PARKER, C. H. *The Casual Laborer and Other Essays*. Harcourt, Brace and Howe, New York, 1920, 1-199.
28. PINTER, R., & TOOPS, H. A. Educational Differences Among Tradesmen. *J. of Appl. Psychology*, 1919, 3, 33-50.
29. PIORKOWSKI, C. A Study in Employment at the Auerlight Company. *Praktische Psychologie*, 1919, 1.
30. Psychological Tests and Results Obtained Therefrom. *Nat. Ass. of Corporation Schools*, Seventh Annual Proceedings, New York, 1919, 342-366.
31. ROBINSON, E. S. The Analysis of Trade Ability. *J. of Appl. Psychol.*, 1919, 3, 352-358.
32. SCHLESSINGER, G. Betriebswissenschaft und Psychotechnik. *Praktische Psychologie*, 1919, 1, 1-5.
33. SCOTT, COMPANY. Tables to Facilitate the Calculation of Coefficients of Correlation by the Rank Difference Method. *J. of App. Psychol.*, 1919, 3, 115-125.
34. SHELTON, H. Wood Mutual Rating. *Bull. of the Taylor Soc.*, Vol. 5, 1919.
35. SPAETH, R. A. The Prevention of Fatigue in Manufacturing. *Journal of Industrial Hygiene*, 1920, 1, 435-447.
36. SPAETH, R. A. The Problem of Fatigue. *J. of Ind. Hygiene*, 1919, 1, 22-54.
37. SOUTHARD, E. E. The Mental Hygiene of Industry. *Industrial Management*, 1920, Vol. 59, No. 2, 100-106.

38. SOUTHARD, E. E. The Modern Specialist in Unrest. *Industrial Management*, 1920, **59**, 462-466.
39. SOUTHARD, E. E. Trade Unionism and Temperment. *Industrial Management*, 1920, **59**, 265-272.
40. TEAD, O. *Instincts in Industry*. New York: Houghton Mifflin Co., 1919. Pp. xiv + 222.
41. THORNDIKE, E. L. A Constant Error in Psychological Rating. *J. of Appl. Psychol.*, 1920, **4**, 25-30.
42. THURSTONE, L. L. A Standardized Test for Office Clerks. *J. of Appl. Psychol.*, 1919, **3**, 248-252.
43. THURSTONE, L. L. Mental Tests for Prospective Telegraphers, A Study of the Diagnostic Value of Mental Tests for Predicting Ability to Learn Telegraphy, *J. of Appl. Psychol.*, 1919, **3**, 110-118.
44. TRAMM, R. M. The Systematic Training of Street Car Motormen According to the Methods of Psycho-Technique. *Praktische Psychologie*, 1919.
45. WATSON, J. B. *Psychology from the Standpoint of a Behaviorist*. Philadelphia: Lippincott, 1919. Pp. xi + 429.
46. WYATT, S., & WESTON, H. C. A Performance test under Industrial Conditions. *Brit. J. of Psychol.*, 1920, **10**, 293-309.
47. WOLF, R. W. *Non-Financial Incentives*. An address Made at the American Society of Mechanical Engineers, New York, Dec. 3, 1918.
48. YOAKUM, C. S., & YERKES, M. *Army Mental Tests*. New York, Henry Holt, 1920. Pp. xiii + 303.

DREAMS

BY MARY L. SMALL

Johns Hopkins Medical School

The literature on dreams published since 1916 may be characterized generally as unremarkable. It is devoted essentially either to the criticism, explanation, or illustration of the Freudian thesis. One real contribution, however, in the first class, is offered by Horton (II) who maintains that the levitation dream is a mental reaction to the changes in the sensorium produced by dilatation of the blood vessels after the short-lived constricting effect of adrenin, which is automatically aroused in response to chill. The dreamer's interpretation of the sensorium accompanying the action of adrenin itself accounts for the "angry Sheik" and "insufficient clothing" dream that so frequently precede the flying dream. Kinesthetic repose and the mid-state of attention are respectively the physical and psychical conditions requisite for such interpretations of these sensorii. The author has experimentally produced these conditions and occasionally experienced, along with them, illusions of flying, falling, and kinesthetic revelation.

Platt (17) and Kollarits (14) likewise list themselves as critics of Freud. The former suggests a somatic theory of dreams. He assumes that the conscious brain centers are more readily fatigued than are the perceptive centers, and need therefore more rest. At that period, then, when the perceptive centers are rested and awake, and while the higher centers sleep on, any stimulation will set off phylogenically and ontogenically facilitated brain paths in the perceptive regions. The hazy and irrelevant outline of dreams is caused by the "dragging in" of surrounding areas. The implications presented in this theory upset the whole foundation of orthodox psychology. Platt is aware of the difficulty but does not, in my estimation, cope with it successfully. The latter (14) treats of three kinds of dream assimilations. The first, the weaving into the dream of outward stimulation, such as a voice speaking to the dreamer, occurs only in light sleep, and the spoken words in Kollarits's experiments were disposed of in the dream as imposed, foreign material. The two other kinds of assimilations: the melting of one dream picture into another, and the representation of two different places or persons as one, are incompletely explained.

The very fervid anti-Freudians, Mott (15), Weber (21), Armstrong-Jones (2), direct their ire against the sweeping sexual interpretation of all dreams. By an appeal to the literature of "by-gone" days when no ban was put on free references to sexual matters, and partly by appeal *ad hominem*, they show that the activities of life expressing the self-preservation instinct—eating, exercise, reactions to fear, horror, etc.—are more fundamental than those connected with the instinct of the preservation of the species (sexual instinct) and are thus bound to be represented in the dream as frequently as the latter. Also, the artificial nature of symbolism precludes a recognition of the limits within which it may be legitimately used.

Strictly Freudian are the many clever interpretations of dreams with the introduction of new symbols: (6), (13), (19), (5), (7), (18), (1).

In addition, Ferenczi (8), by analysis of two types of dreams—one apparently unsexual but accompanied by unconscious bodily sexual expression (pollution), the other very apparently sexual but not accompanied by bodily sexual activity—demonstrates the rule that "it is only the strong *unconscious* wish that has access to bodily expression, while the foreconscious wish may release only psychical events."

Besides confirming experimentally many of the Freudian teachings, Abraham (1), by short exposures of pictures in the tachistoscope, produced in the dreams of normal persons the same "Nachlieferungen" that are observed in psychopathic individuals.

Another of Freud's tenets, namely, that the adult sexual constitution is formed from the original undifferentiated sexuality (bisexuality) of the human child, is evidenced by hermaphroditic dreams. Coriat (3) emphasizes the importance of these dreams as indicating a good prognosis in the course of the psychoanalytic treatment of homosexuality. They mark the first (neutral) stage of recovery after the definitely pathological homosexual dream; the second stage, or complete recovery, being signified by the heterosexual dream.

Attention is called in several papers (9), (20), (19), to the striking resemblance between the understanding and treatment of dreams, delusional states and mental conflicts in certain works of literature, and the Freudian interpretation of these mental processes. Freud (9), for example, analyzes the actions and dreams of the hero of the novel "Gradiva" and points out their conformity to those of the actual neurotic, as he understands them.

The whole subject of dreams has been put in commendable form both for the layman and for the student of psychology in several comprehensive but short and lucid treatises (4), (12), (16).

REFERENCES

1. ABRAHAM, K. Experimental Erregte Traumbilder in ihren Beziehungen zum indirecten Sehen. *Zeit. f. d. ges. Neurol. u. Psychiatrie*, 1917, 37.
2. ARMSTRONG-JONES, R. Dreams and their Interpretation with special Application to Freudism. *Jour. of Mental Sci.*, 1917, 63, 200-225.
3. CORIAT, J. H. Hermaphroditic Dreams. *Psychoanalytic Rev.*, 1917, 4, 388-392.
4. CRAIG, K. *The Fabric of Dreams*. Dutton and Co., N. Y., 1918.
5. DAVIDSON. Erklärung eines Alptraumes. *Int. Zeit. f. Arzt. Psychoanalyse*, 1917, 4, 207-208.
6. EISLER, J. Beiträge zur Traumdeutung. *Int. Zeit. f. Arzt. Psychoanalyse*, 1919, 5, 295-299.
7. FERENCZI, S. Traume der Ahnungslosen. *Int. Zeit. f. Arzt. Psychoanalyse*, 1917, 4, 208-210.
8. FERENCZI, S. Pollution ohne orgastische Traum und Orgasmus im Traume ohne Pollution. *Int. Zeit. f. Arzt. Psychoanalyse*, 1917, 4, 187-192.
9. FERUD, S. *Delusion and Dream*. Moffat, Yard and Co., N. Y., 1917. Pp. 243.
10. GROSSMANN, J. Ein Beitrag zur Traumdeutung. *Int. Zeit. f. Arzt. Psychoanalyse*, 1919, 5, 301-303.
11. HORTON, L. H. Levitation Dreams, Their Physiology. *J. of Abnor. Psychol.*, 1919, 13.

12. JOHNSON, A. Dream Analysis. *Proc. Soc. Psych. Research*, 1918, **30**, 33-133.
13. KARDOS, M. Zur Traumdeutung. *Int. Zeit. f. Arzt. Psychoanalyse*, 1919, **5**, 299-301.
14. KOLLARITS, J. Uber Traumassimilationen. *J. f. Psychol. u. Neurol.*, 1918, **23**, 163-170.
15. MOTT, F. W. The Psychology of Soldiers' Dreams, *Lancet*, 1918, **1**, 169-173.
16. NICOLL, M. *Dream Psychology*. Oxford Univ. Press, 1917. Pp. 208.
17. PLATT, C. The Origin of Dreams, A Somatic Theory. *Hahneman Monthly*, 1918, **53**, 193-203.
18. PUTNAM, J. J. The Interpretation of Certain symbolisms. *Psychoanalytic Rev.*, 1918, **5**, 121-150.
19. ROBITSEK, P. A. An Analysis of Egmont's Dream. *Jahrb. f. Psychoanal. u. Psychopathol. Forsch.*, 1917, **2**.
20. SADGER, J. The Unconscious and Dreams in Hebbel. *Imago*, 1913, **2**, 336-356.
21. WEBER, F. P. A Note on Dreams. *The Practitioner*, 1918, **100**, 472-482.

BOOKS RECEIVED

- MACDOUGALL, WILLIAM. *The Group Mind*. New York: Putnam's, 1920. Pp. xxii + 418. \$5.00.
- EDMAN, I. *Human Traits and their Social Significance*. Boston: Houghton Mifflin, 1920. xi + 467. \$3.00.
- PARKER, DEWITT H. *The Principles of Aesthetics*. Boston: Silver, Burdett, 1920. Pp. v + 374.
- LACY, BENJAMIN F. *Pessimism*. Philadelphia: Lippincott, 1920. Pp. 95.
- RIGNANO, EUGENIO. *Psychologie du Raisonnement*. Paris: Alcan, 1920. Pp. xi + 544. Fr. 15.
- GALLI, ETTORE. *Nel Dominio dell' "Io."* Milan: Unitas Società Edit., 1919. Pp. 205. L. 12.50.
- GALLI, ETTORE. *Alle Radici della Morale*. Milan: Unitas Società Edit., 1919. Pp. 414.
- PALCOS, ALBERTO. *El Genio*. Buenos Aires: Cooperativa Editorial Limitada, 1920. Pp. 448. \$3.00.
- CARLINI, ARMANDO. *La filosofia di G. Locke*. Firenze: Vallecchi, 1920. Pp. XCIV + 287. L. 10.
- CASOTTI, MARIO. *Saggio di Una Concezione Idealistica della Storia*. Firenze, Vallecchi, 1920. Pp. 443. L. 12.
- WIRTH, WILHELM. *Spezielle psychophysische Massmethoden*. Berlin: Urban & Schwarzenberg, 1920. Pp. 349.
- PFÄNDER, ALEXANDER. *Einführung in die Psychologie*. Leipzig: Barth, 1920. Pp. 383. M. 46.
- ROUMA, GEORGES. *El Desarrollo Fisico del Escolar Cubano Sus Curvas Normales del Crecimiento*. Havana: Casa Editorial Jorge Morlón, 1920. Pp. 133.
- MACKENZIE, WILLIAM. *Gli Animali "Pensanti."* Genoa: G. B. Marsano, 1920. Pp. 29. (From "Quaderni di Psichiatria," 7, 1920, No. 7-8.)
- PIKLER, JULIUS. *Theorie der Empfindungsstärke und insbesondere des Weberschen Gesetzes*. Leipzig: Barth, 1920. Pp. 26. M. 2.40.

- PHILLIPS, G. E. *Mental Fatigue*. Sydney: William Applegate Gullick, 1920. Pp. 103. 7s. 6d.
- SEASHORE, C. E. *A Survey of Musical Talent in the Public Schools*. University of Iowa Studies in Child Welfare, Vol. I, No. 2. Pp. 36. \$0.25.
- Revue de L'Institut de Sociologie*. Instituts Solvay, Brussels, 1920. 1, No. 1.
- La Escuela Moderna*. Editor: Gerardo Rodriguez Garcia. Madrid, 1920., 30, No. 7.

NOTES AND NEWS.

Dr. H. J. HUMPHSTONE, formerly of the University of Pennsylvania, has been appointed professor of psychology at the University of North Dakota.

Dr. L. R. GEISSLER, formerly of Clark College, has been appointed professor of psychology at Randolph Macon College for Women, Lynchburg, Va.

Dr. H. M. JOHNSON has been discharged from the Army and has accepted a position with the B. F. Goodrich Company, Akron, Ohio where he will carry on research in some problems of vision of importance in factory lighting.

THE following items have been taken from the press:

WILHELM WUNDT, professor of philosophy at the University of Leipzig, where he established the first laboratory of psychology, died on August 31, in his eighty-ninth year.

Dr. CHARLES MACFIE CAMPBELL, assistant director of the Henry Phipps Psychiatric Clinic, Johns Hopkins Hospital, had resigned to become professor of psychiatry at Harvard Medical School and director of the Boston Psychopathic Hospital.

Dr. SHEPARD IVORY FRANZ, of George Washington University and the Government Hospital for the Insane, and the editor of the BULLETIN, represented the American Association for the Advancement of Science at the recent Cardiff meeting of the British Association.

THE forthcoming establishment in the University of Paris of an Institute of Psychology is reported. The Institute will be administered by a council composed of Professors Delacroix, Dumas, Janet, Pieron and Rabaud, and the deans of the faculty of letters

and sciences. It will afford instruction, both theoretical and practical, in general, physiological, experimental, pathological and comparative psychology. It will be attached to the recently established Institute of Pedagogy, forming its pedagogical section. Other sections of the institute, dealing with the general applications of psychology and with vocational selection, will be formed shortly. The institute will grant diplomas to successful students in each of these sections and to those who, after attending other courses of instruction, have passed the examinations therein. It will also be open for research work in connection with the University doctorate or higher diplomas. Previously Professor Janet with his colleague, Professor Dumas, worked in psychopathology quite independently of the late Alfred Binet, who directed the psychological laboratory. Professor Pieron, Binet's successor, is now joining forces with the representatives of French pathological psychology, and the institute thus formed is also to encourage the applications of psychology to education and to industry.

The most meritorious research on *The Effects of Music* submitted to the American Psychological Association before June 1, 1921, will be awarded a prize of \$500. Intending competitors are advised to communicate with Professor W. V. Bingham, Carnegie Institute of Technology, Pittsburgh, Pa., from whom information regarding the conditions of award may be obtained.

THE
PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

MENTAL TESTS¹

BY FRANK N. FREEMAN

University of Chicago

THE ARMY TESTS

The widespread experimentation with the army tests, particularly Scale Alpha, and their influence on the development of other tests, makes it appropriate to give them the place of emphasis in this year's review. These tests, the publicity which has been given them and the large number of men who gained experience in giving tests by using them as psychological examiners in the army, are doing very much to popularize intelligence tests, and to make familiar the outstanding facts concerning human abilities which tests reveal. Much of the experimentation, to be sure, is the merely routine repetition of what others have done, but occasionally there is an investigator who attacks the problems from a slightly new angle.

Of considerable interest and value to those who are interested in the army tests is the publication of the virtually official manual under the authorship of Yoakum and Yerkes (48). The book contains a reproduction and description of the different scales which were in use in the psychological service, including the group tests, Alpha and Beta, and the individual tests, both language and performance. In addition are given directions for giving and scoring, scoring keys, the scheme for rating and for interpreting

¹ On account of the closing of one library and the moving of another at the time this review was being prepared some of the articles were not available. Those of especial importance will be included in the next article.

the rating on each scale in terms of the others. Besides this account of the tests themselves is a sketchy statement of the methods of designing the tests and a brief account of typical results. This account is evidently a popularized anticipation of the fuller and more technical report which is to follow. For the technical reader the present presentation will raise more questions than it will answer.

During the period covered by this survey there is record of the application of army test Alpha, the general group scale, to students in nine higher institutions and three high schools. The institutions and the authors of the studies follow: Dickinson College, M. G. Filler (6); Hamline University, G. D. Walcott (43); Southern Methodist University, H. T. Hunter (10); Purdue University, G. L. Roberts and G. C. Brandenburg (36); Oberlin College, E. S. Jones (11); University of Minnesota, M. J. Van Wagenen (42); Ohio State University, E. L. Noble and G. F. Arps (25); University of Oklahoma, A. M. Jordan (12); the high schools of Madison, Rock Island and Sioux City, I. N. Madsen and R. H. Sylvester (19, 20 and 21). From these studies data of interest can be gathered with reference to such matters as institution medians, class medians, differences between school groups and sex groups within institutions and correlation with marks.

While the comparison between institutions is somewhat vitiated by some uncertainty concerning the class and sex tested and the method of timing, it is apparent that there are rather wide variations. The highest freshman median recorded is that for the students at Yale, 159.5. The score for Oberlin freshmen is 153, and for the Ohio freshmen, 130. Other scores probably include women, for which an allowance must be made, as will appear shortly. The median at Dickinson is 141, at The Southern Methodist University, 127, and at The University of Oklahoma, 119. Making due allowance for the above-mentioned factors it appears that there is a difference in the general ability of typical students in various educational institutions, due either to selection or training. The explanation involves the general problem of the interpretation of test scores, but whether the differences be ascribed to training or capacity they present administrative problems, such as that of accrediting students and accepting degrees.

Almost uniform sex differences are found in favor of the men in the army test scores. That these differences are specialized rather than general appears when the scores in the individual tests

are compared separately. It appears that the superiority of the men, which amounts in total to from four to eleven points, resides almost entirely in their higher scores in tests 2 and 8, the arithmetic and information tests. The information test is clearly better adapted to men than to women. That the same difference appears between the sexes in the grammar school was found by Uhrbrock (41).

College and university students, and as well the high school students who were tested, are a very highly selected group. The poorest pupils in high school get a rating of C, and in some colleges very few, in others none, are rated as low as this. Undoubtedly a part, but certainly not all, of this superiority is due to training.

The practical usefulness of the tests is indicated to some extent by degree to which the scores correlate with school and college marks. The correlation in college varies from .305 to .52, and in high school from .20 to .38. Of the nine first honor men at Yale, out of 373 freshmen, two were below the median in the test. If the tests are to be used for prognosis a very wide margin of error must be allowed for. There is evidence that other tests are better adapted to the differentiation of high-grade ability.

In view of the usually moderate attainment of members of fraternities as measured by marks, it is interesting that at Dickinson fraternity men made 11.8 points more in the tests than others, and fraternity women 8.7 more. Different schools at Purdue varied from 124.1 (pharmacy) to 137.7 points (chemical engineering) median score, and at Ohio from 112 (veterinary) to 157 (graduate). A comparison of private school and high school alumni at Yale brought out no significant difference. The medians of successive classes indicate a steady and marked progression up to the freshman year of the college, and a less marked progression throughout the college. How much of this is due to elimination of the poor students and how much to maturity the evidence does not show.

Doll (4 and 5) argues from the reported results of the army tests that mental growth in the "average" individual ceases at 13 years, and bases his conclusion on the fact that the average "mental age" of recruits was found to be 13.5 years. He further proposes that 13 be used instead of 16 as the age to correspond to adult mentality in reckoning the IQ of adults. But the evidence is so strong that mental growth continues even beyond the age of 16 that a contrary result should lead to a search for imperfection in the test. Refuge cannot be taken in a fine-drawn distinction be-

tween pure growth and the result of experience, because nobody has succeeded in clearly separating the two. One clue is to be sought in the limitation in the difficulty of the test, which fails to give opportunity to the higher grades of ability, or to the type of ability represented in the older individuals.

TECHNICAL PROBLEMS IN ORGANIZATION AND EVALUATION

One of the problems which is prominent in the design of the modern point scale is the determination of the method of scoring the individual tests and of combining these scores; and a phase of this problem is the weighting of the individual tests. Two elaborate schemes of weighting are presented in the articles by Arthur and Woodrow, and by Herring (2 and 9). The tests used in the first-mentioned study are mostly familiar,—memory span, opposites, substitution, word-building, language completion, cancellation and comprehension (Kuhlmann's). They were given to children from six to thirteen years of age. The point value of each tests was calculated on the basis of its discriminative value, that is, the extent to which the scores from it were differentiated in successive years. The formula used was

$$D.V. = \frac{Av.1 - Av.2}{\frac{1}{2}(\sigma_1 + \sigma_2)},$$

in which *Av. 1* and *Av. 2* represent the average scores in two successive ages. The values obtained are used as point scale values, and the value of the score of a given age is found by adding the values up to that point. The value for each age of the entire scale is found by adding those for the individual tests. This, the authors hold, constitutes an absolute scale of mental growth; but it should be noted that the form of the growth curve still depends on the adaptation of the tests to the ability of the pupils at successive ages. Herring used successive grades instead of ages and found the differences in the median performance of successive grades in terms of the P.E. of the distribution in each of his 33 tests. Unlike Arthur and Woodrow, Herring relates his scale values to zero.

The technique of the interpretation of the scores in tests is discussed in three articles. Kelley (13) points out the important fact that the amount of overlapping in the scores of successive ages or grades represents the true overlapping in ability only when the test is perfectly reliable, and that the unreliability of tests has

resulted in gross overestimation of the true amount of overlapping. Thorndike (38) names and calls attention to a factor, which those who have dealt with estimates of ability must have noticed, through which the correlation between the estimates of various traits by the same judges is unduly raised. This factor, which Thorndike names appropriately the "error of the halo," is the effect on the judges estimate of an individual's capacity in a particular trait of his general opinion of the individual's ability. This factor undoubtedly has a large influence on school marks. Thorndike suggests its avoidance by having one person produce the data and another judge each trait independently on the basis of the data. Myers (23) points out what he calls a fallacy in correlation of test scores, which rests on the fact that if all unselected individuals—presumably by ages—are put into a group for the calculation of correlation, the coefficient will be higher than if the more homogeneous group within a given school grade are used—presumably again by ages. This by no means makes the first practice a fallacy. In fact, it is more useful for the administrator to know what the facts are, independent of the artificial grade grouping.

A series of brief studies on a number of tests, particularly to discover means of making them non-coachable, is reported by F. L. Wells and C. M. Kelley (47). The differential reaction of persons over fifty years of age to the tests of the Yerkes Point Scale is reported by Foster and Taylor (7). They find marked peculiarities in their scores in naming words, combining three words in a sentence, drawing from memory and rearranging dissected sentences, and give norms with these omitted.

MISCELLANEOUS CORRELATIONS

The possibility of finding specific tests in ability in aviation and of predicting success or failure in extreme cases is shown by Henmon (8). The composite series or team of tests selected as a result of the correlation study of each one gives a correlation with judgments of flying ability of .70. Parsons and Segar (26) found no correlation between the Bárány chair test and flying ability.

Practically identical results with the Pearson and the army rating scales used by instructors in rating college students is reported by Kitson (14). This suggests the need of investigating the error of the halo in the use of rating scales.

Several studies, in addition to those with the army tests, have

been made between tests and other measures of ability. Caldwell (3) reports a correlation of .44 between the adult Stanford tests and college marks in the case of students at the Randolph-Macon Woman's College, and .47 with estimated intelligence. Sunne (37) gave the Yerkes and Stanford adult tests to high school and college students and obtained correlations ranging from .43 to .74 in the point scale, and from .30 to .65 in the Stanford tests. The correlation between reading ability as measured by the Monroe Silent Reading test and general ability as measured by Alpha, is reported by Webb (46), also the correlation of Alpha and Thurstone's tests A and B tests with marks. The coefficients are, Alpha with comprehension .68, Alpha with marks .57, Thurstone A with marks .41, Thurstone B with marks .49. Ratings of college students by Scott's Rating Scale and college marks were found by Kohs and Irle (15) to have such low predictive value for promotion in the army as to be of no practical value.

DIFFERENCES BETWEEN RACIAL AND ENVIRONMENTAL GROUPS

Important differences between racial, occupational and regional groups are reported to have been found in the results of the army tests, but the complete returns have not yet been published. In the meantime less extensive comparisons are being made from time to time. Pressey and Teter report a comparison of 187 colored children with white children in Indiana by the Pressey group scale (34). In conformity with other studies they find the colored children about two years behind. Their inferiority is less in the simpler rote memory tests than in those which require thinking, and they are poorer in the later tests of the scale, which suggests fatigue. A similar difference was found by Partlow and Haines (27) in Alabama. A comparison of Chinese with American students made by Walcott (44) by means of the Stanford revision gave rather inconclusive results.

A comparison of children in a good and a poor country district in Indiana is made by S. L. Pressey and Thomas (35), and a comparison of country and city children and of four occupational groups in the city by L. W. Pressey (29). Another comparison of occupational groups is reported by S. L. Pressey and Ralston (32). In both studies in which country children were compared with city children the former were found to be markedly behind. Only from 20 per cent to 36 per cent exceeded the median of the city group. A considerable portion of this inferiority in the tests is

ascribed to incidental causes, but that some of it represents inherent difference in ability is strongly suggested by the fact that 16 per cent more of the children in the good country district exceeded the median of the city children than of the poor district. Within the city the occupations were grouped under the heads, professional, executive, artisan and laborer. The children stood in this order in the average scores of the groups, and in each case the average of the professional group was a little over double that of the laboring group. There was, of course, considerable overlapping.

Delinquents and dependents in four industrial schools in Alabama were found by Partlow and Haines (27) to be very inferior in a test patterned after the army test. Of the white boys and girls nearly half are below the five percentile score of normal children. The colored boy delinquents, however, differed much less from a random sampling of colored children. The group tests place in the lowest two percentile nearly all of those who are diagnosed by individual tests to be feeble-minded.

NEW TESTS OR NEW FORMS OF OLD TESTS

New group tests are appearing very rapidly. In addition to those which are described in the literature and which are referred to in the list of references below a few others which have come to the attention of the writer may be named. Space does not permit further description.

Author or Name	Grades	Type	Publisher or Distributor
Chicago Intelligence Test	7 to 12	Verbal	Univ. of Chicago bookstore
Dearborn, W. F.		Non-verbal	Lippincott
Haggerty, M. E.			
Delta 1.	1 to 4	Non-verbal	World Book Co.
Delta 2.	4 to 9	Verbal	World Book Co.
Kingsbury, F. A.	1 to 4	Non-verbal	Univ. of Ill. Bureau of Educ. Research
Illinois Examination.	{ 3 to 5	Verbal }	Univ. of Ill. Bureau of Educ. Research
	{ 6 to 8	Verbal }	
National Intelligence Test			
Scales A and B.	3 to 9	Chiefly verbal	World Book Co.
Omaha Group Test.	5 to 8 (?)	Verbal	P. R. Stevenson, Univ. of Illinois
Terman Group.	7 to 12	Verbal	World Book Co.
Trabue, M. E. and Stockbridge, F. P.	?	Mixed	Doubleday, Page & Co.
Whipple, G. M.	5 to 8	Chiefly verbal	Public School Pub. Co.

Besides those listed above a number of group tests have recently appeared, and are reported in articles. A group scale for primary

grades consisting chiefly in the adaptation of certain of the tests of the Binet Scale is described by Miss Lowell (17) and 18). Five tests each are places at ages five to nine. Scoring is on the age level principle. A group, non-verbal point scale of four tests for primary grades is described by C. and G. Myers (24). Pintner (28) is the author of a non-verbal group scale of six tests which gives a reasonably normal curve of distribution for children of the upper grades. A brief scale of crossout tests, that is, tests which can be passed by crossing out one element, has been devised by the Presseys (31). One of these is a test for moral judgments, and further suggestions are made for moral tests. These suggestions are elaborated in an interesting manner in the article by Pressey and Chambers (30). This is perhaps the most novel contribution to the field of tests during the year. The five tests are designed to measure, (1) emotional spread and displacement, (2) emotional distractibility, (3) moral discrimination and experience, (4) free association (with, however, limited choice), and (5) emotional memory.

Three adaptations of the Binet Scale are described by Pressey and Shively (33), who substitute terms involving practical information for these in the vocabulary test, by Lincoln and Cowdery (16), and by Washburne (45), who seeks to make an analytical diagnosis by classifying the tests according to mental function.

Three groups of tests having the purpose of vocational diagnosis are reported by Thurstone (39) and 40) and Murray (22). Thurstone's are general tests adapted in content to the experience and interests of the groups to whom they are given. Miss Murray attempted to distinguish four general types of ability among college students,—intelligence, accuracy, practical ability and social ability, but was not able to find convincing objective verification of her hypothesis.

REFERENCES

1. ANDERSON, J. E. Intelligence Tests of Yale Freshmen. *School & Soc.*, 1920, **11**, 417-420.
2. ARTHUR, G. & WOODROW, H. An Absolute Intelligence Scale: a Study in Method. *J. of Appl. Psychol.*, 1919, **3**, 118-137.
3. CALDWELL, H. H. Adult Tests of the Stanford Revision applied to College Students. *J. of Educ. Psychol.*, 1919, **10**, 477-488.
4. DOLL, E. A. The Average Mental Age of Adults. *J. of Appl. Psychol.*, 1919, **3**, 317-328.
5. DOLL, E. A. The Growth of Intelligence. *J. of Educ. Psychol.*, 1919, **10**, 524-525.
6. FILLER, M. G. A Psychological Test. *School & Soc.*, 1919, **10**, 208-209.

7. FOSTER, J. C., & TAYLOR, G. A. The Applicability of Mental Tests to Persons over Fifty Years of Age. *J. of Appl. Psychol.*, 1920, 4, 39-58.
8. HENMON, V. A. C. Air Service Tests of Aptitude for Flying. *J. of Appl. Psychol.*, 1919, 3, 103-109.
9. HERRING, J. P. The Derivation of a Scale to Measure Ability in Scientific Thinking. *J. of Educ. Psychol.*, 1919, 10, 417-432.
10. HUNTER, H. T. Intelligence Tests at Southern Methodist University. *School & Soc.*, 1919, 10, 437-440.
11. JONES, E. S. The Army Tests and Oberlin College Freshmen. *School & Soc.*, 1920, 11, 389-390.
12. JORDAN, A. M. Some Results and Correlations of Army Alpha Tests. *School Soc.*, 1920, 11, 354-358.
13. KELLEY, T. L. The Measure of Overlapping. *J. of Educ. Psychol.*, 1919, 10, 458-461.
14. KITSON, H. D. Comparison between Two Scales for the Estimation of Intelligence. *J. of Appl. Psychol.*, 1919, 3, 310-316.
15. KOHS, S. C. & IRLE, K. W. Prophesying Army Promotion. *J. of Appl. Psychol.*, 1920, 4, 73-87.
16. LINCLON, E. A. & COWDERY, K. M. An Abbreviated Mental Age Scale for Adults. *School & Soc.*, 1919, 10, 707-709.
17. LOWELL, F. A Preliminary Report of Some Tests of General Intelligence. *J. of Educ. Psychol.*, 1919, 10, 323-344.
18. LOWELL, F. A Group Intelligence Scale for Primary Grades. *J. of Appl. Psychol.*, 1919, 3, 215-247.
19. MADSEN, I. N. & SYLVESTER, R. H. High-school Students' Intelligence Ratings according to the Army Alpha Test. *School & Soc.*, 1919, 10, 407-410.
20. MADSEN, I. N. High-school Students' Intelligence Ratings according to the Army Alpha Test. *School & Soc.*, 1920, 11, 298-300.
21. MADSEN, I. N. The Army Intelligence Test as a Means of Prognosis in High School. *School & Soc.*, 1920, 11, 625-628.
22. MURRAY, E. Psychological Tests as Diagnosis of Vocational Aptitudes in College Women. *J. of Appl. Psychol.*, 1920, 4, 30-38.
23. MYERS, G. C. A Grave Fallacy in Intelligence Test Correlations. *School & Soc.*, 1920, 11, 528-529.
24. MYERS, C. & MYERS, G. A Group Intelligence Test. *School & Soc.*, 1919, 10, 355-360.
25. NOBLE, E. L. & ARPS, G. F. University Students' Intelligence Ratings according to Army Alpha Test. *School & Soc.*, 1920, 11, 233-237.
26. PARSONS, R. P. & SEGAR, L. H. Bárány Chair Tests and Flying Ability. *J. Amer. Med. Ass.*, 1919, 70, 1064-1065.
27. PARTLOW, W. D., & HAINES, T. H. Mental Rating of Juvenal Dependents and Delinquents in Alabama. *J. of App. Psychol.*, 1919, 3, 291-309.
28. PINTER, R. A Non-language Group Intelligence Test. *J. of Appl. Psychol.*, 1919, 3, 199-214.
29. PRESSEY, L. W. The Influence of (a) Inadequate Schooling and (b) Poor Environment upon Results with Tests of Intelligence. *J. of Appl. Psychol.*, 1920, 4, 91-96.
30. PRESSEY, S. L. & CHAMBERS, C. R. A Group Scale for the Emotions. *J. of Appl. Psychol.*, 1920, 4, 97-104.

31. PRESSEY, S. L. & PRESSEY, L. W. Cross-out Tests, with Suggestions as to a Group Scale of the Emotions. *J. of Appl. Psychol.*, 1919, 3, 138-150.
32. PRESSEY, S. L. & RALSTON, R. The Relation of General Intelligence of School Children to the Occupation of their Fathers. *J. of Appl. Psychol.*, 1919, 3, 366-373.
33. PRESSEY, S. & SHIVELY, I. M. A Practical Information Test for Use with Delinquents and Illiterate Adults. *J. of Appl. Psychol.*, 1919, 3, 374-380.
34. PRESSEY, S. I. & TETER, G. F. A Comparison of Colored and White Children by Means of a Group Scale of Intelligence. *J. of Appl. Psychol.*, 1919, 3, 277-282.
35. PRESSEY, S. L. & THOMAS, J. B. A Study of Country Children in (1) a Good and (2) a Poor Farming District by Means of a Group Scale of Intelligence. *J. of Appl. Psychol.*, 1919, 3, 283-296.
36. ROBERTS, G. L. & BRANDENBURG, G. C. The Army Intelligence Tests at Purdue University. *School & Soc.*, 1919, 10, 776-778.
37. SUNNE, D. The Relation of Scholarships to the Yerkes and Terman Adult Tests. *J. of Educ. Psychol.*, 1919, 10, 520-524.
38. THORNDIKE, E. L. A Constant Error in Psychological Ratings. *J. of Appl. Psychol.*, 1920, 4, 25-29.
39. THURSTONE, L. L. A Standardized Test for Office Clerks. *J. of Appl. Psychol.*, 1919, 3, 248-251.
40. THURSTONE, L. L. Mental Tests for Prospective Telegraphers, etc. *J. of Appl. Psychol.*, 1919, 3, 110-117.
41. UHRBOCK, R. S. Sex Differences as Noted in Grammar-school children. *School & Soc.*, 1920, 11, 507-509.
42. VAN WAGENEN, M. J. Some Results and Inferences derived from the Use of the Army Tests at the University of Minnesota. *J. of Appl. Psychol.*, 1920, 4, 59-72.
43. WALCOTT, G. D. Mental Testing at Hamline University. *School & Soc.*, 1919, 10, 57-60.
44. WALCOTT, G. D. The Intelligence of Chinese Students. *School & Soc.*, 1920, 11, 474-480.
45. WASHBURN, C. W. A Classified Scale for Measuring Intelligence. *J. of Educ. Psychol.*, 1919, 10, 309-322.
46. WEBB, L. W. Ability in Mental Tests in Relation to Reading Ability. *School & Soc.*, 1920, 11, 567-570.
47. WELLS, F. L. & KELLEY, C. M. Briefer Studies from the Psychological Laboratory of McLean Hospital. *J. of Appl. Psychol.*, 1919, 3, 172-193.
48. YOAKUM, C. S. & YERKES, R. M. *Army mental tests*. New York: Henry Holt & Co., 1920. Pp. 303.

CHILD PSYCHOLOGY

BY DAVID MITCHELL

New York City

General Discussions.—*Were You Ever a Child* by Dell (10) attempts to show a child's attitude toward the situations in which he is placed. The chief point of consideration is the school. He reports that the present system fails to meet requirements and insists on revolutionary changes. Modern education, to meet the demands of present civilization, must be revised. To progressive teachers the notion that the stimuli which are presented to a child must not be foreign to the situations which he will inevitably meet, is somewhat unnecessary. The book is a stimulating discussion of the problem and many people may find it helpful in clarifying their thinking on how children should be treated.

Evans (12) in *The Problem of The Nervous Child* has a psycho-analytic background. One is somewhat impressed with the rather meager psychological knowledge which the author displays, and can hardly avoid thinking that a general philosophy has been developed on a weak foundation. It is not necessary to deny that all children are free from sex complexes. It seems just as unnecessary to affirm that all neurotic conditions among children have their origin in such complexes. The subject is one on which a great deal more information is necessary, but such information will be secured on the basis of experimental studies and actual contact with children.

From one of the early students of children in this country we have a discussion of the historical child. Chrisman (7) in *Paidology; The Science of The Child*, brings together a great deal of information. He deals with child life in many different countries and times. He thus presents some valuable information and gives students of the subject a better idea of childhood experiences in times other than our own. The title of his book goes back to his early study when he first used the term "paidology" as the name for this scientific investigation.

The title of Dunn's (11) book, *The Natural History of the Child, A Book for All Sorts and Conditions of Men, Women and Children*,

gives one a faint idea of what to expect in the discussion. There is plenty of interesting information in this introduction to child study but unfortunately it is not well organized and the reader must search long to get any unified picture of the author's notion of a child's mental condition, his behavior, his play or his attitudes.

According to Meriam (26) in *Child Life and the Curriculum*, the situations which we arrange for the modern child are thought desirable simply because of tradition. They do not consider present demands or opportunities. When presenting this indictment of educational procedure, the author also shows what has been done in an experimental school conducted in the middle west. In that school the procedure is outlined to meet what are now considered to be the pressing needs of the child.

Woodrow (44) when he discusses *Brightness and Dullness in Children* has a similar thesis to uphold. The child's interests must be appealed to by the educational procedure. Furthermore, education must cease to consider children as though they were all of the same material with like capacities and abilities. Rather, it must vary the procedure in accordance with an understanding of the individual. In giving information concerning children, the author discusses measurements of intelligence, the question of what is meant by brightness and dullness, pedagogical age and various mental processes.

Kirkpatrick (21) divides his book on *Imagination and its Place in Education* into three sections. The first part deals with imagination from a general point of view. The third is concerned with the relation of imagination to school subjects. It is in the second part that the imaginative life of children is considered. For his discussion he has an excellent basis of fact in the imaginative products of children. This important capacity of each child should be developed. It has significance from the pedagogical point of view, and he shows its application in school studies.

In *The Child Under Eight* by Murray and Smith (28) there is an attempt to show the development of the child in these early years. The first part of the book deals with early infancy and attempts to show how the child develops from his original innocence or ignorance to a realization of fact. In the second part, the child has grown away from his world of fantasy and has come into a world of "things as they are." He thus begins to deal with vital principles. While there are some interesting suggestions, this discussion of a child's life seems to be faulty from the standpoint

of what is known of child psychology. The child's attitude is undoubtedly changing to a marked degree. Relatively, there is probably more adaptation made in those first eight years than there is in any other similar length of time. It hardly seems justifiable, however, to say that the child of two or three does not have fairly clear ideas of things as they are. He is responding to stimuli according to the nature of his nervous mechanism and the experience which he has had up to date. From the writer's observation of a considerable number of children, he feels constrained to say that there are as wide variations in the adaptation of a child of this age as there are at later periods. It may be that in the introduction to school life the child is dealing with something altogether extraneous to his natural inclinations and desires. This is, however, not a question of child development but rather a consideration of the unnecessary conditions which we arbitrarily impose upon the developing child.

Cather (6) has recognized the fact that stories stimulate the imagination, and in *Taking up Story-Telling* she says that in the dependence upon books the story is likely to be overlooked. Its importance is minimized and other forms of instruction are used when the story might be more effective. The author states that there are four periods of story interests. She also presents a number of stories which could be used. Any person who wishes to adopt this method of stimulating a child's imagination and developing him in other ways, will find much helpful material in this book.

Intelligence and Exceptional Children.—*Intelligence of School Children* by Terman (36) discusses the principles of intelligence testing. The aim is to show the great differences in original endowment. A valuable part of the report for the child psychologist is that of the individual differences among kindergarten and first grade children. The author shows that throughout the various grades there is a great overlapping. In most cases it is not a question of training or environment which accounts for this fact. It is a question of original endowment. Separate studies are presented of a number of superior children. These discussions help us to understand that child who in some ways is more retarded than those children who are several years behind their age-grade.

Sylvester (35) reports *An Intelligence Survey of a Typical Town School*. He examined 267 children and found that according to the tests, the distribution in intelligence was approximately that of the so-called normal curve. Slightly more than half the number

were classed as average, 15 were rated as having very superior intelligence and 11 as inferior. More than one third of the children were mentally peculiar in some way.

Pressey (31) has attempted to fill a long felt want. *The Group Scale of Intelligence for Use in the First Three Grades* has been needed for classification purposes. Instead of classifying children according to the day they enter school, or alphabetically, the aim is to group them so that too wide differences in native capacity will not be found in any one school group. In formulating the series of tests the author had to avoid five difficulties,—inability to read and write, fatigue, inability to understand formal terms, inability to change readily from one type of problem to another, refusal to work unless completely understanding the directions. These difficulties have been fairly well overcome in the series of tests suggested, but the author admitting that this is the first scale of intelligence for such young children says that it is pioneer work. The tables of norms and distributions which he has presented are, therefore, tentative. The evidence, however, leads one to believe in the validity of the scale.

Teter and Pressey (37) made *A Comparison of Colored and White Children by Means of a Group Scale of Intelligence*. He had three questions to answer. First, grade for grade, how do colored children compare with white; second, age for age, how do the two groups compare; third, do the colored children show a distinctive make-up of mental abilities? The tests included rote and logical memory, practical judgment, arithmetical and literary problems. In every way, the colored children are inferior to the white. Various hypothetical reasons are presented for the difference. The colored children are not examined by people of their own race. They come from a social and psychological environment different from that which molds the mentalities of white children. There is a race consciousness in the part of the country where the experiment was made. There was no adaptation to the particular needs of the colored group. These hypothetical explanations, however, are partially rejected because the difference in results is so marked. It seemed impossible that these causes could be adequate.

In *A Study of Country Children in (a) A Good and (b) A Poor Farming District*, this same author with Thomas (38) finds that country children make a poorer showing than city children. Various reasons for this condition may be suggested. The test situation

is somewhat less familiar to the country children. The latter are also shy with strangers, being awkward and embarrassed. The tests required the use of pencils and country children were not so much accustomed to that use. In an unselected group of country children the mental rating is about one year below that of city children. There is, however, no particular thing that is distinctive. In the same way, the children of a good farming district average above children in a poor district. The authors also suggest that these particular types of intelligence tests do not give adequate measures of the ability of country children. Performance tests and others more appropriate to the environment of the country children might show a different result.

The Relation of the General Intelligence of School Children to the Occupation of Their Fathers is a subject studied by Ralston and Pressey (32). The object of the investigation was to obtain a measure of differences in children coming from different kinds of homes and to examine the amount of overlapping between groups. Fourteen thousand cases were studied and it is reported that there are 548 cases where the parent's occupation was known. There were four groups of occupations—the professional, the executive, the artisan and the laborer. Percentages of children in each occupation group who make scores in the highest and lowest 10 per cent for their age are given. In all cases, the children of the professional group are superior.

Some Adaptive Difficulties Found in School Children by Richards (33) is a sequel to reports given on the Locust Point District in Baltimore. It is a rather extensive study of a considerable number of individual children. It gives information concerning the school history, the type and beginning of difficulties, and suggests modifications in the method of treatment. The recommendations are based on a study of biological, psychological, psychopathological, and sociological factors. The plans suggested for the modification of treatment add considerable value to the whole discussion.

Patri (30) in *The Gifted Child* gives a well-written story in popular style in which he outlines the attitude of these children and points the way to a fuller understanding of them. *The Training of Very Bright Children* by Witmer (43) is a plea for greater attention to the exceptionally competent child. According to the author special education should begin about four years of age and by means of a clinic teacher who would supplement either the kindergarten or the first grade teacher. The point of attack would be

the ability and characteristics of the child. The author insists that it is possible to determine with great precision before a child is six years of age what is his competency for the work of the first grade under prescribed conditions.

Ide (16) discusses *The Educability of Five-Year-Old Children*. The subjects of the investigation were children of the best residential district. A significant part of the report is the presentation of individual case studies.

Speech and Vocabularies.—Magni (24) in *Vocabularies* gives a synopsis of previous studies and outlines the different methods for acquiring a vocabulary. He says that at four or five years of age the process of language formation is about finished. The foundation for the development of a vocabulary has been laid. According to the author "in about four or five years the most important and decisive stage in psychic unfoldment has been completed." Tompkins (39) in *The Stammering Problem Solved* gives expression to his views on the right method of training for defective speech. It would be of great value to teachers if it could be definitely shown that any one theory is satisfactory or any one method of procedure produced the desired results. In *Stammering As a Disorder of Speech Dependent on Conditions of Child Development*, Kenyon (20) discusses the development of stammering and its psychological implications. According to him, this defective speech is a perversion of normal processes dependent on emotional disturbances. The immediate psychology involves (1) emotional excitement, (2) mental confusion and (3) the impulsive effort to talk while in this confused state of mind. "The result is a speech panic in which normal control of the peripheral speech machine is for the moment lost."

Special Topics.—Burt (4) discusses the development of reasoning in school children. According to him the mental mechanism necessary for formal reasoning is developed by the time the child reaches the mental age of seven. This has an important bearing on educational procedure and it will be wise to have considerable experimental investigation in order to determine just what the educational methods should be.

White (41) takes up *Expression in Childhood*. Far more encouragement should be given to this phase of a child's development. As it now stands, natural and sincere expression is not found easy by the majority of young people when they leave school. This handicap is a more or less lasting hindrance to the

fullest and most complete life. According to the author the school experience tends to inhibit spontaneity and curb freedom. The natural expressiveness of childhood is crushed by an adverse environment or unsympathetic treatment.

Malzberg (25) discusses the mind of the child from the Freudian standpoint. Considering the contribution of Freud, he says "it is not too much to compare the intellectual stimulus resulting from his study and writings with that brought about by Charles Darwin in the field of biology." The chief point of this article is a review of three books written by Lay, White and von Hug-Hellmuth on the mental life of the children. Each of these has the Freudian philosophy as a background.

According to Jewell (18) "ideals transfer all through life, once we can produce them." It is, therefore, necessary to turn out from our school rooms children with high ideals, worthy purposes and true standards of conduct. We need not then be greatly concerned with the acquisition of useful knowledge or its good application.

According to Sidis (34) a child is usually regarded as a sort of little beast, or at best a little savage. He is trained to act not by the light of reason but according to the command of superior force. He is ruled by fear and trained into discipline and obedience through this emotional factor. In the early education of children they should be immunized against "mental microbes," against superstitions and prejudices. We should encourage the cultivation of critical judgment and work against the formation of harmful beliefs. This is an excellent discussion on the necessity of avoiding a harmful method of instruction.

White (42) comments, "all approaches to the understanding of defective psychological adjustments point indubitably to childhood as the period when things first go wrong, and the indication is therefore clear that this is the period which must be studied and modified to prevent the failure of later life." An individual adjustment is conditioned by two factors: (1) the nature of a problem and (2) the character equipment. White recognizes the importance of the causal relationship between present conditions and past experiences. We must not consider the child as a little adult, but there must be a real understanding and development of child psychology together with an understanding of the relation to his environment. The author suggests that in an investigation of a child we should not limit ourselves to the Binet test. Fortunately, child psychologists have insisted on this point for many years.

Campbell (5) discusses the effect on character of the experiences of a child. He comes out strongly for the statement that the problem of mental adjustment inevitably goes back to childhood. He presents several interesting cases where character was modified by specific experiences and shows where re-education was possible by changing the method of treatment. To the reviewer, the discussion of the topic is somewhat marred by the almost invariable reference to the sex attitude between parent and child. The author has presented some extremely significant points which have no reference to this attitude and which seem to be much more important than it.

The influence of success and failure in mental health is discussed by Burnham (3). "It is a great aid in the life of a boy or girl when the first conscious effort for a definite thing is distinctly made." The influence of this effort and the notion that definite success in a certain line of work is possible, in some cases never dies out. The stimulus of that experience has made one work as never before. According to the author, "The teacher's business is to see to it that every child at some time, in some way, in some subject, achieves a marked success, and that sometimes they get an honest gauge of themselves by failure."

Abbott (1) outlines a *Program for Mental Hygiene in the Public Schools*. His aim is to meet the needs of the normal child, showing also in what way the needs of the teacher affect the situation. He presents two programs of action, one he calls the Ideal and the other the Practical. The Ideal is certainly much to be desired. His discussion of it is most appropriate and his attempt to define the functions of the various assistants in a Mental Hygiene Bureau will help to clarify our ideas.

In a *Parent's Study of Children's Lies*, Leonard (22) states that the "evidence of deceit in a child precedes speech." The author understands the child fairly well and says that his exaggerations are due in large measure to faulty judgment. He discusses the reasons and methods for training and insists that parents should ask as few incriminating questions as possible. They should be worded so as not to suggest an untruth to the child. The chief cause of lying or deceit is fear, and much of the responsibility for it lies in the parent's attitude.

Averill (2) in *The War and the Psychology of the Child* says that children had an interest in it. He reports five observations of free native responses made by them. The younger children make

a noise and have a hazy idea of military activities. The older children, those between 7 and 10 years, imagine and act scenes of war according to definite ideas.

Gray (14) reports some of the mental effects of the motion pictures on children. This is an important field of study and one which probably holds ideas of great value for the educator.

Watson (40) writing for teachers of kindergarten and primary grades, discusses the emotional life of children. To a considerable extent he refers to the material which he had reported in other writings.

Loeb (23) gives the results of an experiment in which she wished to ascertain what young children would do when they were given as few suggestions by the teacher as possible and where their activities had little interference. She shows some of the materials which children choose voluntarily and the games they play when left to themselves.

Ioteyko (17) discusses types of memory in children and shows the relation which they have to methods of education.

Court (9) discusses the development of the notions of number, time and space in the first five years. Below the school age children are interested in counting but their interest is modified by seasonal influences, individual preferences and immediate applications. One child's conception of number began at 20 months. A child three and a half years of age made accurate use of "morning" and "afternoon." Another child at two years and ten months "consciously measured space." Noon (29) in *The Child's Use of Numbers* gives a list covering three pages of the ways in which children use numbers. During the period of the elementary school grades the children make little use of arithmetic outside of school. According to the author, below the seventh grade "no needs are felt by the child which require the teaching of arithmetic in school." The reading of numbers and counting meet all the requirements.

The influence of physical condition on mental ability is discussed by Mitchell and Forbes (27). The ability of a well-nourished group of children is measured by a group of tests and comparison is made with that of the under-nourished. No superiority of one group over the other is definitely established. This result is similar to those from many other experiments, in which the relation of different factors to mental ability was considered.

Hollingsworth (15) discusses *Special Disabilities That Contribute to Retardation in School Children*. There are several interesting

cases presented of special disabilities in apparently normal children.

Johnson (19) makes use of a modified Woodworth questionnaire to study the emotional characteristics of children. There are 60 questions in the list and they were given individually to 75 boys from 10 to 15 years of age.

Conklin (8) discusses *The Foster-Child Fantasy*. He reports that the psychoanalysts have the idea that all or most children experience this fantasy. It is thought that it exerts a considerable influence upon the child's conduct. By the questionnaire method this author investigates the problem. His subjects were students in the two upper classes of high schools. He had 920 returns and judges 904 of them as being sincere. He concludes from his results that the foster-child fantasy has been demonstrated to be a common experience of childhood. His discussion includes the causes for the fantasy, ages at which it developed and the variety of attitudes from partial belief to none at all. The common age for the appearance of the fantasy is around twelve years. The effect of the fantasy was "conduct alienating the children from parental authority."

Frasier (13) considers variability in the capacity of boys and girls. After outlining the opinion of two opposed schools and presenting historical evidence both for and against a belief in a sex difference, he reports a study which included over 62,000 thirteen year old boys and girls. On the basis of his results the author suggests that there is little difference as far as mental ability is concerned.

REFERENCES

1. ABBOTT, E. S. Program for Mental Hygiene in the Public Schools. *Ment. Hyg.*, 1920, 4, 320-330.
2. AVERILL, L. A. The War and the Psychology of the Child. *Ped. Sem.*, 1919, 26, 356-364.
3. BURNHAM, W. H. Success and Failure as Conditions of Mental Health. *Ment. Hyg.*, 1919, 3, 387-397.
4. BURT, C. The Development of Reasoning in School Children. *J. of Exper. Ped.*, 1919, 5, 121-127.
5. CAMPBELL, C. M. The Experiences of the Child, How They Affect Character. *Ment. Hyg.*, 1920, 4, 312-319.
6. CATHER, K. D. *Taking up Story-telling*. Yonkers-on-Hudson: World Book, 1918. Pp. 316.
7. CHRISMAN, O. *Paidology; the Science of the Child. The Historical Child*. Boston: Badger, 1920. Pp. 471.
8. CONKLIN, E. The Foster-Child Fantasy. *Amer. J. of Psychol.*, 1920, 31, 59-76.
9. COURT, S. R. A. Number, Time and Space in the First Five Years of a Child's Life. *Ped. Sem.*, 1920, 27, 71-89.

10. DELL, F. *Were You Ever a Child?* New York: Knopf, 1919. Pp. vii + 202.
11. DUNN, C. *The Natural History of the Child; A Book for All Sorts and Conditions of Men, Women, and Children.* New York: Lane. Pp. 316.
12. EVANS, E. *The Problem of the Nervous Child.* New York: Dodd, Mead, 1920. Pp. vii + 299.
13. FRASIER, G. W. A Comparative Study of the Variability of Boys and Girls. *J. of Appl. Psychol.*, 1919, 3, 151-155.
14. GRAY, P. L. Children and the Cinema. *J. of Exper. Psychol.*, 1920, 5, 194-198.
15. HOLLINGWORTH, L. S. Special Disabilities That Contribute to Retardation in School Children. *Ungraded*, 1919, 5, 49-54.
16. IDE, G. G. The Educability of Five Year Old Children. *Psychol. Clinic*, 1919, 13, 146-172.
17. IOTYKO, J. Les types de memoire chez l'enfant au point de vue pedagogique. *Educ.*, 1919, 11, 19-31.
18. JEWELL, J. R. The Education of the Feelings. *Sch. and Soc.*, 1920, 11, 151-153.
19. JOHNSON, B. Emotional Instability in Children. *Ungraded*, 1919, 5, 73-79.
20. KENYON, E. L. Stammering as a Disorder of Speech Dependent on Conditions of Child Development. *Volta Rev.*, 1920, 22, 39-45.
21. KIRKPATRICK, E. A. *Imagination and Its Place in Education.* Boston: Ginn, 1920. Pp. 214.
22. LEONARD, E. A. A Parent's Study of Children's Lies. *Ped. Sem.*, 1920, 27, 105-136.
23. LOEB, J. An Experiment in a Public School Kindergarten. *Kindergarten and First Grade*. 1920, 5, 52-63.
24. MAGMI, J. A. Vocabularies. *Ped. Sem.*, 1919, 26, 209-233.
25. MALZBERG, B. The Child's Mind a la Freud. *Social Hyg.*, 1920, 6, 105-112.
26. MERIAM, J. L. *A Child's Life and the Curriculum.* Yonkers-on-Hudson: World Book, 1920. Pp. xii + 538.
27. MITCHELL, D. & FORBES, H. Malnutrition and Health Education. *Ped. Sem.*, 1920, 27, 36-66.
28. MURRAY, E. R. & SMITH, H. B. *The Child Under Eight.* New York: Longmans, Green, 1919. Pp. 236.
29. NOON, P. G. The Child's Use of Numbers. *J. of Educ. Psychol.*, 1919, 10, 462-467.
30. PATRI, A. The Gifted Child. *Red Cross Mag.*, 1920, 15, 37-42.
31. PRESSEY, W. L. The Group Scale of Intelligence for Use in the First Three Grades. *J. of Educ. Psychol.*, 1919, 10, 297-308.
32. PRESSEY, S. L. & RALSTON, R. The Relation of the General Intelligence of School Children to the Occupation of Their Fathers. *J. of Appl. Psychol.*, 1919, 3, 366-373.
33. RICHARDS, E. L. Some Adaptive Difficulties Found in School Children. *Ment. Hyg.*, 1920, 4, 331-363.
34. SIDIS, B. A Lecture on the Abuse of the Fear Instinct in Early Education. *J. of Abnor. Psychol.*, 1919, 14, 333-348.
35. SYLVESTER, R. H. An Intelligence Survey of a Typical Town School. *Ped. Sem.*, 1920, 26, 365-371.
36. TERMAN, L. M. *Intelligence of School Children.* New York: Houghton Mifflin, 1919. Pp. 317.
37. TETER, G. F. & PRESSEY, S. L. A Comparison of Colored and White Children

- by Means of a Group Scale of Intelligence. *J. of Appl. Psychol.*, 1919, 3, 277-282.
38. THOMAS, J. B. & PRESSEY, S. L. A Study of Country Children in (a) A Good and (b) A Poor Farming District by Means of a Group Scale of Intelligence. *J. of Appl. Psychol.*, 1919, 3, 283-286.
39. TOMPKINS, E. The Stammering Problem Solved. *J. of Abnor. Psychol.*, 1919, 14, 349-352.
40. WATSON, J. B. The Pre-Kindergarten Age—a Laboratory Study. *Kindergarten and First Grade*. 1920, 5, 14-18, 68-72, 105-109.
41. WHITE, E. M. On Expression in Childhood. *The Child*. 1920, 10, 303-307.
42. WHITE, W. A. Childhood: the Golden Period for Mental Hygiene. *Ment. Hyg.*, 1920, 4, 257-267.
43. WITMER, L. The Training of Very Bright Children. *Psychol. Clinic*, 1919, 13, 88-96.
44. WOODROW, H. *Brightness and Dullness in Children*. Philadelphia: Lippincott; 1919. Pp. 332.

EDUCATIONAL PSYCHOLOGY

BY C. TRUMAN GRAY

University of Texas

The outstanding features of the literature in educational psychology for the past year may be summarized as follows:

(1) No decrease is to be noted in the interest shown in educational tests and measurements. Several new scales and tests have appeared along with articles which attempt careful and detailed interpretations of data collected by means of the earlier tests and scales. Interest in this type of work among those who are concerned with the subject-matter of the various subjects rather than with psychology seems to be increasing. (2) Many articles have appeared which are concerned with intelligence tests as a basis for educational procedure. (3) Clinical methods for diagnosing difficulties in particular school subjects has been discussed briefly. (4) The proper instruction of bright children has received the attention of a few investigators.

TEXTBOOKS AND MONOGRAPHS

The first book to be mentioned in this connection is by Strong (83). This text is intended for beginners in the subject and is behavioristic in its approach to all problems. It is divided into three parts. These parts treat of the learning process, of individual differences, and of some of the physiological aspects of psychology. The topics treated under these heads are well selected and are familiar to all teachers of the subject. A criticism which will doubtless occur to some is that too many physiological details are given in the treatment of certain topics in the last part.

The contribution of the book lies in the method of presentation. First, the book is inductive in most of its procedure. This method has received a great deal of emphasis on the part of those who have taught educational psychology, but the same persons have been very slow to introduce this method into their own work. Second, laboratory problems are correlated very closely with the work of the course. Such problems are introduced as a regular part of the work and apparently are to be dealt with during the regular class

hours rather than in a manner which makes them more or less separate and apart from the course, and which makes it somewhat difficult for the student to see the relations which exist between the various parts of the course. These features in the book make it worthy of the careful attention of all those who teach this subject.

A second book treating of educational psychology by La Rue (47), has been treated in a special review in this number of the BULLETIN. Critics will object to certain expressions which are to be found in the text. Among these are the statements that *mind dwells in the brain* and that *mind is experience*. Further criticisms will evidently be that too much space is given to the psychology of sound and vision for a text of this type.

A book entitled "Brightness and Dullness in Children" by Woodrow (100) will be of interest to all teachers and students of mental measurements. The author begins with concrete examples which show clearly the great differences in intelligence which exist between individuals. These are followed by a brief discussion of methods of measuring intelligence, and a discussion of "Brightness and Dullness." Brightness is defined in terms of the social status, in terms of mental age, and in terms of intelligence quotients. This chapter along with those on the organization of education and educational methods will prove of most interest to teachers. For students of education the book will serve well as an introduction to many of the problems and methods involved in mental measurements.

Probably the most noteworthy special treatise of the past year is one by Seashore (80) entitled "The Psychology of Musical Talent." The book begins with an analysis of musical ability. This discussion shows how such an analysis can be made to serve as a basis for a "talent inventory." A number of such talent charts for different persons are shown and discussed. This analysis is followed by chapters devoted to discussions of the various elements which enter into musical talent. The topics treated are as follows: pitch, intensity, time, rhythm, timbre, consonance, auditory space, motor control, musical action, musical imagery, musical memory, musical intellect, musical feeling and training in the art of music.

The entire work is based upon detailed laboratory experiments. This gives it high rank as a scientific treatise. As a result of his study, the author has devised a series of six tests which are of such a nature that they may be given to school children in groups. These tests for the most part deal with native equipment and

may, therefore, be used for the vocational and avocational guidance of childhood. A report (80a) on their use in the 5th and 6th grades of the Des Moines, Iowa, schools is published as a study from the Iowa Child Welfare Research Station. This work will be of interest to all those who may have to deal with the problems of musical education and surveys of musical talent.

The Nineteenth Yearbook (59), Part II, is devoted to a discussion of education of gifted children. The treatise first considers certain methods for dealing with children of this type. These methods involve flexible promotion schemes and special rooms. These discussions are followed by detailed results from an experiment in teaching gifted children at Urbana. The monograph closes with a series of directions for the selection of gifted children, for the organization of special rooms for such pupils, and for their instruction.

Three monographs in the series issued by Teachers College, Columbia University, are at hand. One of these by Murdock (55) presents a scale for measuring certain elements in sewing. The material upon which this scale is based was obtained from a special exercise given in sewing to 1212 persons of various ages and of distinctly different mental abilities. The methods by which the scale is derived are similar to those employed in all scales in which Professor Thorndike has been interested.

This scale differs from those in other subjects in that it attempts a detailed analysis of sewing. The purpose of this analysis is set forth by the author in the following words: "In the first place, it was hoped that as it stands it [analysis] will be a direct aid in the teaching of sewing. In the second place, this analysis was used . . . as a basis for a study of the number of faults which actually do exist in children's sewing under present conditions." The various elements derived from this analysis are evaluated very carefully by statistical methods. The analytic phase of this scale probably marks a distinct advance in the development of educational measure. Another important phase of the scale is the careful way in which its reliability and validity has been worked out.

A second monograph in this series is by Wilson (96). It is entitled "A Survey of the Social and Business Usage of Arithmetic." The problem is concerned with determining the amount and kinds of arithmetic which is used by adults in their daily experiences. It is the opinion of the author that arithmetic as thus used should serve as a basis for the school curriculum in this subject. His

philosophy of the curriculum is expressed in the following quotation: "While not denying the cultural and disciplinary value of arithmetic . . . , it is assumed that arithmetic in the grades is justified only on the basis of its utility in the common affairs of life."

The data upon which the conclusions are based were collected by asking fathers and mothers of sixth, seventh, and eighth grade children to report different problems which they meet in daily life. In this way 14,583 problems were collected from 4,068 people living in 23 cities and towns. Among this number of persons 155 occupations are represented. The results show that a very large percentage of the problems involve only one of the four fundamental processes and that the problems reported are very simple. On the basis of these results the writer argues that many of the traditional processes in arithmetic should be omitted. In other words his argument is that arithmetic required of children should be reduced to the level set by adult usage.

A third monograph in this series is by O'Brien (61) and has to do with failures made by pupils in high school. The causes for such failures are those which are to be found within the schools themselves. The particular type of evidence sought is that contained in school records. In line with this the grades of 6,541 pupils in 12 different high schools are studied.

The following problems are considered from the standpoint mentioned above: (1) How extensive are failures? (2) The prognosis of the number of failures. (3) The relation between graduation and the number of failures. (4) The relation between persistence in school and the number of failures. (5) Means employed for remedying failures. (6) Relation between capability for high school work and failures. (7) What treatment is suggested?

One of the most interesting conclusions of the writer is that pupils who lack native ability sufficient to do high school work are few in numbers. Such a statement sounds a little strange in view of the large amount of emphasis which is being placed at the present time upon intelligence and its relation to education. The monograph deserves the careful consideration of all those who are concerned in any way with the education of the adolescent child.

A monograph by Manuel (51) deals with two problems as found in drawing ability. These are: (1) The essential psychophysical characteristics which accompany drawing ability, and (2) The application of the test methods to the diagnosis of such ability. Forty five tests were given nineteen subjects who had been selected

because of their special ability in drawing. The work marks considerable progress in this field and the author promises further contributions along the same lines.

The last monograph (81) to be mentioned is one in which the results of the sixth annual conference on educational measurements at Indiana University are reported. This consists of a series of reports upon the use and derivation of various tests by different speakers. It contains much interesting and valuable material.

INTELLIGENCE TESTS

As suggested earlier, there is a great deal of interest at the present time in intelligence tests from the standpoint of their use as a basis for educational procedure. By this is meant that their value is seen not only as a means of dealing with the student of low grade mental activity but also as a way of locating children of superior and of average intelligence. Further results from the use of the army tests upon students in college have been reported by Roberts and Brandenburg (76), Noble and Arps (60), Jordon (40), Jones (38), and Anderson (1). The use of the same tests upon high school students has been reported by Madsen (49), and an intelligence survey of a town school has been made by Sylvester (84).

Certain general problems in connection with intelligence testing such as the significance of such work and its methods have been discussed by Dodge (20), Colvin (11), and Myers (57).

Other writers have discussed intelligence tests in their relation to various educational problems. In this connection Authur (2) has dealt with such tests in their relation to retardation. Toops and Pintner (90) have an article entitled, "Mentality and School Progress." The value of such tests for prognosis has been treated by Pressey (67), Proctor (73) and Madsen (50), while Terman (85) has shown the value of intelligence tests in grading children. Proctor (71) and (72) also has articles which deal with such tests in their relation to the vocational and educational guidance of pupils. Further than this Dickson (19) has reported upon the use of tests of this type in the first grade, and Pressey (69) has made a similar report upon the second grade. Psychological tests as a basis for admission of students to college have been discussed by Jones (37) and Thorndike (88). Thorndike (89) has also dealt with the problem of intelligence tests as a substitute for content examinations.

A series of tests which combine intelligence and educational

tests has been devised by Buckingham and Monroe (9). This combination of tests has been called the "Illinois Examination" and has been developed to meet the growing demand for tests which pertain both to intelligence and to abilities in the various school subjects.

New group tests have been reported by Pressey (66) and (68) and by the National Research Council (58). The last test is a modification of the army tests. It is known that the work upon this test has been carried out in the most careful and detailed manner. The test meets a very decided need and will evidently find wide use.

SCHOOL SUBJECTS

Arithmetic.—The effect of special drill in this subject has been studied by Evans and Knoche (23); and different methods of teaching the process of subtraction has been made the subject of an investigation by Winch (97). In addition to these articles Wertheimer (94) has given some results obtained by means of Monroe's tests, and Curtis and Thorndike (14) have discussed correction formulæ for addition tests. This last article offers an important contribution to the technique of testing in this field. Finally, methods of testing in common fractions have been reported upon by Kallom (41).

Algebra.—Kelley (44) has studied in a careful and detailed way the values of algebra. Data upon this problem were procured by means of a questionnaire. The results were given a very careful analysis and evaluation by statistical methods. The article deserves the attention of all teachers of this subject. A series of tests for first year students in this subject have been devised by Dalman (18).

Drawing.—The use of objective criteria for measuring ability in this subject has been carefully discussed by Cohan (10). This is an interesting article written from the standpoint of the drawing teacher rather than from that of the psychologist. He points out some of the limitations of methods used in measurements but has much to say with regard to their value.

English.—A bulletin by Van Wagenen (91) has to do with improvement in the ability to write English compositions.

Grammar.—Tests in this subject have been devised by Kirby (45) and by Charters (9).

Handwriting.—A new scale for measuring handwriting has been proposed by Gilchrist (28), and a unit plan of practice in this subject has been developed by Walker (92).

History.—A very careful evaluation and criticism of all existing tests in this subject has been given in an article by Rugg (77). An index for determining efficiency in history has been proposed by Buckingham (6). This index is based upon the correlation which exists between ability to answer facts in history, and the ability to think in historical terms. The method proposes a new approach to the problem of testing the higher mental activities. It merits the critical attention of all those interested in measurements.

Music.—Two short selections of music written by children have been studied by Platt (62).

Latin.—A test in Latin has been devised by Starch (82), and correlations between translation of Latin and ethical discrimination have been investigated by Cummins (17).

Reading.—Reading ability in its relation to ability in mental tests has been studied by Webb (93) and the content of school reading books has been investigated by Hosic (34), and Woody (103). The results of oral and silent reading tests in the Evanston schools have been discussed by Jones and Lockhart (39). An interesting article by Pressey and Pressey (70) attempts to bring out some of the relations which exist between various elements in reading ability. Their methods involve partial correlation and the results seem to indicate that rate and comprehension are only different phases of the same ability. Improving methods for teaching reading serves as the basis for a discussion by Brown (5) and Theisen (86). An article which looks toward the improvement of reading tests is by Kallom (42). This author compares the question method and the reproduction method of testing comprehension. He reaches the conclusion that the question method is the better. Finally, Gray (29) shows the value of informal tests in this subject.

Spelling.—Murray (56) has reported upon spelling ability of college students, and Richards (75) discusses individual methods as they apply in this subject. An extension of the Ayres' spelling Scale has been developed by Buckingham (7). This increases the number of words in the scale and thus makes it more serviceable for teaching purposes. Scientific methods have been used by Woody (102) in evaluating subject matter for spellers.

OTHER EDUCATIONAL PROBLEMS

Attitude of Students toward Life Work.—The change which takes place with respect to life work between high school and college has been studied by Crathorne (15).

Bright Children.—Witmer (99) and Cummins (16) have given suggestions upon dealing with children of this type. These articles together with the book mentioned earlier show an increasing interest in this important phase of educational psychology.

Clinical Methods.—The relation of such methods to educational procedure has been discussed by Freeman (25). His suggestions are illustrated by the careful study of a child who had great difficulty in learning to read. Other contributions upon the same general problems have been made by Poole (63) and (64).

Education Courses.—The relation of psychology to such courses has been studied by Woody (101).

Emotions.—The development of the emotion of admiration in children has been reported upon by Moore (54).

Evaluating Test Material.—An interesting contribution upon this problem has been made by Greene (30). This is a type of work which looks toward the further refinement of testing methods.

Examinations.—A new kind of examination which is patterned after certain psychological tests has been used by McCall (52).

Grading.—A comparison of the ranking of pupils by teachers and principals has been made by Powers (65) and age-grade distributions have been studied by Witham (98).

Improvement in School Subjects.—The improvement of school children in school subjects through the period of a school year has been investigated by Henmon (31).

Interest.—The relation between interest and abilities of college students has been studied by Bridges and Dollinger (3).

Methods for Evaluating the Character of High School Students.—Scales which deal with this general problem have been published by Rugg (79) and by Reeder (74). A method for rating intelligence and will-temperament has been prepared by Downey (22). Another article which has to do with the same general topic is by Freeman (26). The title of his article is "Types of High School Students." There is here an attempt to apply the methods of measurement to a new type of problem in education.

Methods of Instruction.—This problem as it relates to the presentation of material to undergraduates in college has been studied by Holton (33), and the use of educational tests as a means of evaluating instruction has been reported upon by Johnson (36). The relation of tests to certain elements in instruction has been investigated by Monroe (53) and Willing (95).

Rating of Teachers.—This problem has been studied by Dolch

(21)). His method consisted in having pupils render judgment with respect to their teachers. A new method for meeting this problem has been prepared by Conner (12).

Retardation.—This problem as it applies to small country schools has been studied by Kelly and Loomis (43).

Scientific Thinking.—A scale for measuring this type of ability as exhibited in high school students has been proposed by Herring (32).

Study.—Tests of the study methods of Junior High School pupils have been given by Finch (24), and Garth (27) has reported upon the methods used by college students in the preparation of their lessons. An article by Thorndike (87) deals with the relation of environment to study. Other articles which deal with other phases of the problem of study are by Rugg (78), Cooper (13), and Hughes (35).

Transfer.—"The Bode Theory of Transfer as Applied to the Teaching of Mathematics" is the title of an article by Lytle (48).

Use of Tests in Small Schools.—This problem has been discussed by Koos (46) and by Brooks (4).

REFERENCES

1. ANDERSON, J. R. Intelligence Tests of Yale Freshmen. *Sch. & Soc.*, 1920, **11**, 417-420.
2. AUTHUR, G. An application of Intelligence Tests to the Problem of School Retardation. *Sch. & Soc.*, 1919, **10**, 614-620.
3. BRIDGES, J. W. & DALLINGER, V. M. The Correlation between Interests and Abilities in College Courses. *Psychol. Rev.*, 1920, **28**, 308-314.
4. BROOKS, S. S. Practical Use of Standardized Tests in Rural Schools. *J. of Educ. Res.*, 1920, **1**, 392-397.
5. BROWN, H. A. Formulation of Method in Reading. *J. of Educ. Res.*, 1920, **2**, 436-451.
6. BUCKINGHAM, B. R. A Proposed Index of Efficiency in Teaching United States History. *J. of Educ. Res.*, 1920, **1**, 161-171.
7. BUCKINGHAM, B. R. *Extension of the Ayres Spelling Scale*. Urbana, Ill.: *Bur. Educ. Res.*, Univ. of Illinois, 1919. Pp. 25.
8. BUCKINGHAM, B. R. & MONROE, W. S. A Testing Program for Elementary Schools. *J. of Educ. Res.*, 1920, **2**, 521-532.
9. CHARTERS, W. W. Constructing a Language and Grammar Scale. *J. of Educ. Res.*, 1920, **1**, 249-257.
10. COHEN, J. The Use of Objective Criteria in the Measure of Drawing Ability. *Ped. Sem.*, 1920, **28**, 137-151.
11. COLVIN, S. S. The Purposes and Methods of Psychological Tests in Schools and Colleges. *Educ.*, 1920, **11**, 404-416.
12. CONNER, W. L. A New Method of Rating Teachers. *J. of Educ. Res.*, 1920, **1**, 338-358.

13. COOPER, S. G. Teaching Students How to Study. *Educ. Rev.*, 1919, 57, 388-398.
14. COURTIS, S. A. & THORNDIKE, E. L. Correction Formulæ for Addition Tests. *Teacher's Coll. Rec.*, 1920, 21, 1-24.
15. CRATHRONE, A. R. Change of Mind Between High School and College as to Life Work. *Educ. Admin. & Sup.*, 1920, 6, 274-284.
16. CUMMINS, R. A. 'Bright' and 'Slow' Pupils in Elementary and High School. *J. of Educ. Psychol.*, 1919, 10, 377-388.
17. CUMMINS, R. A. Correlation between Translation of Latin Prose and Ethical Discrimination. *J. of Educ. Psychol.*, 1919, 10, 349-350.
18. DALMAN, M. A. Hurdles, A Series of Calibrated Objective Tests in First Year Algebra. *J. of Educ. Res.*, 1920, 1, 47-62.
19. DICKSON, V. E. What First Grade Can Do in School as Related to What is Shown by Mental Tests. *J. of Educ. Res.*, 1920, 2, 475-480.
20. DODGE, R. The Educational Significance of the Army Intelligence Tests. *Educ.*, 1920, 40, 417-428.
21. DOLCH, E. W., JR. Pupils' Judgments of their Teachers. *Ped. Sem.*, 1920, 27, 195-199.
22. DOWNEY, J. E. Rating for Intelligence and for Will-Temperament. *Sch. & Soc.*, 1920, 12, 292-294.
23. EVANS, J. E. & KNOCHE, F. E. The Effect of Special Drill in Arithmetic as Measured by the Woody and the Courtis Arithmetic Tests. *J. of Educ. Psychol.*, 1919, 10, 263-276.
24. FINCH, C. E. Junior High School Study Tests. *Sch. Rev.*, 1920, 28, 220-226.
25. FREEMAN, F. N. Clinical Study as a Method in Experimental Education. *J. of App. Psychol.*, 1920, 4, 126-142.
26. FREEMAN, F. N. Types of High School Students. *Sch. Rev.*, 1920, 28, 383-387.
27. GARTH, T. R. How College Students Prepare their Lessons. *Ped. Sem.*, 1920, 27, 90-98.
28. GILCHRIST, E. P. A Handwriting Scale. *Sch. & Soc.*, 1920, 12, 203-204.
29. GRAY, W. S. Value of Informal Tests of Reading Accomplishment. *J. of Educ. Res.*, 1920, 1, 103-111.
30. GREENE, H. A. A Comparison of Two Methods of Evaluating Test Material. *Sch. & Soc.*, 1920, 11, 777-780.
31. HENMON, V. A. C. Improvement in School Subjects throughout the School Year. *J. of Educ. Res.*, 1920, 1, 81-95.
32. HERRING, J. P. Derivation of a Scale to Measure Abilities in Scientific Thinking. *J. of Educ. Psychol.*, 1919, 10, 417-431.
33. HOLTON, E. L. A Study of Methods of Presenting Subjecting Subject-Matter to Undergraduates in College. *Sch. & Soc.*, 1920, 11, 58-59.
34. HOSIC, J. F. The Contents of School Reading Books. *Sch. & Soc.*, 1920, 11, 179-180.
35. HUGHES, W. H. Standardizing Procedure in a Combination System of Supervised Study, Varying Scope of Work, and Weighted Credit. *J. of Educ. Res.*, 1920, 2, 547-556.
36. JOHNSON, B. The Use of Tests in the Evaluation of Methods of Instruction. *J. of Educ. Psychol.*, 1920, 11, 78-88.
37. JONES, A. L. The Place of Psychological Tests in the Admission of Students to College. *Educ.*, 1920, 40, 429-431.
38. JONES, E. S. The Army Tests and Oberlin College Freshmen. *Sch. & Soc.*, 1920, 11, 389-390.

39. JONES, E. E. & LOCKHART, A. V. A Study of Oral and Silent Reading in the Elementary Schools of Evanston. *Sch. & Soc.*, 1919, 10, 587-590.
40. JORDON, A. M. Some Results and Correlations of Army Alpha Tests. *Sch. & Soc.*, 1920, 11, 354-358.
41. KALLOM, A. W. Analysis of and Testing in Common Fractions. *J. of Educ. Res.*, 1920, 1, 177-192.
42. KALLOM, A. W. Reproduction as a Measure of Reading Ability. *J. of Educ. Res.*, 1920, 1, 359-368.
43. KELLY, F. J. & LOOMIS, A. K. Retardation in One-Room Rural Schools in Kansas. *J. of Educ. Res.*, 1920, 1, 271-284.
44. KELLEY, T. L. Values in High School Algebra and Their Measurement. *Teachers' Coll. Rec.*, 1920, 21, 246-290.
45. KIRBY, T. J. A grammar Test. *Sch. & Soc.*, 1920, 11, 714-719.
46. KOOS, F. H. Educational Measurements in a Small School System. *J. of Educ. Res.*, 1920, 2, 493-501.
47. LA RUE, D. W. *Psychology for Teachers*. New York: American Book Co., 1920. Pp. 288.
48. LYTLE, E. B. The Bode Theory of Transfer Applied to the Teaching of Mathematics. *Sch. & Soc.*, 1920, 11, 457-461.
49. MADSEN, I. N. High-School Students' Intelligence Ratings According to the Army Alpha Test. *Sch. & Soc.*, 1920, 11, 298-300.
50. MADSEN, I. N. The Army Intelligence Test as a Means of Prognosis in High School. *Sch. & Soc.*, 1920, 11, 625-629.
51. MANUEL, H. T. *Talent in Drawing*. (School & Home Educ. Monog. No. 3.) Bloomington, Ill. Pub. Sch. Pub. Co., 1919. Pp. 152.
52. MCCALL, W. A. A New Kind of School Examination. *J. of Educ. Res.*, 1920, 1, 33-46.
53. MONROE, W. S. Improvement of Instruction through the Use of Educational Tests. *J. of Educ. Res.*, 1920, 1, 96-102.
54. MOORE, R. C. The Emotion of Admiration and its Development in Children. *J. of Exper. Psychol.*, 1920, 5, 221-235.
55. MURDOCH, K. *The Measurement of Certain Elements of Hand Sewing*. (Columbia Univ. Contrib. to Educ. No. 103). New York Columbia Univ., 1919. Pp. 120.
56. MURRAY, E. The Spelling Ability of College Students. *J. of Educ. Psychol.*, 1919, 10, 357-376.
57. MYERS, G. E. Economy in Intelligence Classification. *Educ. Admin. & Sup.*, 1920, 6, 309-312.
58. *National Intelligence Tests*. Yonkers-on-Hudson, New York World Book Co., 1920.
59. *National Society for the Study of Education. Nineteenth Year Book, Part II*. Bloomington, Ill. Pub. Sch. Pub. Co., 1920. Pp. 125.
60. NOBLE, E. L. & ARPS, G. F. University Students' Intelligence Ratings According to the Army Alpha Test. *Sch. & Soc.*, 1920, 11, 233-237.
61. O'BRIEN, F. P. *The High School Failures*. (Columbia Contrib. to Educ. No. 102). New York Columbia University, 1919. Pp. vii + 97.
62. PLATT, W. Two Examples of Child Music. *Brit. J. of Psychol.*, 1920, 10, 310-311.
63. POOLE, G. E. An Analysis of the Proficiency and Competency of a Fourth Grade Class. *Psychol. Clinic*, 1919, 13, 51-58.

64. POOLE, G. E. The Attempt to Teach. A Diagnostic Method Illustrated by the Clinic Teaching of Typical Cases. *Psychol. Clinic*, 1920, 13, 173-189.
65. POWER, L. The Principal and Teachers' Methods of Ranking Pupils. *Elem. Sch. J.*, 1919, 20, 285-291.
66. PRESSEY, S. L. A Brief Group Scale of Intelligence for Use in School Surveys. *J. of Educ. Psychol.*, 1920, 11, 89-100.
67. PRESSEY, S. L. The "Efficiency" of a Group Scale of Intelligence in Prognosticating Success and Failure in Junior High School. *J. of Appl. Psychol.*, 1919, 3, 381-385.
68. PRESSEY, L. W. A Group Scale of Intelligence for Use in the First Three Grades. *J. of Educ. Res.*, 1920, 1, 285-294.
69. PRESSEY, L. W. Scale of Attainment No. An Examination of Achievement in the Second Grade. *J. of Educ. Res.*, 1920, 2, 572-581.
70. PRESSEY, S. L. & PRESSEY, L. W. Measures of Reading Ability. *Sch. & Soc.*, 1920, 11, 747-749.
71. PROCTOR, W. M. Psychological Tests in Educational Guidance. *J. of Educ. Res.*, 1920, 1, 369-381.
72. PROCTOR, W. M. The Use of Psycholgoical Tests in the Vocational Guidance at High School Pupils. *J. of Educ. Res.*, 1920, 2, 533-546.
73. PROCTOR, W. M. Psychological Tests and the Probable School Success of High School Pupils. *J. of Educ. Res.*, 1920, 1, 258-270.
74. REEDER, J. C. The Genesio Scale of Qualities. *Elem. Sch., J.*, 1919, 20, 292-296.
75. RICHARDS, A. A. Spelling and the Individual System. *Sch. & Soc.*, 1919, 10, 647-650.
76. ROBERTS, G. L. & BRANDENBURG, G. C. The Army Intelligence Tests at Purdue University. *Sch. & Soc.*, 1919, 10, 776-778.
77. RUGG, E. U. Character and Value of Standardized Tests in History. *The Hist. Outlook*, 1920, 11, 231-236.
78. RUGG, E. U. Supervised Study in History. *The Hist. Outlook*, 1920, 11, 142-149.
79. RUGG, H. O. Rating Scales for Pupils' Dynamic Qualities. Standardizing Methods of Judging Human Character. *Sch. Rev.*, 1920, 28, 337-349.
80. SEASHORE, C. E. *The Psychology of Musical Talent*. Chicago. Silver, Burdett and Co., 1919. Pp. 288.
80. SEASHORE, C. E. *A Survey of Musical Talent in the Public Schools*. (University of Iowa Studies in Child Welfare). Iowa City: University of Iowa, 1920, 1, No. 2. Pp. 36.
81. *Sixth Conference on Educational Measurements*. (Bull. of the Extension Div. Indiana University, 5. No. 1), Bloomington, Indiana Extension Div., Indiana Univ., 1919. Pp. 35.
82. STARCH, D. A Test in Latin. *J. of Educ. Psychol.*, 1919, 10. Pp. 489-500.
83. STRONG, E. J., JR. *Introductory Psychology for Teachers*. Baltimore, Warwick & York, 1920. Pp. xii + 233.
84. SYLVESTER, R. H. An Intelligence Survey of a Typical Town School. *Ped. Sem.*, 1919, 26, 463-371.
85. Terman, L. M. The Use of Intelligence Tests in the Grading of School Children. *J. of Educ. Res.*, 1920, 1, 20-32.
86. THEISEN, W. W. Provision for Individual Differences in Teaching Reading. *J. of Educ. Res.*, 1920, 2, 560-571.
87. THORNDIKE, E. Environment as a Factor in Pupils' Study Life. *Educ.*, 1920, 40, 470-483.

88. THORNDIKE, E. L. Intelligence Examinations for College Entrant. *J. of Educ. Res.*, 1920, 1, 329-337.
89. THORNDIKE, E. L. The New Psychological Tests. Are they a Substitutute for Content Examinations? *Educ. Rev.*, 1920, 59, 97-104.
90. TOOPS, H. A. & PINTNER, R. Mentality and School Progress. *J. of Educ. Psychol.*, 1919, 10, 253-262.
91. VAN WAGENEN, M. J. An Investigation into the Amount of Improvement in Ability to Write English Composition. Minneapolis. *Bulletin of Univ. of Minnesota*, 1919, 22. Pp. 18.
92. WALKER, H. C. The Development of the Unit Plan of Penmanship Practice. *J. of Educ. Res.*, 1920, 1, 112-118.
93. WEBB, L. W. Ability in Mental Tests in Relation to Reading Ability. *Sch. & Soc.*, 1920, 11, 567-570.
94. WERTHEIMER, J. E. Some Results from Monroe's Diagnostic Tests in Arithmetic. *J. of Educ. Psychol.*, 1920, 11, 109-112.
95. WILLING, M. H. The Encouragement of Individual Instruction by Means of Standardized Tests. *J. of Educ. Res.*, 1920, 1, 193-198.
96. WILSON, G. M. *Survey of the Social and Business Usage of Arithmetic*. (Columbia Contrib. to Educ. No. 100). New York. Columbia University, 1919. Pp. v + 62.
97. WINCH, W. H. "Equal Additions" versus "Decomposition" in Teaching Subtraction. *J. of Exper. Psychol.*, 1920, 5. Pp. 207-220.
98. WITHAM, E. C. Age-grade distribution. Its principles and application. *J. of Educ. Psychol.*, 1919, 10, 433-444.
99. WITMER, L. The Training of Very Bright Children. *Psychol. Clinic*, 1919, 13, 88-96.
100. WOODROW, H. *Brightness and Dullness in Children*. Chicago. J. B. Lippincott Co., 1919. Pp. 322.
101. WOODY, C. The Administration of the Psychology Prerequisite to Courses in Education. *J. of Educ. Psychol.*, 1920, 11, 61-77.
102. WOODY, C. Application of Scientific Method in Evaluating the Subject Matter of Spellers. *J. of Educ. Res.*, 1920, 1, 119-128.
103. WOODY, C. Overlapping in the Content of Fifteen Second Readers. *J. of Educ. Res.*, 1920, 2, 465-474.

CORRELATION

BY JAMES BURT MINER

Carnegie Institute of Technology

One object of these annual summaries on correlation, when they began in 1912, was to encourage the more frequent use of this important statistical tool. The deluge of studies using correlation in recent years makes it clear to the writer that this need has been met. The mere indexing of analagous studies does not justify the time required. The writer expects hereafter to cite papers that indicate extensions in new fields, and those in which contrasting points of view are involved. The main emphasis will be on the interpretation of coefficients and improvement in the statistical methods involved.

Interpretation of Coefficients.—Several papers inquire into the fundamental psychological assumptions on which measurements rest. The doubtful psychological equivalence of the units of measurement in tests and the clearer meaning of ranks in behavior, raises the question whether ranks might not be psychologically more sound and practically more fruitful even if they are biologically less broadly significant. Units of rank orders, Boring (9) concludes, are validly demonstrable for abilities. They afford the possibility of statistical treatment in terms of medians, quartiles, contingencies and correlation ratios, while we are not justified in assuming that the usual mental test scales are made up of equivalent units which can be treated with the statistics of averages, standard deviations, coefficients of correlation and linear regressions. See also McEwen and Michael (22) and the Scott Laboratory (32). Ruml (28) thinks that the failures of mental tests may in part be traced to "a willingness to accept statistical hypotheses as applied to intelligence simply to have statistical technique available for use." In particular he criticizes the assumptions: (1) That general intelligence can be expressed as a one-dimensional function. It is analogous to "size." (2) That regression of general intelligence upon test performances is linear. Evidences that it is linear which are based upon judged intelligence is "ordinarily worthless." Gross departures from linearity are found in age and in trade test relations.

(3) That an individual maintains a static level of intelligence from time to time. Correction for attenuation is made on this assumption, viz., that the difference between performances with the same test are due to errors in measuring rather than to actual variation of the ability from time to time. Mitchell (23) gives evidence that memory span is not static for the same individual. Myers (25) cautions against concluding that a close correlation between group and individual tests for school groups including several grades and wide ranges of mental ages would hold for a homogeneous group in any single school grade. Thorndike (38) indicates that a "halo" of general merit affects estimates of special traits so as to make their intercorrelations too large.

Thompson's paper (33) may upset the common explanation of the size of coefficients. It shows the possible effects of what he defines as "interference factors." These are groups of elements which operate in favor of one test and against another, a condition which is psychologically likely. If interference factors exist, zero correlation does not show that either general or group factors are not common to the two variates measured; high common factors may exist with low correlations; transfer of training is possible with no improvement of the second variate after the training and a reduction of the coefficient; after training the coefficient may remain the same in spite of the common factors having been much improved; the contemporary training of two abilities with common factors does not necessarily alter their correlation. Experiments might be arranged to discriminate some of these different effects. His method is an extension of Weldon's and of Thomson's dice patterns in which the factors producing correlation are additive. It gives splendid possibilities of visualizing possible sources of effects on the correlation coefficients and may be utilized by a non-mathematical experimenter who wishes to test whether his generalizations are justified. Other interpretations of correlations than those that assume the overlapping of common factors which are additive are to be taken up later. For example, the correlation may result from exclusion due to drawing from a limited pool, as in whist hands. Combination of elements by multiplying, instead of adding, would not affect the results provided that the form of function according to which the elements combine is the same in each variate, and the standard deviation of each element is the same.

Group Factors versus a General Factor.—A number of important papers treat of the relation of mental abilities to general, group,

and specific factors. It is quite impossible in this summary to state the numerous qualifying clauses in these papers, but the drift of the discussion leaves the problem as follows: (1) A perfect hierarchy would demonstrate, as Spearman claims, that there is a *single* general factor and no group factors except for quite similar activities and these of small effect. (2) An imperfect hierarchy would be explained by group factors with or without general factors. (3) Interference elements included in general factors would account for any set of correlation coefficients, Thompson (33). (4) It is not certain whether the empirical data form a perfect hierarchy or only approach it. In this situation there is a general tendency to accept important group factors, types or levels, with possible universal factors. In the discussion Spearman defends his theory of the Two Factors, General and Specific, and believes his contention is proved. Thomson regards General Factors as unproved and unnecessary, although possible, and believes that the overlapping of important group factors best explains the available data. Garnett prefers Spearman's theory.

The mathematical foundation on which Spearman erected his valiant hypothesis on the General Common Factor has been seriously shaken by Thomson (35, 36, 37). He shows that the criterion for determining the degree of perfection in a hierarchy of coefficients is mathematically incorrect and exaggerates the approach to perfection. In an artificial example, the known true degree of perfection, .59, was calculated by the Spearman criterion to be 1.00. Two sources of error in Spearman's proof of his criterion are demonstrated: (1) The arbitrary plan by which he rejects coefficients from a table happens to leave those which bring the average to about 1.00; (2) the equation for degree of perfection of the hierarchy assumes certain quantities uncorrelated when they are really strongly correlated and cannot be neglected. The use of Spearman's criterion mars Webb's and Garnett's deductions as to "general ability" and "will" factors. Thomson (35) also shows how overlapping group factors may be harmonized with a small transfer of training which otherwise tends to support the hypothesis of the absence of group factors. If improvement were due to the selection, mainly the economy, of elemental factors used in any activity, this might occur without the improvement of the elements themselves and so transfer only slightly to other group combinations of the elements. Similarly one might conceive a football team to gain by playing together, by its team work, by its elimination of

useless factors, without the players becoming better individual players and without the improvement transferring to other teams in which the men play. In restating his hypothesis, under which "any performance is considered as being carried out by a sample of group factors," Thomson names it the Sampling Theory of Ability. A hierarchical order of coefficients is the natural order to expect on the theory alone of chance sampling of abilities. On the Mendelian theory any individual is a sample of unit qualities, so each of his activities may involve a further sampling of these qualities. A general factor, if found in Smith, may not be the same as a general factor found in Jones. He gives an admirable review in non-mathematical language of the entire discussion of the General Factor.

Regarding his theory of Two Factors, which was forecast in 1904, Spearman (31) says: "Hardly any writer (outside of those working in more or less intimate connection with myself) has so far uttered a sign of being convinced." He thinks that this obduracy may be due to a question in the minds of investigators who admit that his theory requires the data to conform to his equation and yet believe that other theories would also meet the same criterion. Now that Garnett (14, 15, 16) and Spearman (31) show that a perfect hierarchy requires a single general factor, Spearman hopes for a more general acceptance of his Theory. He also elaborates an earlier note regarding the method of showing by dice patterns that hierarchies could be produced from group factors. The dice hierarchy introduces the General Factor under another form. As shown also by Garnett and admitted by Thomson (16) the perfect hierarchy may mean either a single General Factor or group factors which are made up of an infinite number of interchangeable elements of the General Factor, which would still be interpretable as an underlying fund of brain energy. In discussing the group-factor hypothesis for explaining perfect hierarchies Garnett (15) is only concerned with variables that are distributed according to the normal law and measured in such units as will give each the same standard deviation. The correlations between three variables will always satisfy the conditions for a hierarchy expressed by terms of four independent variables of which one is a general factor while each of the others is a specific factor. There can always be found an infinite number of general factors of correlated variables. These general factors are to be distinguished from the unique general factor whose correlations satisfy the conditions for a perfect hier-

archy. Garnett (13) finds that the data from Webb's monograph on Character and Intelligence indicate that several intellectual qualities (humor, originality and quickness) may be regarded as compounded of General Ability, and of an independent group factor "Cleverness." The latter, following Mercier, seems to be innate while General Ability may be acquired. A number of character traits (tendency not to abandon tasks in the face of obstacles or from mere changeability, kindness on principle, trustworthiness, conscientiousness, working with distant objects in view) show not only General Ability but "Purpose" which is a factor compounded of General Ability and an independent Group factor. He gives an equation for testing these relations and shows how the relations of General Ability and a group factor may be represented in three dimensions.

Other Contrasting Interpretations.—Pearson (26) finds that the resemblance of sibling orphans, published by Kate Gordon, .508, is very close to that found by the Galton Laboratory, .515, for siblings in general. It is new evidence that the sameness in environment of the non-orphan sibling pairs could hardly be the cause of their resemblance. Bagg (6) utilizes correlation, probably for the first time, in connection with the study of habit formation and family resemblance in animal behavior. No family resemblance appears in the behavior of mice, as judged by the non-reduction of the mean variations within the litters as compared with random groups of the same size. There is a correlation between early and late performances of the same mice. Rosenow (29) and Murchuson (24) discuss the relation of delinquency to intellectual deficiency. The former concludes, that, if the coefficient of correlation between intelligence and delinquency is $+0.66$ as Goring found in *The English Convict*, "the correct conclusion to be drawn is that it is exceedingly probable that factors other than intelligence are of *greater* importance as determinants of crime than intelligence." To the reviewer it does not seem that his demonstrations that all other causes combined correlate over .66 with delinquency, that there is a *possibility* of a score of larger causes and that these when combined with deficiency produce only a small addition to the total correlation with delinquency, do not raise the *probability* that there is one larger cause. Murchuson tested 3,328 criminals who could read and write and found a median intelligence score with the army tests of 62, which compares with that for the army and concludes "the difference between the average

individual and the average criminal is not a difference which can be expressed in terms of intelligence." This conclusion is not clear from the data published. His exclusion of illiterates may have affected the comparison. Moreover the criminals should be compared with the intelligence average of their states not with the army generally.

The Statistical Methods of Correlation.—A more general method than multiple correlation or than least squares has been provided by McEwen and Michael (22) for determining the functional relation of one variable to each of a number of correlated variables. The method has been found to be practically more useful in making predictions when the forms of the functions are unknown, as is frequently the case in dealing with biological material, especially social material. It avoids the assumption of practical linearity made in multiple correlation or that of any pre-determined mathematical function as in the method of least squares. The method consists of determining the relation of the independent variable to each of the dependent variables by a successive approximation to group averages. The coefficient is comparatively easily calculated by following their model. An illustrative case is worked out in the prediction of wheat yield per acre in South Dakota on the basis of the season's temperature and precipitation. The writers were collaborating on problems concerning the quantitative relation between variations in the number of certain marine organisms and fluctuations in the elements of their environment. The paper is introduced by Wm. E. Ritter as an important step forward in the methodology of natural science. Smith (30) develops the method for proper choice of distributions of observations for two variates connected by a linear relation. Isserlis' paper (18) is described by its title. Kornhauser, Meine and Ruml (21) explain the construction of two three-dimension models which materially assist in visualizing and understanding the meaning and relations of the coefficients of correlation and regression, the standard error of the variates, and the standard error of estimation.

Short Methods.—The Scott Company Laboratory (32) gives tables for facilitating the calculation of correlation by the rank difference method. They include the squares of differences up to a difference of 80, and the corresponding coefficients. Burr (8) shows how to calculate partial correlations with a slide rule and finds it as rapid and accurate as using tables. Chapman (11) supplements Thurstone's method of calculating the product-

moment coefficient without the use of deviations by also avoiding cross multiplying of the two variates. The necessary operations can then be performed by tables of squares and an adding machine. A splendid series of papers by Ayres shows short and easy ways of computing the product-moment coefficient (4, 1, 5), the coefficient of regression (2) and the correlation ratio (3). His simple method for computing the product-moment coefficient (4) saves from half to three fourths of the time of the common method. The method is based in the principle that in any series of numbers the sum of the squares of the deviations from the average is equal to the sum of the squares of the numbers in the series, minus the product of the total of the series and its average.

New Applications.—Thomson (34) shows that the problem of right and wrong cases in psycho-physics is a special case of the application of Pearson's Criterion of Goodness of Fit. Kelley (20) shows how partial correlation indicates principles for the selection of tests for classifying men. He also calculates that the army mental tests correlate .484 with vocational choice, and that all factors not measured by the tests would correlate .875. This method of estimating the relation to other factors than those tested is suggestive. It is also followed by Rosenow (29) who gives a table for facilitating the calculation, assuming various intercorrelations of the variables. Toops and Pintner (40) find a rank correlation of the intelligence level of trades with the grades at leaving school amounting to .79. Pressey and Ralston (27) trace the relation of the occupations of fathers to the intelligence of their children. Burt (7) shows how he utilized regression equations for weighting test scores to place men at the work for which they were best fitted in an auto tire factory. Kelley (19) gives a method for correcting the measure of overlapping in school grades for a tested ability. All other measures have been incorrect, he claims, in not allowing for the reliability coefficients of the tests. Thurstone (39) derives a formula for weighting the right and wrong answers of a test in order to obtain the highest correlation with the criterion chosen. Curtis and Thorndike (12) set forth a method for developing correction formulæ for a test, in this case an addition test, under which the results are tested for various methods of giving and scoring the test. Through the intercorrelations it was found that scoring this test by the rate of performance at 75 per cent. accuracy corrected for motor ability was best. Rate scores are better than accuracy. The relations between

interests and abilities are shown by (10) and (17), between mentality and school progress by (41). Yoakum and Yerkes (42) give the best summary of the application of the army tests to educational and industrial problems.

REFERENCES

1. AYRES, L. P. The Application to Tables of Distribution of a Shorter Method for Computing Coefficients of Correlation. *J. of Educ. Res.*, 1920, 1, 295-325.
2. AYRES, L. P. Coefficients of Regression. *J. of Educ. Res.*, 1920, 1, 398-421.
3. AYRES, L. P. Correlation Ratio. *J. of Educ. Res.*, 1920, 2, 452-457.
4. AYRES, L. P. A Shorter Method for Computing the Coefficient of Correlation. *J. of Educ. Res.*, 1920, 1, 216-239.
5. AYRES, L. P. Substituting Small Numbers for Large Ones in the Computation of Coefficients of Correlation. *J. of Educ. Res.*, 1920, 2, 502-519.
6. BAGG, H. J. Individual Differences and Family Resemblances in Animal Behavior. *Archives of Psychol.*, 1920, 26, 1-58.
7. BURTT, H. E. Employment Psychology in the Rubber Industry. *J. of Appl. Psychol.*, 1920, 4, 1-18.
8. BURTT, H. E. Partial Correlations on a Slide Rule. *Psychol. Bull.*, 1919, 16, 240-242.
9. BORING, Edwin G. The Logic of the Normal Law of Error in Mental Measurement. *Amer. J. of Psychol.*, 1920, 31, 1-33.
10. BRIDGES, J. W. & DOLLINGER, V. M. The Correlation between Interests and Abilities in College Courses. *Psychol. Rev.*, 1920, 27, 308-315.
11. CHAPMAN, J. C. A Method of Calculating the Pearson Coefficient of Correlation without the Use of Deviations or Cross Multiplying. *Psychol. Bull.*, 1919, 16, 369-371.
12. COURTIS, S. A. & THORNDIKE, E. L. Correction Formulæ for Addition Tests. *Teachers College Record*, 1920, 21, 1-24.
13. GARNETT, J. C. M. General Ability, Cleverness and Purpose. *Brit. J. of Psychol.*, 1919, 9, 345-367.
14. GARNETT, J. C. M. On Certain Independent Factors in Mental Measurements. *Proc. Royal Soc.*, 1919, A, 96, 91-112.
15. GARNETT, J. C. M. The Single General Factor in Dissimilar Mental Measurements. *Brit. J. of Psychol.*, 1920, 10, 242-259.
16. GARNETT, J. C. M. & THOMSON, G. H. Joint note on "The Hierarchy of Abilities." *Brit. J. of Psychol.*, 1919, 9, 367-369.
17. HARTMAN, R. & DASHIELL, J. F. An Experiment to Determine the Relation of Interests to Abilities. *Psychol. Bull.*, 1919, 16, 259-262.
18. ISSERLIS, I. Formulæ for Determining the Mean Values of Products of Deviations of Mixed Moment Coefficients in Two to Eight Variables in Samples taken from a Limited Population. *Biometrika*, 1918, 12, 183-184.
19. KELLEY, T. L. The Measurement of Overlapping. *J. of Educ. Psychol.*, 1919, 10, 458-461.
20. KELLEY, T. L. Principles Underlying the Classification of Men. *J. of Appl. Psychol.*, 3, 50-68.
21. KORNHAUSER, A. W., MEINE, F. & RUMML, B. Two Models Showing the Interrelation of Several Significant Correlation Variables. *Psychol. Bull.*, 1919, 16, 230-235.

22. McEWEN, G. F. & MICHAEL, E. L. The Functional Relation of one Variable to Each of a Number of Correlated Variables Determined by a Method of Successive Approximation to Group Averages: A Contribution to Statistical Methods. *Proc. Amer. Acad. of Arts and Sci.*, 1919, **55**, 95-133.
23. MITCHELL, D. Variability in Memory Span. *J. of Educ. Psychol.*, 1919, **10**, 445-458.
24. MURCHUSON, C. Criminals and College Students. *School & Soc.*, 1920, **12**, 24-30.
25. MYERS, G. C. A Grave Fallacy in Intelligence Test Correlations. *School & Soc.*, 1920, **11**, 528-529.
26. PEARSON, K. Inheritance of Psychical Characters. *Biometrika*, 1919, **12**, 367-376.
27. PRESSEY, S. L. & RALSTON, R. The Relation of the General Intelligence of School Children to the Occupation of Their Fathers. *J. of Appl. Psychol.*, 1919, **3**, 366-374.
28. RUMI, B. The Need for an Examination of Certain Hypotheses in Mental Tests. *J. of Phil., Psychol. & Sci. Meth.*, 1920, **17**, 57-61.
29. ROSENOW, C. Is Lack of Intelligence the Chief Cause of Delinquency. *Psychol. Rev.*, 1920, **27**, 147-157.
30. SMITH, K. On the Standard Deviations of Adjusted and Interpolated Values of an Observed *Polynomial Function* and its Constants and the Guidance they give towards a Proper Choice of the Distribution of Observations. *Biometrika*, 1918, **12**, 1-85.
31. SPEARMAN, C. Manifold Sub-theories of "The Two Factors." *Psychol. Rev.*, 1920, **27**, 159-173.
32. SCOTT COMPANY LABORATORY. Tables to Facilitate the Computation of Coefficients of Correlation by the Rank Difference Method. *J. of Appl. Psychol.*, 1920, **4**, 115-125.
33. THOMPSON, J. R. The Role of Interference Factors in Producing Correlation. *Brit. J. of Psychol.*, 1919, **10**, 81-100.
34. THOMSON, G. H. The Criterion of Goodness of Fit of Psychophysical Curves. *Biometrika*, 1919, **12**, 216-230.
35. THOMSON, G. H. The General Factor Fallacy in Psychology. *Brit. J. of Psychol.*, 1920, **10**, 319-326.
36. THOMSON, G. H. General versus Group Factors in Mental Activities. *Psychol. Rev.*, 1920, **27**, 173-191.
37. THOMSON, G. H. On the Degree of Perfection of Hierarchical Order Among Correlation Coefficients. *Biometrika*, 1919, **12**, 355-366.
38. THORNDIKE, E. L. A Constant Error in Psychological Ratings. *J. of Appl. Psychol.*, **4**, 25-30.
39. THURSTONE, L. L. A Scoring Method for Mental Tests. *Psychol. Bull.*, 1919, **16**, 235-240.
40. TOOPS, H. A. & PINTER, R. Educational Differences among Tradesmen. *J. of Appl. Psychol.*, 1919, **3**, 33-50.
41. TOOPS, H. A. & PINTER, R. Mentality and School Progress. *J. of Educ. Psychol.*, 1919, **10**, 253-263.
42. YOAKUM, C. S. & YERKES, R. M. *Army Mental Tests*. Henry Holt & Co., 1920. Pp. xiii + 303.

Princeton University

DEPARTMENTS OF PSYCHOLOGY AND PHILOSOPHY

Graduate Courses, 1920—1921

PSYCHOLOGY

Theory and Methods of Experimental Psychology. Both terms (3). Professor Warren.

Research in Experimental Psychology. Both terms (3). Professor McComas.
Psychological Seminary. Topic determined in consultation with class. Both terms. Professor Warren.

Physiological Psychology. First term (3). —————.

Psychopathology. Second term (3). Dr. Cotton.

The History and Psychology of Education. First term (3). Professor McComas.

PHILOSOPHY

Critical and Historical Survey. First term (12 lectures). Professor Fite.

Seminary in Philosophy. First term, Professor Fite; Second term, Professor Longwell.

The Philosophy of Kant. Both terms (3). Professor Whitney.

The Speculative Movement in Germany between 1794 and 1831. Both terms (3). Professor Bowman.

The History of Ethics. Second term (3). Professor Fite.

The Logical Structure of Philosophical Systems. Both terms (3). Professor Spaulding.

Nineteenth-Century Philosophy. First term (3). Professor Longwell.

Theory of Reality. Both terms (3). Professor Johnson.

Fundamental Problems in Philosophy. First term (3). Professor Bowman.

Present Tendencies in Philosophy. Second term (3). Professor Spaulding.

History of Greek Philosophy. First term (3). Professor Bowman.

Ethics. First term (3). Professor Fite.

Social and Political Ethics. Second term (3). Dr. Hendel.

Hellenistic and Patristic Philosophy. Second term (3). Mr. More.

Philosophy and Religion. Second term (3). Professor Longwell.

Philosophy and History of Modern Science. First term (3). Professor Spaulding.

For courses in cognate subjects, regulations respecting degrees, etc., see the University Catalogue or special pamphlet containing the official Announcement of the Department of Philosophy.

Enquiries may be addressed to any of the professors in the Department, or to

DEAN ANDREW F. WEST, Princeton, N. J.

The Johns Hopkins University

DEPARTMENTS OF PHILOSOPHY, PSYCHOLOGY AND EDUCATION

GRADUATE COURSES, 1920-1921

PHILOSOPHY. Students may take for their principal subject general systematic philosophy, logic and scientific methodology, ethics, or the history of philosophical ideas, both in the technical systems and in literature and the sciences. An important part of the student's work will each year consist in individual study on selected topics (systematic reading, methodical analysis of problems, frequent written papers) under the supervision of one of the professors of the department. Other courses will be announced later.

PSYCHOLOGY. Research and Graduate Instruction is provided for in Human Psychology and Animal Behavior. Course are offered by *John B. Watson* in the Psychological Laboratory, in the Phipps Psychiatric Clinic of the Johns Hopkins Hospital as follows: Introduction to the Study of Animal Behavior; Objective Psychology (General); Experimental Psychology (Research Course) and Animal Behavior (Research Course). Experimental work in Animal Behavior is provided in the New Hunterian Laboratory.

Courses are offered in the Psychological Laboratory at Homewood by *Knight Dunlap* in Experimental Psychology and Applied Psychology. Opportunities for research in Experimental Psychology, Social Psychology and Child Psychology are provided.

EDUCATION. Opportunities for instruction and investigation are offered to meet the needs of students whose interest leads them to specialize in the fields of Educational Administration, Educational Psychology, Experimental Education, or Educational Theory and Practice. Courses are offered in 1920-1921 as follows: Educational Administration and Experimental Education, *Edward F. Buchner*; Modern Educational Theory, *Florence E. Bamberger*; Secondary Education, *David E. Weglein*; Supervision of Elementary Education, *Florence E. Bamberger*.

For Philosophy, Professor A. O. LOVEJOY

For Psychology, Professor KNIGHT DUNLAP

For Education, Professor EDWARD F. BUCHNER

THE PSYCHOLOGICAL BULLETIN

THE PSYCHOLOGY, BIOLOGY AND PEDAGOGY OF GENIUS

BY LEWIS M. TERMAN AND JESSIE M. CHASE

Leland Stanford Jr. University

(SUMMARY OF LITERATURE SINCE 1914)

Psychological and Literary Interpretations of Genius.—Meumann's work (46) is too well known to warrant extensive comment here. Volume II presents an extensive summary of the experimental data on the higher thought processes. Genius is only incidentally touched upon, but the author's definition of higher intelligence as the ability to deal with concepts and to think in terms of symbols is pertinent. Volume III contains many valuable observations relating to the analysis of the abilities involved in the mastery of the various types of school subject matter. Kiernan (39), after a description of the ability of various men of genius, arrives at the conclusion that genius is not a sport nor a neurosis, but a child potentiality developed through the transformation of attention into a fixed idea dominating the life work. Epilepsy in particular he shows to have no relation to genius. Garnett (22) attempts to prove statistically the existence of independent factors (e.g., "cleverness") which, in addition to Spearman's general factor, enter into divers mental tests. The author offers the following mathematical formula for genius: $\epsilon = \sqrt{g^2 + c^2}$, where g = general ability, or capacity to concentrate attention, and c = "cleverness," or the tendency to associate by similarity! Knowlson's book (40) is addressed to "general readers of the more thoughtful type." It is intended "to show the importance of a study of creative thought" and "to institute a regime for the individual whereby he may secure the highest mental efficiency." It stresses the subconscious factor in creative thinking. The author is always entertaining, but as

he depends chiefly upon quoted authority and clever speculation there is little in his volume of interest to the scientific student. Poincaré has given us (55) an extremely interesting account of his own methods of work and of the circumstances leading up to his mathematical discoveries. The passage indicated constitutes an invaluable document of a kind all too rare. The author tells us that his discoveries nearly all came by intuition. Ordinarily there was first a period of unsuccessful application to a problem, then a longer or shorter period of diversion to other interests, and finally a spontaneous flashing up of the solution. The author attributes the final result to the activity of a subconscious ego and believes that this activity is guided by an aesthetic sensibility which is fundamental to creative thinking. Sturt (77) devotes a chapter of his semi-philosophical volume to a speculative treatment of the psychology of invention. He emphasizes the part played by subconscious factors and opposes the mechanistic and neural explanations of creative thinking. An anonymous article (1) holds that greatness depends, 1st, on the flash of original idea: 2d, on appreciation of its value to the world: 3d, on determination to succeed: 4th, on opportunity. Surely no one would dispute these theses. In an introduction by Jack London the book by Schwarz (67), is characterized as an "immortal and epoch-making" work. The reviewers are more inclined to agree with Max Nordau who also furnishes an introductory letter in which he frankly says: "your book is teeming with ideas, but still more with feeling. It is a vehement preaching . . . a pretext for invective against the average man . . . it is dogmatic, not scientific" The tenor of the book suggests a literary and perhaps gifted mind working *in vacuo*. In two volumes Hall (31) has given us an epoch-making study, chiefly from the psychological point of view, of the greatest moral genius of all time. It is impossible even to characterize such a monumental work in the few lines here available, much less to summarize it. Delage (17), criticizes Ostwald's study of the lives of great men as unscientific, insincere and designed to exploit German Kultur. Surely not all will agree with Ostwald's view that the chief function of woman is merely to smoothe the pathway for her genius husband. Wilson's novel, "Martin Schöler" (91), is highly praised by the Dial and the New Statesman as a literary picture of genius. The reviewers have not seen it.

Statistical, Biological, and Genetic Studies of Genius.—In his

valuable summaries of data on 1000 American men of science Cattell (10) deals chiefly with eugenic, economic, and environmental factors. Statistics too extensive to summarize here are given on nationality, social class, education, marriage, and size of family. The author is inclined to stress the importance of environmental factors. The "order of merit method" used in the selection of these 1000 men has many possibilities of application in psychological research. Pearce (54) presents statistics as to parentage, education, and interests of the medical group in Cattell's 1000 American men of science. No conclusions are drawn. Clarke's study of 1000 men of letters (12) is stimulated by Ward's "Applied Sociology." He fails to verify Ward's conclusions as to the preponderating influence of nurture and the uniform distribution of genius. He presents interesting data in regard to environment, economic situation, family, geographical distribution, and the like. Some of his conclusions are decidedly questionable; *e.g.*, that there is slight relation between intelligence and acquisition of a high-school education, and that the different nationalities are equally productive of genius. Nearing (50) concludes from his study of the distribution of men included in *Who's Who in America* that the concentration of genius in the New England states indicates a superiority of stock in this region. The second article (51) points out the concentration of ability in cities and in certain universities. Woods (95) has made a valuable study of the racial origin of successful Americans, showing the importance of racial stock in the production of genius. Davenport and Scudder (16) have investigated the heredity and the juvenile traits of great naval officers. Nomadism, extreme venturesomeness or *thalassophilia* (sea lust), characterized the youth of nearly all. Sea lust is "a definite instinct," especially marked in certain races. "That sea lust is a racial trait is recognized by seamen themselves"! *Thalassophilia* "acts like a recessive." The authors believe their findings could be advantageously used in the selection of naval officers. Davenport (15) also gives a valuable account of the late Professor C. O. Whitman's heredity and early interests and of the environmental influences which molded his development. Walcott's statistical study (87) of men taking the Ph.D. degree in certain institutions between 1885 and 1904 shows that they obtain this degree on an average a little less than six years after graduation, that the death rate of the Ph.D. group is lower than for college graduates as a whole, that their proportion to A.B. men is about 1 in 22, and that approximately

one third are included in "Who's Who," one third in American Men of Science, and 10 per cent. in Cattell's 100 men of science. Ellis (19) reiterates his earlier views to the effect that genius is related to certain traits of abnormality and that women display genius less often than men because they are less variable. The author evidently remains unconvinced by the data of Pearson and L. S. Hollingworth. Armstrong (4) argues, without data, for the close relation between genius and insanity, citing selected cases to prove his theory. Redfield (59) maintains that rapid breeding inevitably leads to the production of inferior stock, slow breeding to the production of superior stock. Inferior stock can be transformed into superior stock in 100 years, and into eminent men in 200 years! The author cites 571 specially selected pedigrees to prove his theory. In another article which one is surprised to find in a reputable scientific journal (58) the author argues that improvement comes chiefly through the inheritance of acquired traits. Millard (47) gives brief descriptions of a number of eminent men who displayed precocity and speculates as to the influence of advanced age of parents. Gemmill (24) points out that since many geniuses have come from defective strains, we should use caution in the social condemnation or sterilization of the so-called "unfit." Escott (20) in a discursive article cites examples of the inheritance of genius.

Social Aspects of Genius.—More studies are needed of the type furnished by Tanner (78) on the social aspects of genius. The inventions of Arkwright, Cartright, Hargreaves, Whitney, Howe, and Watt are studied from this point of view and the dependence of inventive progress upon economic conditions is convincingly shown. Suggestions are made bearing on the psychological nature of the typical inventive processes. Adler's theory of "Minderwertigkeit" is suggested as a possible explanation of Watt's preoccupation with steam power. Burgess (7) gives a broad and scholarly treatment of the part played by "socialization" in the intellectual advancement of mankind. While he has dealt with the problem in an exceptionally able manner, it will doubtless seem to many psychologists that he underestimates the factor of racial and individual differences in endowment. Professor Kroeber (42) shows the influence of timeliness and general social milieu as factors in invention and discovery. Darwin's work, *e.g.*, would soon have been done even if Darwin had never lived. The article may be taken as a social explanation of genius. Todd (84) also argues that the

typical "great man" is more a product than a cause of social evolution. The argument is ably presented, but probably few psychologists will agree with him when he says that "genius is scattered somewhat uniformly throughout the whole mass of the population," or when he follows Ward "in rejecting the familiar spindle-shaped graph of distribution of ability" in favor of a distribution which is rectangular. Gillette (26) gives a resumé of the writings of Galton, Ward, Odin, and Cattell, and from their data concludes that talent and genius depend on educational and conventional agencies of the cultural kind for their development. Nutting (52) discusses endowment, education, incentives, and fortuitous circumstances as factors in achievement.

Psychoanalytical Studies of Genius.—According to Mordell (48), the literary genius is one who has experienced a repression, drawn certain conclusions from it, and expressed what society does not wish to admit. Literature is largely created by unfulfilled wishes. "If there were no repression there would be no literature." By making an outlet for their repressions in imaginative literature Rousseau, Goethe and many others have saved themselves from insanity. Psychologists will at least agree with the author when he argues for the necessity of interpreting literature in the light of biography. Kempf (38) presents "a psychoanalytical study of Darwin's inferiority and compensations." Darwin's long period of ill health offers a fruitful field for the psychoanalyst, of which Miss Kempf makes the most. Darwin's whole life work is explained on the basis of his mother's influence, made possible by his wife's "reduplication of the mother image," while behind his ill health is assumed a suppressed affective conflict toward his father. Darwin's expressed admiration for his father is explained as overcompensation for a real aversion. Freud (21) makes a psychoanalytical study of the many-sided da Vinci, whom he regards as a case of homosexuality due to the circumstances of his illegitimate birth, the absence of his father, and the resulting infantile attachment to his mother. Evidence: one or two curious dream fantasies, the fact that he never married, and that he buried his mother with a sumptuous funeral! The artist's breadth of interests was due to the sublimation of an infantile sex curiosity into a general investigation impulse. Karpas (37) attempts to show that Socrates' philosophy is in accord with the principles of psychoanalysis, his "know thyself" being taken in the psychoanalytic sense of uncovering repressions. The personality of Socrates is analyzed in

detail, with emphasis upon the influences of the Œdipus complex and homosexual tendencies. His asceticism is interpreted as masochism, and his unhappy married life is connected in the usual fashion with his veneration for his mother. Dooley (18) summarizes various psychoanalytic studies of men of genius, including Jensen, da Vinci, Andrea del Sarto, Hamlet, Dante, Lenau, von Kleist, Gogol, Wagner, Napoleon, Amenhotep IV (!), von Zinzendorf, Loyola, Schopenhauer, and others. Their works and lives are dissected in the usual psychoanalytic style in the attempt to explain genius in terms of sex complexes and repressions. What a pity the testimony of the victims can not be appealed to!

The Psychology of Special Talent.—Miss Rogers' (64) study of mathematical ability is one of the most important to date in the field of special talent. Thirteen carefully selected "mathematical" tests and four "verbal" tests were given to 114 first year high school girls. Statistical treatment of the data yielded a battery of six tests, requiring an hour and a half to administer, which correlates from .60 to .80 with class marks in mathematics. A high correlation was found between the "mathematical" tests and the "language" tests (.65 when corrected). The correlation between Algebra and Geometry was only .30 when the language element was eliminated. Seashore's investigations of musical talent are epoch-making. In collaboration with Mount (71), he presents fundamental data on pitch, intensity, discrimination, consonance, time sense, motor ability, rhythm, and imagery in their relation to musical ability. In a volume written for the general reader (70), Seashore brings together the chief results of his twenty years or more of research on musical talent. The psychophysical traits underlying musical talent can be measured even in the lower school grades, and are little subject to improvement by training. Seashore has later described a survey of musical talent in the fifth and eighth grade classes of Des Moines (68). The study is extremely interesting, but it is unfortunate that the author fails to state clearly his method of combining and weighting the measures of the various traits. In a general discussion of musical prodigies Révész (61) asserts that these are characterized rather by their originality in musical interpretation than by exceptional skill in execution. No data are given. The same author reports a special study of a musical prodigy (62). Manual (45) used 45 mental and motor tests with 19 subjects of more than ordinary ability in drawing. The subjects ranged from elementary to university grade. The

conclusion reached is that there is no one type of psychophysical constitution underlying ability in drawing. Twelve abilities are listed which are considered important, but suitable tests for these are not offered. On the whole the study is disappointing. A more sagacious selection of subjects and tests would have yielded data more amenable to statistical treatment and of far greater value. Tildesley (83) discusses the dependence of artistic ability upon steadiness and rapidity of the hand. His data admittedly are inconclusive, but Gruenberg (30) sees great possibilities for educational guidance in this line of experimentation. In this connection the investigation of H. J. and W. A. Pannenberg (53) also deserve mention. Giese (25) has made an analytical study of more than 1,000 prose compositions and poems written by children under eighteen years. He finds the poetry of children characteristic in form as well as in content. Data are given on metre, themes, mood, etc. Striking differences are found between spontaneous poetry and that written as a school exercise. The author concludes that irony, satire, and criticism are masculine traits, while girls are more emotional, romantic, and imaginative. Boys originate, girls imitate. Boys' writings show more *Ernst*, those of girls' more *Heiterkeit*. Scholz (66) gives an a priori and theoretical analysis of the psychological processes involved in literary composition. Gowin (28) has written an interesting volume on a psychologically neglected type of genius,—the business executive. His data seem to show that executives greatly excel most other groups of men in height and weight, but as the questionnaire was used we can not be sure of the height and weight of those who failed to respond. The author's style is fluent and often brilliant. Chas-sell (11) gave to one hundred university students and to one inventor a series of twelve mental tests designed to test originality. These included, among others, word building, language completion, picture writing, chain puzzles, and mechanical invention. That the tests were not wholly successful is indicated by the fact that the inventor who was tested did not do especially well in them. Taussig (79) emphasizes the part played by the "instinct of contrivance" in invention, although he admits that the motives of inventors are often extremely complicated. Great money-makers have been largely motivated by the collecting instinct, domination, love of adventure, emulation, imitation, display, and sex striving.

Gifted Children.—Terman devotes 102 pages of his latest book (80) to a summary of findings regarding 59 gifted children

and to clinical descriptions of 42 cases. Most of these tested between 140 and 185 I.Q. Extensive social and educational data are summarized, including ratings by parents and teachers on mental and physical traits. These children in general came from superior stocks. They averaged well in health and social adaptability. On the basis of chronological age there was an average acceleration of two grades. On all the twenty traits teachers rated the children higher than did the parents. Re-tests usually agree with the original findings. Similar but more limited data had been presented by the same author in an earlier article (82). In another article (81) Terman analyzes certain documentary evidence presented in Karl Pearson's biography of Galton, from which he concludes that the boy Galton possessed an I.Q. which could not have been much less than 200. The conclusion is of special interest in view of Galton's place in the history of mental measurement. Garrison, Burke, and Hollingworth (23) nearly four years ago reported the case of a boy aged 8 years, 4 months whose I.Q. was 187. Exceptionally full data were given. (As this review goes to press Mrs. Hollingworth reports that the boy is now entering Columbia University at the age of twelve years with considerable advanced standing, having passed the entrance intelligence examination with high score.) Miss Coy's account of a ten-year-old girl with I.Q. 167 is typical (14). The child possessed the intellectual ability of the average second year high school pupil, but was only in the fifth grade. There were no indications of abnormality. Rusk (65) describes the Binet performances of a child tested at the age of five years and again two and a half years later. In each case the I.Q. was close to 200. Miss Langenbeck (43) gives an interesting account of a five-year old child with I.Q. of approximately 200. The vocabulary of this child included approximately 6,000 words. Busch (8) gives an incomplete description of a rather bright child of 39 months. A four-year-old who could read well in the second reader is described by Reed (60). The father of Martha S. has described (2) in detail the methods by which he taught her to read while a mere baby. Instruction began at 19 months, and at 26 months Martha read as well as the average child at the end of the first grade. (Those who saw this article will be interested to know that recently, at the age of four years, Martha was tested and found to have an I.Q. of 140.) Jones (35) emphasizes the need of basing the study of gifted children on experimental procedure, and outlines the kinds of data which ought to

be included. Later in a series of articles (36) he presents the results of numerous mental and physical tests of 5 very bright and 5 borderline or defective children of about the same mental age. The superiority of the bright group is plainly shown in tests of the higher mental processes. In the sensory, perceptive, and motor functions they are no better than, and are often inferior to, the defectives. Professor Wiener has performed a real service in translating the old book in which Pastor Witte recounts the mental development of his gifted son (93). A certain amount of documentary evidence is included. Young Karl entered college at nine, took his Ph.D. with distinction before fourteen, and at sixteen was appointed on the teaching staff at the University of Berlin. He spent his life as a professor of law, became the leading Dante scholar of his century, and lived to his eighty-third year. According to Cantley (9) mental precocity is an hereditary trait and more often occurs in the first or last child of parents having widely dissimilar ages. We should distinguish true from artificial precocity. The article contains no data. Hollander (34) reiterates the ancient superstitions to the effect that precocious children are nervous, morbid, undersized, and likely to "become stupid, dull and clumsy." In view of their terrible handicaps how fitting that they should also be supposed to die young! According to Groszmann (29) bright children belong to four types, two of which are atypical and two pseudo-atypical. Atypical children are defined as representing variations from type, the pseudo-atypical as representing deviations merely from the normal (whatever this distinction means). The author's treatment is of no interest except as illustrating a defunct "type psychology."

The widespread interest evident particularly in the United States and Germany in regard to the education of gifted children is indicated by the following references, which can not here be reviewed for lack of space: (88, 33, 74, 73, 94, 72, 32, 56, 27, 49, 69, 92, 44, 75). Whipple (88) and Henry (33) are based chiefly on the Urbana experiment conducted by Whipple. The latter contains 157 references. These studies taken together show that children of 125 I.Q. or higher are able to progress at far more than the usual rate through the grades (often as rapidly as two or three grades in one year), that they need far less drill and explanation than average children, that in general they show few signs of abnormality in health and character traits, and that their needs cannot be met without extensive modifications of the curriculum.

As was to be expected, the publication of Daisy Ashford's precocious novelette (3) brought to light a host of juvenile authors. Easily the most interesting of these is Opal Whitely (89), though it is improbable that any psychologist of childhood will accept the assurance of the Atlantic editor that the journal was written at the time its author claims. Many of the free verse poems of Hilda Conkling (13) have real merit. Miss Stoner (76) has been before the public since childhood. The story of Horace Wade (86) is drivel, notwithstanding the laudatory introduction by George Ade.

Miscellaneous.—Contributors which the reviewers have not seen include: (6, 41, 57, 64, 85, and 90). Most of these are probably of little value for the psychology of genius.

REFERENCES

1. ANON. The Genius of Science. *Science Progress*, 1914, 8, 391-397.
2. ANON. With introduction by Lewis M. Terman. An experiment in Infant Education. *J. of Appl. Psychol.*, 1919, 2, 219-228.
3. ASHFORD, D. *The Young Visitors*. New York: Doran, 1919.
4. ARMSTRONG, J. R. Relations of Genius to Insanity. *Sociol. R.*, 1914, 7, 156-163.
5. BERLE, A. A. *Teaching in the Home*. New York: Moffatt, Yard & Co., 1915, pp. 354.
6. BRISCHAR, K. M. *Das Genie: Ein Versuch*. Leipzig: Spohr, 1914, pp. 35.
7. BURGESS, E. W. *The Function of Socialization in Social Evolution*. Chicago: U. of Chic. Press, 1916, pp. 237.
8. BUSCH, A. D. B.-S. Tests of a Thirty-nine Months Old Child. *Psychol. Clinic*, 1914, 7, 250-257.
9. CANTLEY, E. The Precocious Child. *The Child*, 1919, 9, 481-6.
10. CATTELL, J. M. Families of American Men of Science. *Pop. Sci. Mo.*, 1915, 86, 504-515.
11. CHASSELL, L. M. Tests for Originality. *J. of Educ. Psychol.*, 1918, 7, 317-328.
12. CLARKE, E. L. American Men of Letters; Their Nature and Nurture. *Stud. in Hist. Econ. and Public Law*: Columbia Univ., whole no. 168, 1916, pp. 169.
13. CONKLING, H. *Poems by a Little Girl*. New York: Stokes, 1920.
14. COY, L. G. The Mentality of a Gifted Child. *J. of Appl. Psychol.*, 1918, 2, 299-307.
15. DAVENPORT, C. B. The Personality, Heredity, and Work of Chas. Otis Whitman. *Amer. Natural.*, 1917, 51, 5-30.
16. DAVENPORT, C. B., assisted by M. T. SCUDDER. Naval Officers; Their Heredity and Development. *Carnegie Institution*, 259, 1919, pp. 236.
17. DELAGE, Y. "Les Grands Hommes" d'Ostwald et le manifeste des 93. *Bull. Instit. Gén. Psychol.*, 1915, 15, 57-74.
18. DOOLEY, L. Psychoanalytic Studies of Genius. *Amer. J. of Psychol.*, 1916, 27, 362-416.
19. ELLIS, H. The Mind of Woman. *Atlantic M.*, 1916, 118, 366-374.
20. ESCOTT, T. H. S. Heredity in British Brains. *Lond. Q. Rev.*, 1918, 129, 196-205.

21. FREUD, S. *Leonardo da Vinci; A Psychosexual Study of an Infantile Reminiscence*, New York: Moffatt, Yard & Co., 1916, pp. 130.
22. GARNETT, J. C. M. General Ability, Cleverness, and Purpose. *Brit. J. of Psychol.*, 1919, 9, 345-366.
23. GARRISON, C. G., BURKE, A. & HOLLINGWORTH, L. S. The Psychology of a Prodigious Child. *J. of Appl. Psychol.*, 1917, 1, 101-110.
24. GEMMILL, S. N. Genius and Eugenics. *J. of Crim. Law*, 1915, 6, 83-100.
25. GIESE, F. Das freie literarische Schaffen bei Kinder und Jugendlichen. *Beihefte z. Zsch. f. Angew. Psychol.* Leipzig, 1914, 1, S 220, 2, S 242.
26. GILLETTE, J. M. Conservation of Talent through Utilization. *Scient. Mo.* 1915, 1, 151-164.
27. GILLINGHAM, A. Bright Child and the School. *J. of Educ. Psychol.*, 1919, 9, 237-252.
28. GOWIN, E. B. *The Executive and his Control of Men*. New York: Macmillan, 1915, pp. 349.
29. GROSZMANN, M. P. E. *The Exceptional Child*. Scribners, 1917, pp. 764, Chapt. 7, 106-140.
30. GRUENBERG, B. C. Toward the Discovery of Native Talent. *School. & Soc.*, 1919, 9, 209-211.
31. HALL, G. S. *Jesus, the Christ, in the Light of Psychology*. (2 Vols.). New York: Doubleday & Page, 1917, pp. 733.
32. HANAUER, DR. Der Aufstieg der Begabten. *Zsch. f. Schulges.*, 1918, 31, 177-186.
33. HENRY, T. S. Classroom Problems in the Education of Gifted Children. Part 2. *19th Yearbook Nat'l. Soc. for Study of Educ.*, Bloomington, Ill.: Pub. School Pub. Co., 1920, pp. 125.
34. HOLLANDER, B. *Abnormal Children*. London: Kegan Paul, Trench, Trubner & Co., 1916, pp. 224. See Chap. 7, "Nervous and Precocious Children," pp. 107-120.
35. JONES, C. T. Suggestive Plan for the Study of Very Bright Children. *J. of Educ.*, 1917, 85, 290-292.
36. JONES, C. T. Very Bright and Feeble-Minded Children. *Training School Bull.* 1919, 16, 137-140; 1920, 16, 153-164.
37. KARPAS, M. J. Socrates in the Light of Modern Psychopathology. *J. of Abn. Psychol.*, 1915, 10, 185-200.
38. KEMPF, E. J. Chas. Darwin—The Affective Sources of his Inspiration and Anxiety Neurosis. *Psychoan. Rev.*, 1918, 5, 151-192.
39. KIERNAN, J. G. Is Genius a Sport, a Neurosis, or a Child Potentiality Developed? *Alienist & Neur.*, 1915, 36, 165-182, 236-246, 384-395; 1916, 37, 70-82, 141-157; 1919, 40, 114-118.
40. KNOWLSON, T. S. *Originality: A Popular Study of the Creative Mind*. Lond: T. Werner Laurie, 1918, pp. 304.
41. KOHLBRUGGE, J. H. F. War Darwin ein originelles Genie? *Biol. Centralbl.*, 1915, 35, 93-111.
42. KROEBER, A. L. The Superorganic. *Amer. Anthropol.*, 1917, 19, 163-214.
43. LANGENBECK, M. A Study of a Five Year Old Child. *Ped. Sem.*, 1915, 22, 65-88.
44. McDONALD, R. A. F. The Adjustment of School Organization to various Population Groups. *Teach. Coll. Contrib. to Educ.*, No. 75, 1915. (See esp. Chap. 11.)

45. MANUAL, H. T. *A Study of Talent in Drawing*. Bloomington, Ill.: Pub. School Pub. Co., 1919, pp. 152.
46. MEUMANN, E. *Vorlesungen z. Einführung in die Experimentelle Pädagogik*. 2d ed., Engelmann, Leipzig, Bd. 2, 1913; Bd. 3, 1914.
47. MILLARD, B. Precocity and Genius. *Bookman*, 1915, 42, 340-345.
48. MORDELL, A. *The Erotic Motive in Literature*. New York: Boni & Liveright, 1919, pp. 250. Esp. Chap. 8, "Genius as a Product of the Unconscious."
49. MYERS, G. C. Broadening the Course of Study for the Brighter Children. *Educ. Adm. & Superv.*, 3, 1917, 33-37.
50. NEARING, S. The Geographical Distribution of American Genius. *Pop. Sci. Mo.*, 1914, 85, 189-199.
51. NEARING, S. The Younger Generation of American Genius. (Continuation of 51.) *Scient. Mo.*, 1916, 2, 48-61.
52. NUTTING, P. G. Factors in Achievement. *Scient. Mo.*, 1918, 7, 326-334.
53. PANNENBERG, H. J. & W. A. Die Psychologie der Zeichners u. Malers. *Zsch. f. Angew. Psychol.*, 1919, 12 pp. 230-275.
54. PEARCE, R. M. Analysis of the Medical Group in Cattell's 1000 Leading Men of Science. *Science*, 1915, 42, 264-277.
55. POINCARÉ, H. *Science and Method*. (Tr. by Francis Maitland.) London: Thos. Nelson & Sons, pp. 288., Esp. Chap. 3, "Mathematical Discovery." 46-63.
56. RACE, H. V. A Study of a Class of Children of Superior Intelligence. *J. of Educ. Psychol.*, 1918, 9, 91-97.
57. REBHURN, H. Entwurf eines psychographischen Beobachtungsbogens für begabte Volksschüler. *Zsch. f. Angew. Psychol.*, 1918, 13, 416-429.
58. REDFIELD, C. L. Ancestors of Eminent Men. *J. of Educ. Psychol.*, 1916, 7, 548-552.
59. REDFIELD, C. L. *Great Men and How they are Produced*. Chicago: Privately pub., 1915, pp. 32.
60. REED, I. K. The Three R's at Four Years Old. *Atlantic Mo.*, 1919, 123, 664-8.
61. RÉVÉSZ, G. *Erwin Nyiregyházi: Psychologische Analyse eines musikalisch hervorragenden Kindes*. Leipzig: Veit u. Co., 1916.
62. RÉVÉSZ, G. Das musikalische Wunderkind. *Zsch. f. päd. Psychol.*, 1918, 19, 29-34.
63. RITTER, F. *Die Mathematische Begabung u. die Schule*. Mainz: Schneider, 1914, S. 53.
64. ROGERS, A. L. Experimental Tests of Mathematical Ability and their Prognostic Value. *Teach. Coll. Contrib. to Educ.*, No. 89, 1918, pp. 118.
65. RUSK, R. N. A Case of Precocity. *Child Study*. 1917, 10, 21-27.
66. SCHOLZ, W. von. Das Schaffen des dramatischen Dichters. *Zsch. f. Aesthetik*, 1914, 9, 176-185.
67. SCHWARZ, O. L. *General Types of Superior Men*. Boston: R. G. Badger, 1916, pp. 435.
68. SEASHORE, C. E. A Survey of Musical Talent in the Public Schools. Vol. 1, No. 2 of *Studies in Child Welfare*, Pub. by University of Iowa, 1920, pp. 36.
69. SEASHORE, C. E. The Talented Child. *J. of Educ. Psychol.*, 1916, 7, 241-2.
70. SEASHORE, C. E. *The Psychology of Musical Talent*. New York: Silver, Burdett and Co., 1919, pp. 288.
71. SEASHORE, C. E., & MOUNT, G. H. Correlation of Factors in Musical Training and Talent. (University of Iowa Studies). *Psychol. Monog.*, 1918, 25, no. 108, 47-92.

72. SPECHT, L. H. A Terman Class in Public School No. 64. *Manhattan School and Soc.*, 1919, 9, 393-398.
73. STERN, E. Bemerkungen zur Frage der "Begabterauslese." *Zsch. f. päd. Psychol.*, 1918, 19, 332-335.
74. STERN, W. & PETER, R. Die Auslese befähigter Volksschüler in Hamburg. *Beiheft 13 Zsch. f. angew. Psychol.*, 1919, pp. 157.
75. STONER, W. S. *Manual of Natural Education*. Indianapolis: Bobbs-Merrill, 1916, pp. 216.
76. STONER, W. S., JR. *Facts in Jingles*. Indianapolis: Bobbs-Merrill, 1915.
77. STURT, H. *The Principles of Understanding: An Introduction to Logic from the Standpoint of Personal Idealism*. Cambridge: University Press, 1915, pp. 302.
78. TANNER, A. E. Certain Social Aspects of Invention. *Amer. J. of Psychol.*, 1915, 26, 388-416.
79. TAUSSIG, F. W. *Inventors and Money-Makers*. New York: Macmillan, 1915, 138.
80. TERMAN, L. M. *The Intelligence of School Children*. Boston: Houghton, Mifflin Co., 1919, pp. 317. Esp. Chap. 10, "Some Facts About 59 Superior Children." and Chap. 11, "Case Studies of 41 Superior Children."
81. TERMAN, L. M. The Intelligence Quotient of Francis Galton in Childhood. *Amer. J. of Psychol.*, 1917, 28, 209-215.
82. Terman, L. M. The Mental Hygiene of Exceptional Children. *Ped. Sem.*, 1915, 22, 529-537.
83. TILDESLEY, M. L. Preliminary Note on the Association of Steadiness and Rapidity of Hand with Artistic Capacity. *Biometrika*, 1918, 12, 170-177.
84. TODD, A. J. *Theories of Social Progress*. New York: Macmillan, 1918, pp. 579. Cf. Chap. on "The Eugenists," "Great Men," "Heroes," "The Élite," "The Intellectualists" and "The Artists."
85. TÜRCK, H. *The Man of Genius*. London: Black, New York: Macmillan, 1914, pp. 483.
86. WADE, H. A. *In the Shadow of Great Peril*. Chicago: Reilly, Lee & Co., 1919.
87. WALCOTT, G. D. A Statistical Study of Doctor of Philosophy Men. *School & Soc.*, 1915, 1, 66-71, 102-108.
88. WHIPPLE, G. M. *Classes for Gifted Children: An Experimental Study of Methods of Selection and Instruction*. Bloomington, Ill.: Pub. School Pub. Co., 1919, pp. 151. (Bibliog. of 124 references on genius, etc.)
89. WHITELEY, O. *The Journal of an Understanding Heart*. Boston: Atlantic Mo. Press., 1920.
90. WILLIAM, T. A. Principles and Methods which Result in Intellectual Precocity. *Lancet Clinic*, 1915, 1-28.
91. WILSON, R. *Martin Schüler. (A Novel)* New York: Holt, 1919, pp. 313.
92. WITMER, L. Training of Very Bright Children. *Psychol. Clinic*, 1919, 13, 88-96.
93. WITTE, K. *The Education of Karl Witte*. Tr. by Leo Wiener, with an introduction by H. Addington Bruce. New York: Crowell, 1914, pp. 312.
94. WOODS, E. L. Provision for the Gifted Child. *Educ. Admin. & Superv.*, 1917, 3, 139-149.
95. WOODS, F. A. Racial Origin of Successful Americans. *Pop. Sci. Mo.*, 1914, 84, 997-402.

PROSTITUTION

BY FLORENCE MATEER

Bureau of Juvenile Research, Columbus, Ohio

The last decade has seen a most radical change in all that relates to this ancient social problem from sociological, legislative, medical, and even ethical viewpoints. The development has not been an independent one but so closely interrelated to progress in laboratory technique in medicine, the utilization of trained social workers, the development of psychological methods, changes in the economic and political status of women, and the impetus felt in all of these fields because of the war, that any discussion of the subject per se necessitates a definite understanding of progress in these lines.

The first half of the decade may be justly characterized as a period of surveys and systematic investigations. Over thirty cities in the United States made attempts to ascertain something which would serve as a basis for a constructive policy. These reports varied in length, accuracy, detail from the four page non-effective statement issued by the New York Bureau of Municipal Research concerning Columbus, Ohio (7), to the elaborate statistical reports compiled by Kneeland whose work deserves high credit for perspective given. The study of Chicago (6) conditions reported prostitution as a social evil dependent upon many factors. Local conditions, police morale, ease of supply, prevalence of crime, activity of educational and protective agencies, stringency of prosecution, medical inspection and attitude, and legislation all shared in the responsibility. Segregated districts and police registration similar to European custom were declared insufficient and "constant and persistent repression of prostitution the immediate method," with "absolute annihilation the ultimate ideal" was the final summary of the report.

In 1911, as a result of the work of the Special Grand Jury which investigated the white slave traffic in New York City, the Bureau of Social Hygiene was established to systematize and render continuous effort against the problem of prostitution. To this agency we owe a series of volumes which have been fundamental in stimulating thought and action on this matter. Their first report (11),

compiled by Kneeland, is a step in advance of any civic reports preceding it. It brings out with new emphasis the part played by the double standard for men and women, involving penalty always for the woman, escape as frequently for the man. Exploitation is treated clearly and definitely and shows definitely the relation of social evil to enforcement of law. A later edition of the same report shows the demolition of the system under law enforcement. Careful analyses are submitted of prostitutes under imprisonment but unfortunately the tabular presentation shows each factor individually and little attempt is made to study correlation or multiple determination.

The Massachusetts report, made under the direction of Fernald (13), issued in 1914 differs from those preceding it in its utilization of modern methods for determining the status of the prostitute herself. A study was made of 100 unselected cases in prison, another hundred awaiting trial and another hundred in the Industrial Schools. The study involved examination by the Binet, a school examination, practical information and an attempt to obtain the family, personal, social and economic history of each girl studied. 154 of the 300 women examined showed mental defect "so pronounced and evident as to warrant legal commitment of each one as a feeble-minded person or as a defective delinquent" (p. 29). It is to be regretted that a medical examination of similar thoroughness, including laboratory tests for venereal diseases was not made in all cases. There is a high probability that much of the low mentality found may be a by-product of syphilis and thus at least a concomitant of prostitution rather than a factor in its causation.

Miner (16) in the *Slavery of Prostitution* gives the best illustration of what can be done by individual study of the prostitute. Unfortunately her case studies do not give the scientific data on the individual which could have been gathered even at the date when the study appeared. Psychological, psychiatric, neurological and physiological study would undoubtedly have delimited her various problems in a fashion which would have enabled others to profit more by the writer's experience and success. The study embodies primarily woman's tolerance, understanding of and struggle for the victim of prostitution, woman. The study is a forerunner of the protective work done throughout the country during the war.

The European situation in its historical perspective, covering

conditions up to 1914, has been presented in rather inconvenient statistical fashion by Burgess (3). Probably the greatest value of the book is its chapter on a constructive policy by Olson. The writer is too little scientific and cannot keep even his discussion of the religious aspects of the problem free from his own conviction.

Calhoun (4) gives one a chance to relate the historical development of prostitution in America in its relation to changing social conditions. Although the subject is but incidental to his analysis of family life it provides a well-oriented point of departure for more specialized investigation. The study loses somewhat from the writer's unjustified assumption that the new status of women will eliminate prostitution.

The condition in Europe at the outbreak of the war is most ably and independently stated by Flexner (9). Prostitution, under his pen, becomes an end result of supply and demand, wealth, occupation, law, race, education, the double standard, "unschooled human nature and imperfect social institutions." His application of European experience to American problems involves correlative study of other social problems and the reconstruction of the prostitute.

The religious attitude of this data is presented independently by Begbie (2). He demonstrates the fallacy of the assumption that any one lack or fault may completely account for a social phenomenon as complex as prostitution. A proper ideal of purity is his compensation. "Virtue knows nothing of geography, is indifferent to climate, and triumphs over heredity and environment," p. 97, is his emphatic assertion. But little of this viewpoint remains today, such practical discussions of morals as that by McKeever (15) seeming to replace it.

The government assumption of responsibility for the health of the army and navy upon our entrance into the world war materially changed the angle from which prostitution was viewed. Prostitution became merely a means of decreasing man power because it presented constantly and in constantly aggravated fashion the possibility of infection by gonorrhea and syphilis. The prostitute was merely the conveyer or carrier of this danger. It is impossible for one to believe that anything short of years of propaganda would have brought any such change in attitude in a time of peace.

Blue (25) outlined a policy for the control of venereal diseases which covered control through legislation and strict enforcement,

quarantine, treatment, and education of the public. His circular letter to the states refers directly to venereal disease, discussing prostitution incidentally. Lane (12) presents the opposite side of the question in outlining the work of the Committee on Protective Work for Girls. The aim of this committee is not primarily one of making arrests but of preventing crime through education of the girl, the provision of proper living and recreational conditions and the enforcement of legislation.

Every one knows of the preventive work done in similar fashion among the soldiers themselves. A brief but clear news report of this, at the time, is made by Seymour (22). The war shows us the state laxity in the detection and treatment of this problem. Every avenue leads back to the necessary elimination of the prostitute if venereal disease is to be controlled. The same writer (21) gives us a summary of conditions abroad. Prostitution is a menace because of venereal disease so spread. The civilian must share responsibility with the soldier. Scientific research into cure must go hand in hand with self-control for the sake of the individual, the family and the race. The tradition of sex necessity must go. Education, proper recreation and the relief of debasing monotony because of economic stress must all bear their part in prevention.

As a result of these changes in method of attack the literature of 1918, 1919 and 1920 bears superficially little relation to the subject of Prostitution. Instead the tendency is to drop a discussion of prostitution per se for it is merely the anti-social end product which may be much better understood and dealt with from the standpoint of various factors causing it. Several of these factors have become more prominent than others.

The prostitute herself has been more thoroughly studied. Practically all studies of delinquency devote a part of their analyses to the sex offender, whether merely immoral, a "charity" girl or an actual prostitute. Anderson and Leonard (1) find that venereal disease is not limited to "chastity offenders," although the percentage of disease is much higher in this group. They point out the relation to alcoholism, stealing and other offenses. Fewer of those who were diseased were self supporting no matter what the offense. No data as to mental status are presented in this study. A brief study by Purcell-Guild (19) gives a clear view of the basis in delinquency from which the prostitute is often developed. One hundred of the hundred and thirty-one girls studied were sex delinquents, thirty-five claiming to have been raped but sixteen

of this group had had other sex experiences. Thirteen per cent. of these girls, averaging only fifteen years of age, were already infected with venereal disease. Their delinquency is shown to be the result of low educational (and mental?) ability, economic stress, environment, parental example, and other concomitants.

Norton (17) finds that the median mental age of 127 prostitutes under surveillance for treatment is nine years and ten months and only 16 have a mental age of thirteen or over. Unfortunately only an abbreviated Stanford Binet was used as the basis of this study so that the findings must be suggestive rather than final. McCord (14) finds that 54 per cent. had a mentality of ten or less.

A most important movement has been the development of brief expositions of the dangers of prostitution, the fallacy of the double standard, etc., in pamphlet form for general distribution. Many state Boards of Health, some local boards and private agencies have developed such a series. The series published by the American Social Hygiene Association is undoubtedly one of the best. The various pamphlets cover sex instruction for young children, for boys and girls, help for educators, parents, physicians, and even for those diseased. "Warnings about prostitutes" is published in various tongues, as are other pamphlets.

Closely related to this work is the development of new magazines which deal chiefly with this problem and which, in conjunction with reports and bulletins, reflect most of today's movement against prostitution. A brief and simple manual by Pusey (20) will be found distinctly valuable as an aid to the social worker to whom the subject is a new one. It offers an outline for preventive and control procedures, discusses the suppression of prostitution, and also gives some instruction for the treatment of diseased individuals.

Besides the lines of more or less scientific study of the individual as a factor in prostitution and the development of educational propaganda there has been distinct advance in legislative control, medical enforcement, actual medical research, and recreational prophylaxis.

Written reports on legislation are not easily located and are usually brief and partial in presentation. Law in the making cannot develop a proper critical perspective from which to view itself. Now and then more comprehensive statements are found such as that by Deardorff (8) giving us some of the "local color" back of the continuance of the Interdepartmental Social Hygiene Board.

We await with interest the promised appearance of a government monograph giving us data on the study of 15,000 delinquent women studied by this department. Similarly brief reports, for instance, inform us of the federal aid given to Chicago (5) to reenforce legislation which has carried out the commission recommendations of 1911; and of the recent establishment in Pittsburg (18) of a new Morals Court as recommended so long ago as 1912.

It is too soon to say whether any permanence of change in ethics will grow out of our recent experiences but the stimulus for such a growth and creed is already at hand. Hall (10) in his volume on morale devotes several chapters to the discussion of sex and its sublimation. The greater part of the book is an exposition of the principles of human behavior which justify all the seeming indirectness of the decade's attack on vice. Undirected energy, unfilled time, negative supervision condone and aid vice. Morale, consciously fostered, eliminates much of it.

The field of the greatest development stimulated by the new social consciousness of prostitution is that of medical research on venereal diseases. With the demand for the study of these diseases has come all of the refinements of laboratory technique for their detection and the clinical development of diagnosis. One individual cannot estimate the amount of study involved nor appreciate, as yet, the advance made. Southard's texts on Neurosyphilis (23) and Shellshock and other Neuro-psychiatric problems (24) are splendid illustrations of the work done in relating syphilis to delinquency, disease, war, economics, and social ethics.

The end is not yet, however. Most of the studies made of prostitution or of one of its causative factors are unfinished or so partial and lacking in correlation with other factors that the conclusions reached cannot help being distorted or lacking in balance. There is so far no prolonged and intensive study of young sex delinquents to see whether they furnish the mass of prostitutes. There is no study of prostitutes prolonged and intensive enough to tell what happens to them. Statistics give their disappearance from the group. The death rate does not account for the disappearance. They are not in custody. Is prostitution an incidence in their lives? There is no study prolonged enough to tell how many, affected with venereal disease, become insane. The state hospitals do not know how many of their diseased women have long since been prostitutes. No one has as yet determined the relation between low mental age in the prostitute and deterioration due to

disease of the nervous system. We need to know what per cent. of the so-called "normal" adolescents in our country practise sex experimentation. It is too soon to say how the recent change in the economic and political status of woman will affect prostitution, and illegitimacy. What may the socializing of the church and the school accomplish? What will public health organization and education on sex hygiene accomplish? All we can say is that prostitution is being attacked by modern methods. All work so far is simply rudimentary.

BIBLIOGRAPHY

1. ANDERSON, V. V. & LEONARD, C. M. A Study of the Physical Condition of One Thousand Delinquents Seen in Court. *Jour. Inst. of Criminal Law and Criminology*, 1919, 10, pp. 82-89.
2. BEGBIE, H. *The Crisis of Morals: An Analysis and a Program*. New York, 1914, 159 p.
3. BURGESS, W. *The World's Social Evil: A Historical Review and Study of the Problems Relating to the Subject*. Chicago, 1914, 413 p.
4. CALHOUN, A. W. *A Social History of the American Family from Colonial Times to the Present*. Cleveland, 3 vols., 1917, 1918, 1919, 348, 390, 411 p.
5. Chicago, "The Cleanest City." *Survey*, 1918, 41, p. 164.
6. Chicago, The Vice Commission of. *The Social Evil in Chicago: Study of Existing Conditions with Recommendations*. Chicago, 1911, 399 p.
7. Columbus. *Complete report of the New York Bureau of Municipal Research made Feb. 6, 1917, to the City Council on vice conditions in Columbus, Ohio*. Printed and distributed by the Civic League. 4 p.
8. DEARDORFF, N. R. The Government and Social Hygiene. *Survey*, 1920, 44, 432-433.
9. FLEXNER, A. *Prostitution in Europe*. New York, 1914. 455 p.
10. HALL, G. S. *Morale: The Supreme Standard of Life and Conduct*. New York, 1920, 378 p.
11. KNEELAND, G. J. *Commercialized Prostitution in New York City, with a Supplementary Chapter by Katharine Bement Davis*. New York, 1913, 1917, 344 p.
12. LANE, W. D. Girls and Khaki: Some Practical Measures of Protection for Young Women in Time of War. *Survey*, 1917, 39, 236-240.
13. Massachusetts. *Report of the Commission for the Investigation of the White Slave Traffic, so called*. Boston, State Printers, 1914, 86 p.
14. McCORD, C. P. One Hundred Female Offenders: A Study of the Mentality of Prostitutes and "Wayward" Girls. *Training Sch. Bull.*, 1915, 12, 59-67.
15. McKEEVER, W. A. *Man and the New Democracy*. New York, 1919, 250 p.
16. MINER, M. E. *Slavery of Prostitution: A Plea for Emancipation*. New York, 1916, 308 p.
17. NORTON, J. K. The Mental Ages of a Group of 127 Prostitutes. *Jour. of Delinquency*, 1920, 5, 63-66.
18. Pittsburg, The New Morals Court in. *Survey*, 1918, 40, 639.
19. PURCELL-GUILD, J. Study of One Hundred and Thirty-one Delinquent Girls Held at the Juvenile Detention Home in Chicago, 1917. *Jour. Inst. of Criminal Law and Criminology*, 1919, 10, 441-476.

20. PUSEY, W. A., and others. *A Manual of the Treatment of the Venereal Diseases*. American Medical Association, 1918, 100 p.
21. SEYMOURS, G. Health of Soldier and Civilian: Venereal Disease Abroad. *Survey*, 1917, 39, 363-367.
22. SEYMOURS, G. Health of Soldier and Civilian: Some Aspects of the American Health Movement in War Time. *Survey*, 1918, 40, 158.
23. SOUTHARD, E. E. & SOLOMON, H. C. *Neuro-syphilis: Modern Systematic Diagnosis and Treatment*. Boston, 1917, 496 p.
24. SOUTHARD, E. E. *Shell-shock and other Neuro-psychiatric Problems*. Boston, 1919, 982 and 21 p.
25. All States Asked to Work together to Control Venereal Disease. *Ohio Public Health Journal*, 1918, 9, 26-28.

VISUAL MOTOR FUNCTIONS

BY RAYMOND DODGE

Wesleyan University

The last review of visual motor functions (1916) noted and deprecated the tendency to exploit eye-movement phenomena in studies of related processes rather than to make them the object of investigation. This tendency is noted again in the last three years and again it must be deprecated.

Recent psychological interest in the eye-movements, aside from their utilization as indicators in the effects of drugs, fatigue, etc., centers in the nystagmus of rotation. This is partly because psychological suggestions for a scientific investigation of the significance of rotation tests in the medical examination of prospective aviators were violently smothered by military discipline during the war, and partly because the semi-circular canals lie directly in the line of scientific advance, and nystagmus is the chief objective indicator connected with these mysterious receptors. In all the nystagmus studies that have fallen under the eye of the reviewer, interest centers in the receptors and their central connections rather than in the indicators. This automatically excludes them from this review, though the reactive compensatory eye-movements really present a considerable series of unsolved scientific problems.

The number of studies of the eye-movements that is presented in the Index is small.

Kuntz and Ohm (2) took flash-light photographs of normal and abnormal eyes when the line of regard was horizontal, raised 30° and lowered 30° . Pupil size was only slightly affected. Inter-pupillary distance was regularly smallest when the line of regard was below the horizontal. It increased as the line of regard was raised to the horizontal, and was sometimes further increased and sometimes decreased by further elevation.

Comparison of photographs which were taken when the conditions for binocular fusion were adequate and when one eye was covered until the moment of record, indicated irregular changes in muscular imbalance according to position of the line of regard. Head-holder, photographic and measuring techniques were excellent

but without essential novelty. The technique as a whole, however, is an independent and interesting solution of the problem of photographic registration for pupillary size and distance for various positions of the eyes. The problem of muscular imbalance of the eyes for various directions of regard deserves further investigation.

Ohm (3) presents a statistical clinical investigation of several factors in the endowment that predispose to miners' nystagmus. It is a contribution to diseases of occupation. The development of nystagmus is favored by alcoholism, strabismus, defective vision, bodily size, and some other undetermined factor.

Bikeles and Rutin (1) found reactive compensatory eye-movements in a meningitis patient with non-functioning labyrinths. From rough experimental data they conclude that the stimulus was of joint and muscle origin, and that the compensatory eye-movements were reflex.

On the basis of clinical evidence which he extensively reviews, Walter (5, 6) demonstrates a differential localization of eye-movement disturbances in three main centers.

Using the method of direct microscopic observation of the sclerotic (Blix ophthalmometer) Sundberg (4) studied the course and accuracy of fixation movements. Faulty fixations and corrective movements, that photographic registration has made us familiar with in this country, are independently observed and described. Among the most interesting new observations Sundberg reports that the meridian of movement makes little difference in their precision; but when the path of the line of regard is tangential to circles which are concentric with the primary fixation field, the precision of fixation movements is notably diminished. Increasing the extent of eye-movement from 7° to 50° increased the fixation errors irregularly, less than 100 per cent. Excluding a peripheral view of the point to be fixated increased the errors almost 300 per cent. The discrepancy between the accuracy of eye-movement and space differentiation on the peripheral retina is noted and discussed with reference to the theory of visual space. Wandering of the line of regard (the size of the fixation field, as we call it), was estimated with accuracy. But the various factors in these fixation changes, namely the pulse, divergence drifts and fixation lapses were not identified.

REFERENCES

1. BIKELES, G., u. RUTTIN, E. Ueber die reflektorischen kompensatorischen Augenbewegungen bei beiderseitiger Ausschaltung des N. vestibularis. *Neur. Centr.*, 1915, **34**, 807-810.
2. KUNZ, L., u. OHM, J. Ueber photographische Messung des Augenabstandes und der Pupillen bei Bewegung der Augen von unten nach oben in der mittleren Blickrichtung. *Arch. f. Ophth. (Graefe)*, 1914, **89**, 469-483.
3. OHM, J. Beitræge zur Kenntniss des Augenzitterns der Bergleute. *Arch. f. Ophth. (Graefe)*, 1915, **89**, 505-555.
4. SUNDBERG, C. G. Ueber Blickbewegung und die Bedeutung des indirekten Sehens fuer das Blicken. *Skand. Arch. f. Physiol.*, 1917, **35**, 1-50.
5. WALTER, W. Clinical Pathology of Ocular Muscle Paralysis. A critique of the more recent literature on ocular movements, with special reference to the study of the control of ocular muscles. *Arch. f. Ophth.*, 1916, **45** 172-194.
6. WALTER, W. The Etiology of Monparalytic Ocular Imbalance. Some original conceptions and interpretations based on the physiology and psychology of ocular movements. *J. of Amer. Med. Ass.*, 1916, **67**, 193-201.

LOCOMOTOR FUNCTIONS

BY IVY G. CAMPBELL

Wells College

The last few years have given us considerable opportunity for studying the mechanisms that subserve locomotor functions. In the first place the various treatments of nerve lesions have allowed us to study recovery of functions. In the second place the frequency of cases of so-called "functional paralysis" has made possible new observations and new theories to account for these observations.

A number of methods for remedying paralysis of muscles due to division of nerve have been used. Nerve suturing is common. Nerve anastomosis is reported by some to be very successful, (2, 11, 37, 38), while others condemn it (28). Nerve grafts or transplants are in many cases reported as successful. (9, 11, 12, 16, 17, 24, 31, 34, 36, 40, 44). Huber (17) relates experiments with animals in which good results were obtained with "auto-nerve" transplants and for bridging long gaps he especially recommends "cable auto-nerve" transplants, *i. e.*, several segments of a small cutaneous nerve are used to bridge a gap in a larger motor-sensory nerve. The type of nerve used is not material nor is the direction in which it is inserted, but accurate end to end adjustment is essential. Fresh "homo-nerve" transplants may also be used as may also nerves that have been stored in sterile fluids. "Hetero-nerve" transplants stored in liquid petrolatum were never successful although those stored in fifty per cent. alcohol showed some down growth of central neuraxes. Ingebrightsen (24) experimented with rabbits and guinea pigs and found that auto and homo transplants but not hetero were successful. The bridging of nerve defects by means of nerve flaps is defended by Mackenzie (32) and as strongly condemned by Stookey (45). From a reading of case histories presented in the literature one is persuaded that the above mentioned operations are successful but on the other hand Sir Robert Jones (28) states that the Medical Research Committee whose report is not yet published, after carefully investigating a large number of cases operated upon has come to the conclusion that nerve suturing is the only successful operation while anastomosis, transplants, flaps, etc., are failures.

Direct neurotization of paralyzed muscles in the sense of Heinake and Erlacher is reported by Steindler (41) and by Elsberg (10). Both men found that if the nerve normally supplying a muscle were cut and then re-implanted into the same muscle and at the same time a foreign nerve was implanted into this muscle that the former but not the latter would come to subserve the functions of that muscle. Frazier (11) speaks of the implanting of surplus nerve fibers from the spastic muscle into the weakened antagonistic muscle; thus making the attempt to strengthen the antagonistic muscle by supplying it with an excess of impulse from a center which is over irritable. The transplantation of tendons, successfully accomplished in cases of paralysis, is discussed by (11, 12, 26, 28). F. W. Jones sees in this a "beautiful physiological experiment" which raises the question whether the transplanted muscle will assume a new role altogether antagonistic to that which was its natural one.

As to the time of return of motor function there are varying reports. After suture it is reported to return in a few days (15, in the case of dogs in sixteen days (13), in two months (16). Most writers, *e.g.*, (31, 36, 43), find it after five or more months. In the case of direct implantation it is reported in from six to eight weeks (10, 41). In the case of nerve transplants Ingebrigtsen (24) reports it in one hundred days.

So much for the facts in regard to return of function. Is this return due to (a) recovery of the injured nerve, (b) the taking on by neighboring nerves of the functions of the injured one, (c) the performance of the function by "compensatory" muscles. Most writers seems to assume that (a) is the cause. On the other hand there are those who think that neighboring nerves can assume the functions of injured ones (3, 17, 36). Jones (26-27), however, contends that appeal to vicarious functioning of nerves is unnecessary, that if we examine carefully we will find that it is not another nerve taking on function but rather it is other muscles performing the functions generally performed by the paralyzed ones. Muscles act as antagonists, as synergics, as fixation muscles, as well as in the role of prime movers. It is the interrelation of muscles in these four capacities that give us any specific movement and when one of these capacities is destroyed another one may function indirectly to accomplish a movement. For example the flexion of a paralyzed joint may be accomplished by the contraction of the extensors of a neighboring joint. Many instances of substitute

movements are given. Ingram and Arnett (25) also give a large rôle to compensatory movements and point out that in attributing return of function to recovery of nerve we must be sure just what muscles are effecting the movement. Woods (46) says that an attempt to contract a paralyzed muscle often results in an involuntary contraction of its antagonist which in turn is followed by a rebound due to the resiliency of the soft tissues. Marie and Foix (33) also speak of movements which help toward the automatic execution of habitual movements which would not otherwise be possible. For example the involuntary symmetrical movements occurring on one side when the other side is voluntarily moved. Bethe (1) tells of two soldiers who had their arms amputated about the middle of the arm and whose flexors and extensors were furnished with hooks. Against the patient's will contraction of one set was accompanied by relaxation of the other. By practice this was to some extent overcome by strong efforts of the will. Clarke (7) suggests that in some cases of voluntary disorders the reciprocal innervation through the final common path may be disturbed so that the antagonists are strongly innervated together, the result being not the desired movement but a spasm of the limb in the position of the strongest set of muscles. Hunt (18-19) contends that from studying return of motor function after injury we gain evidence that there are two distinct physiological systems for the transmission of motor impulses in the peripheral nerves. Two types of movement are seen in this restoration: the automatic and associated movements which are phylogenetically older, are under the control of the corpus striatum, are a more diffuse sort of movement; and the isolated, synergic movements which are more specialized, are younger, are under cortical control. In recovery of nerve injuries the older type of movement returns before the younger. This is comparable to the return of protopathic before epicritic sensitivity. The non-medullated fibers are suggested as those which subserve this older type of movement. Evidence from a number of quarters is given to uphold his view.

A number of writers state that artificial stimulation of muscles will hasten recovery of motor function. This seems doubtful in the light of the following experiments. Hartman and Blatz (14) working with rabbits found that neither massage nor galvanic stimulation benefited denervated muscles. Both methods cause increased activity in muscles which are already overstimulated by constant fibrillation. Stevens (42) contends that the cause of

muscular atrophy following nerve section is due to the fatigue which is caused by fibrillar contractions. Over-action of muscle leads to shrinkage of its volume. Langley (29) too found results comparable to those of Hartman and Blatz. He says that "disuse atrophy" is a misnomer.

Observations of "functional" paralysis have resulted in a number of interesting contentions. A great many think of these as hysterical manifestations curable by suggestion. Remarkable "cures" are reported. Hurst (20-23), has written at great length regarding these and has offered an explanation of the facts observed. Very often in cases of functional disorders we are dealing with cases which were originally organic. When the organic basis is removed the symptoms continue. A man who has attempted, unsuccessfully, to make movements gives up after a time and ceases to pay attention to the muscles involved. But attention is necessary in order that one walk, see, feel, hear." For feeling, seeing, hearing are active processes, and require an effort of the will just as much as walking. The latter may become automatic in time, but if the individual accepts the suggestion that he cannot walk he no longer makes the active effort which is required." Anæsthesia following stupor due to shock Hurst would explain as due to withdrawal of attention. As the physiological basis of this lack of attention he suggests increased resistance in the synapses of the sensory tract. If you can arouse the patient's attention to the processes involved you can make him walk, see, hear, etc. In a series of one hundred consecutive case of paralysis and contractions, ninety six were cured at one sitting, one in four days, two in two weeks, one in four weeks, although the average duration of treatment before they were admitted to Hurst's hospital was eleven months. Hurst has found that in *tabes dorsalis* and in *Friederichs ataxia* an hysterical element is often present which he has succeeded in dismissing much to the patient's benefit. One is duly impressed when reading Hurst's case histories and is convinced that attention and effort seem necessary for movement. But may it not be that it is in just these kind of cases that one must watch for movement through "compensatory" muscles? Attention and effort are necessary to make these movements as well as others. If one can get the patient to make an effort he may accomplish movement not through the structure originally injured but through one which may compensate for the lost one. If this is true it hardly seems fair to call the patient hysterical. The loss of reflex action, found

in some of these cases, is not explained in this way, but it may be that these are the truly hysterical cases while the functionally paralyzed who are so marvelously "cured" are not hysterical.

Brown (4) found that if he could make his patient re-live the emotional experience which had precipitated the symptoms that these would leave. He suggests that the emotion may act physically in overcoming synaptic resistance. Brown and Stewart (5) attempt to explain functional paralysis as due to loss of sensory processes. These writers postulate that when the motor mechanism of the cerebral cortex is cut off from the centripetal ("sensory") nerve impulses of the part of the body the movements of which it subserves, it becomes inactive. It is however still a workable mechanism and may be incited through anything that will increase the intensity of the sensory impulses. Suggestion may do this. The "functional gait" of some cases of functional paralysis is explained as a dropping back to an earlier form of movement—the postural. Postural activity is controlled by the red-nuclear mechanism: the newer phasic movement by the cortex. Now "when the cortical mechanism in functional paralysis is with difficulty activated by the centripetal impulses which we may loosely say subserve the 'desire to walk,' the red-nuclear system lies open and progression of the still 'postural' type is conditioned." In the light of Lashley's experiment (30) upon the man who was anaesthetic to passive and active movements of the knee and who even so could carry out accurate movements, one doubts that Brown and Stewart have adequately explained the facts. Of course Lashley's patient was one with spinal injury while the others are speaking of functional paralysis.

Roussy (39) from a study of over two thousand cases of psychoneuroses gives a large predetermining role to the mental factor. These patients seem to do all in their power to lose the use of the limb. "The patients are persons with a special turn of mind, whose will is deficient or more or less perverted."

Directly opposed to those who are contending that functional paralysis is primarily dependent upon some faulty mental process—attention, will, or what not—are those who would give it a physical basis. We will cite Bury and Dana. Bury (6) calls attention to the fact that many of those who have been "cured" relapse. After working with many cases of men who seem—despite the best will in the world—unable to properly innervate their muscles, he writes: "It is difficult to avoid the conclusion that there are

some physical or chemical changes affecting his motor neurones and interfering in the normal relation between impulse and inhibition, changes which in all probability were set up by the effects of the emotional shock caused by the shell explosion. The observed faulty innervation gives one the impression that there is a block at some synapsis which prevents the proper transmission of cortical impulses to the lower motor neurones." Molecular disturbances of the nervous system and altered blood states largely account for the long duration of many cases and the great tendency of these cases to relapse. Dana (8) also emphasizes the physical. Endocrine defects are often involved. These may have an effect upon the synapses. Symptoms such as hemiplegia, stuttering, tremor, etc., following emotion are not due to some subconscious defense mechanism but to organic or biochemical disturbances in the nervous system. If this is true how can a single mental effort overcome an organic cause? "... the organic is in more than a majority of cases biochemical . . . brought on by a shifting of neural changes through attention or concentration on a certain object. . . . In emotional states the total neural or cerebral energies are massed in certain minor and major association groups connected with the particular form of apprehension or terror. By effort of volition or by a counter emotion, the equilibrium is restored. But some patients do not get well by any of these easy methods."

REFERENCES

1. BETHE, A. Beiträge zum Problem der willkürlich beweglichen Prothesen. *Munch. med. Woch.*, 1916, No. 45.
2. BLANC. Las anastomosis nerviosas en las deformidades paralíticas. *Siglo Med.*, Madrid, 44, 1917, 661.
3. BORING, E. G. Cutaneous Sensations after Nerve Division. *Quart. Jour. of Exp. Physiol.*, 10, 1916, 1-95.
4. BROWN, Wm. War Neurosis: A Comparison of early cases seen in the field with those seen at the Base. *Lancet*, 196, 1919, 833-838.
5. BROWN, F. G. & STEWART, R. M. On the Physiology of the "Functional Paralysis" of Voluntary Movement. *Lancet*, 195, 1918, 702-704.
6. BURY, J. S. The Physical Element in the Psycho-Neurosis. *Lancet*, 199, 1920, 66-68.
7. CLARKE, J. M. Some Neuroses of the War. *Bristol. Med. Chirurg.*, 34, 1916, 49-72.
8. DANA, C. L. The Somatic Causes of Psychoneuroses. *Jour. Amer. Med. Ass.*, 74, 1920, 1139-1143.
9. DUBOIS, E. & COUVREUR, A. Contribution expérimentale à l'étude des sections et ressections nerveuses. *Presse Med.*, 1916, 572.
10. ELSBERG, C. A. Experiments on Motor Nerve Regeneration and the Direct

Neurotization of Paralyzed Muscles by their own and by foreign nerves. *Science*, N.S., **45**, 1917, 318-320.

11. FRAZIER, C. H. Surgery of the Peripheral Nerves. *Surg., Gyn., Obstet.*, **24**, 1917, 147-150.
12. FRAZIER, C. H. & SILBERT, S. Observations in 500 cases of Injuries of the Peripheral Nerves at U. S. A. Gen. Hosp. No. 11. *Surg. Gyn., Obstet.*, **30**, 1920, 50-63.
13. FROUIN, A. Sur la suture des nerfs. Note preliminaire. *Compt. Rend. Soc. de Bioll*, **79**, 1916, 1140.
14. HARTMAN, F. A. & BLATZ, W. E. Studies in the Regeneration of Denervated Mammalian Muscle. *Jour. of Physiol.*, **53**, 1920, 320-340.
15. HEEKES, J. W. Prompt recovery after nerve suture. *Brit. Med. Jour.*, 1918, 507-508.
16. HEINEMANN, O. Ueber Schussverletzungen der peripheren Nerven-anatomischen Untersuchungen ueber den inneren Bau der grossen Nervenstaemme. *Arch. f. klin. Chir.*, **108**, 107.
17. HUBER, G. C. Repair of Peripheral Nerve Injuries. *Surg., Gyn., Obstet.*, **30**, 1920, 464-471.
18. HUNT, R. The Existence of two distinct physiological systems for the transmission of Motor Impulses in the Peripheral Nerves. *Brain*, **41**, 1918, 302-331.
19. HUNT, R. The Static and Kinetic Systems of Motility. *Archives of Neurol. and Psychiat.*, **4**, 1920, 353-369.
20. HURST, A. An Address on Hysteria. *Lancet*, **196**, 1919, 771-775.
21. HURST, A. Crooni-n Lectures Delivered before the Royal College of Physicians of London. June, 1920. *Lancet*, **199**, 1920, 235-240; 279-285; 285-289; 333-339.
22. HURST, A & SYMNS, J. F. M. The Hysterical Element in Organic Disease and Injury of the Central Nervous System. *Lancet*, **196**, 1919, 369-374.
23. HURST, A. & SYMNS, J. F. M. Studies on Hysteria. *Rev. of Neurol. and Psychiat.*, **16**, 1918, 1-23.
24. INGEBRIGTSEN, R. Transplantation des nerfs. *Lyon. chir.* **13**, 1916, 828.
25. INGHAM, S. D. & ARNETT, J. H. Practical Considerations in the Diagnosis of Peripheral Nerve Injuries, with special reference to Compensatory Movements. *Archives of Neurol. and Psychiat.*, **3**, 1920, 107-123.
26. JONES, F. W. Voluntary Muscular Movement in cases of Nerve Injuries. *Lancet*, **196**, 1919, 907-909.
27. JONES, F. W. Voluntary Muscular Movements in Cases of Nerve Lesions. *Jour. of Anatomy*, **54**, 1919, 41-57.
28. JONES, Sir R. Joint, Nerve, and other Injuries in War Surgery. *Surg., Gyn., Obstet.*, **30**, 1920, 1-12.
29. LANGLEY, J. N. Observations on Denervated Muscle. *Jour. of Physiol.*, **50**, 1916, 335-344.
30. LASHLEY, K. S. The Accuracy of Movement in the Absence of Excitation from the Moving Organ. *Amer. Jour. of Physiol.*, **43**, 1917, 169-194.
31. LEWIS, D. Principles of Peripheral Nerve Surgery. *Jour. Amer. Med. Assoc.*, **75**, 1920, 73-77.
32. MACKENZIE, K. A. J. The Repair of Large Gaps in Peripheral Nerves by Neuroplasty. *Surg., Gyn. Obstet.*, **27**, 1918, 353-361.
33. MARIE, P. & FOIX, C. Les syncenesies des hemiplegiques. *Revue Neurol.*, **23**, 1916, 145-162.

34. MAYER, L. Autoplastic Nerve Transplantation in the Repair of Gunshot Injuries. *Surg., Gyn., Obstet.*, **27**, 1918, 530-532.
35. PASTINE, C. *Riv. de Patol., nerv. e ment.*, **23**, 1918, 224.
36. POLLOCK, L. J. The Clinical Signs of Nerve Injury and Regeneration. *Surg., Gyn. Obstet.*, **30**, 1920, 472-480.
37. PORTER, C. A. Surgery of the Peripheral Nerves. *Surg., Gyn., Obstet.*, **24**, 1917, 144-146.
38. PRESTON, G. L. A Case of Erb-Duchenne Paralysis due to a Bullet Wound of the Fifth Cranial Nerve. *Lancet*, **190**, 1916, 1215-1216.
39. ROUSSY, G. Elements of Predisposition and Determining Causes of Secondary Disorders in Psychoneurotic Acroparalysis resulting from the war. *Archives of Neurol. and Psychiat.*, **4**, 1920, 247-258.
40. SPRIGGS, N. I. A Case of Nerve Transplantation. *Lancet*, **196**, 1919, 434-435.
41. STEINDLER, A. Direct Neurotization of Paralyzed Muscles. *Amer. Jour. of Orthoped. Surg.*, **14**, 1926, 707-719.
42. STEVENS, H. C. The Cause of Muscular Atrophy following Nerve Section. *Jour. Amer. Med. Assoc.*, **70**, 1918, 835-836.
43. STEWART, P. & EVANS, A. Nerve Injuries and their Treatment. *Oxford Medical Pub.*, London, 1916.
44. STOOKEY, B. Surgical Consideration of Peripheral Nerve Injuries. *Surg. Gyn. Obstet.*, **27**, 1918, 362-368.
45. STOOKEY, B. The Futility of Bridging Nerve Defects by Means of Nerve Flaps. *Surg., Gyn., Obstet.*, **29**, 1919, 287-311.
46. WOODS, A. H. Misleading Symptoms in the Diagnosis of Nerve Wounds. Abstract by the author in *Jour. of Nervous and Mental Dis.*, **52**, 1920, 166.

References no. 1, 2, 9, 13, 16, 24, and 35 were not available and were reported from published abstracts.

DISCUSSION

THE EQUIVOCAL POSITION OF THE *PRESENTATION* IN THE PSYCHOLOGY OF JAMES WARD

BY MARY WHITON CALKINS

Wellesley College

James Ward's recently published *Psychological Principles*¹ need not be commended to the many students of psychology who, like the present writer, have for years profited by Ward's penetrating analyses and illuminating conceptions. It is a satisfaction to possess this enforcement, revision, and supplementation of Ward's doctrines concerning extensity and space-consciousness, the experience of time and of change, and the virtual identity of consciousness with attention to name no other of the outstanding teachings of this highly important book.

In this brief paper I am, however, attempting no review of the *Psychological Principles* as a whole, but am challenging one of its basal conceptions. To make clear my point of divergence it is essential briefly to outline Ward's psychological position. He conceives psychology as dealing with individual experience.² And central in experience, he everywhere teaches, is the subject (or self). This doctrine, reiterated in all his writings, gains fresh emphasis in the *Psychological Principles*. The activity of a self, of a "being who feels and acts" is, he says, "past question."³ The alternative conceptions of self-consciousness—that of a series of psychic phenomena aware of itself and that of one psychic phenomenon as known by another—Ward finds "unthinkable." It is not "my consciousness," he insists, which "remembers": *I* remember.⁴ And he rightly asserts that "the concept of a self . . . is to be found implicitly or explicitly in all psychological writers whatever—not more in Berkeley who accepts it as a fact,

¹ James Ward, *Psychological Principles*. Cambridge University Press, 1918. Pp. xiv + 478.

² Ward adds significantly: that psychology is not for this reason "confined exclusively to the introspective method." (*Op. cit.*, p. 27².)

³ *Op. cit.*, p. 381²

⁴ *Op. cit.*, p. 22. Cf. p. 38².

than in Hume who treats it as a fiction."⁵ The fact that so many psychologists ignore the self or else refuse it admission into scientific psychology he wisely attributes to the common confusion of "the psychological concept of a self or subject . . . with the metaphysical concept of a soul."⁶

And yet Ward's psychology is not in the fullest sense of the phrase, the science of self or subject. It is, rather, the study of experience; and he conceives of experience as including both (1) modes and attributes of a subject and (2) presentations to a subject.⁷ Concretely experience as he analyzes it includes: (I) The subject's "non-voluntarily attending to changes in the sensory continuum;" (II) The subject's "being pleased" and displeased (an ultimate factor of experience to which no special presentations correspond); (III) the subject's "voluntary attention . . . producing changes in the motor continuum."⁸

This programme as a whole merits interested study—in particular the enumeration of the basal forms of psychic life as predominantly receptive, predominantly affective, and predominantly active consciousness. But this paper is simply concerned, as its title suggests, with the part which the "presentation" plays in the psychological system of Professor Ward. Presentations, in his use of the term, are (1) identified with Locke's "ideas" and Kant's *Vorstellungen*; are (2) said to include "sensations, movements percepts, images, intuitions, concepts;"⁹ are (3) regarded as constituting series;¹⁰ and are, finally, (4) described as "psychical objects," largely independent of the subject of consciousness and with "properties and laws of their own."¹¹ These last words indicate the fundamental incongruity of this doctrine about the presentations with the rest of Ward's system. A psychology for which the self is "always in question" whether one seeks "to analyze one's own consciousness or to infer that of a lobster,"¹² ought, it

⁵ *Op. cit.*, p. 35².

⁶ *Op. cit.*, p. 35².

⁷ On page 39² of the *Principles*, "experience" is used as synonym for "mind" and for "the individual mind" and is said to "mean . . . the subject" of a series of "feelings" or phenomena "plus the series of 'feelings' or phenomena, . . . i.e., objects." Ordinarily, however, "experience" is distinguished from "the experiencing subject."

⁸ *Op. cit.*, p. 56.

⁹ *Op. cit.*, p. 46¹. On p. 50² Ward used for 'movements' the more accurate term, 'motor presentation.'

¹⁰ *Ibid.*, p. 39².

¹¹ *Ibid.*, p. 56.

¹² *Op. cit.*, p. 35¹.

would seem, to regard perceptions, images and the other presentations solely as possessions or characters of the subject or subjects. To attribute to the presentations "properties and laws of their own" is to come perilously near a regression to that form of traditional psychology which studies (in more or less close affiliation to the associationism repudiated by Ward) the series of related "mental states," "contents," or "processes," ignoring completely the subject of the states and processes.¹³ The truth is that there is no room, on Ward's principles, for this anomalous *tertium quid*, the presentation, this something which is neither subject nor concrete object. Impersonalistic psychological systems must of course be weighted with "contents or "states" or "psychic objects, abstractions one and all. But Ward need never have encountered the difficulties involved. He might have treated psychology throughout, after the fashion in which he once defines it, as the study of the subject "intercourse with his special environment,"¹⁴ and he might and should have meant by environment the complex of objects of the "common-sense" world—terms and relations, people and things—objects which the philosopher must probe further but which the psychologist may well accept at their face value. The psychology of Ward, thus relieved of the presentations, would still be a study of "individual experience," but the specific object of study would be the experiencing subject in its different relations or attitudes to the environment. A psychology, thus conceived, would not only find place for all the positive teachings of the presentation doctrine but would enrich and supplement these by fruitful observations from the subjective, or personalistic, point of vantage. Thus, in place of sensations, or "primary presentations," there would be the receptive, sensing self involuntarily affected;¹⁵ in place of the "train of ideations," the continuously imagining or thinking self; in place of 'conations,' the willing self. As a matter of fact, Ward often treats non-sensational consciousness in terms not of the successive presentations but of the conscious subject. Thus, he defines thinking as "analysis and resynthesis;"¹⁶ he asserts that "we assume an attitude and so become conative;"

¹³ The difference on which Ward insists between (1) the presentation as *psychical* object "presented to the subject" and (2) the *physical* object "conceived as independent of any particular object" at least suggests that he feels this difficulty of conceiving presentations as independent of the subject. Cf. pp. 46² ff.

¹⁴ *Ibid.*, p. 17². Cf. pp. 30², 381².

¹⁵ Cf. Ward's virtual use of this conception, p. 104².

¹⁶ *Op. cit.*, p. 305².

and his fine analysis of expectation, also, is in terms of "active attitude."¹⁷ Finally, he expressly describes feeling as "not itself a presentation but a purely subjective state . . . a unique and ultimate factor of experience." By these words, Ward means, of course, to distinguish feeling from perception and will;¹⁸ the contention of this paper is that he should have regarded all forms of consciousness, and not feeling alone, as "purely subjective."

It remains briefly to indicate the apparent reason of Ward's neglect of this conception of psychology as science of the experiencing subject and his consequent persistent entanglement of himself with the presentation doctrine which is really so foreign to his system. The reason is this: Ward denies the coextension of self-consciousness with consciousness. Not "every self," he teaches, "only some experients" are aware of themselves and that, gradually.¹⁹ The subject of experience, round whom his whole system revolves, he describes as self-knower only, not self-known. And, to cap the climax, he once at least reduces the self-as-known to the level of the presentation, describing it as a temporal self, a presented self, "one presentation among others."²⁰ This conclusion, mainly unargued, is strongly at variance with the whole trend of Ward's doctrine. For surely the self must be, in a fundamental sense of the word, known in order to be both described and treated as center of experience. Ward avoids the dilemma by the implication that the subject self is *experienced*, not known.²¹ But this seems a quibble in words. A subject which is experienced *is* known in any save a narrow and artificial use of the word. And a self which is experienced is, consistently with Ward's own basal conceptions, the real topic of psychological study.

¹⁷ *Ibid.*, pp. 210 ff.

¹⁸ It is beside my main purpose to suggest that Ward himself later seems virtually to abandon this sharp distinction of feeling from perception and will and to recognize feelings which are virtually on a par with presentations. Cf. pp. 245² and 266.

¹⁹ *Op. cit.*, 361¹.

²⁰ *Op. cit.*, p. 363².

²¹ *Op. cit.*, p. 378². Cf. p. 364 where, curiously enough, Ward says of the presentation self that it "knows itself."

COMMUNICATIONS

CONSULTING PSYCHOLOGISTS

The following open letters to the members of the American Psychological Association have been received through the chairman of the Committee on Qualifications and Certification of Consulting Psychologists. Although they specifically concern the situation in clinical psychology, the matters dealt with are of interest to all psychologists. During the past few years there have been numerous instances of the exploitation of different communities by persons not proved as professional psychologists but who are unknown for their psychological experience and investigations. Psychology, and its derivatives, has become one of the most popular "catch words" of the time, and it is being widely utilized, largely for easy financial gain, to the detriment of psychology, both science and technology, and of professional psychologists.

THE EDITOR

TO THE AMERICAN PSYCHOLOGICAL ASSOCIATION:

Mental examinations, and recommendations in the management of cases, are now made in the name of clinical psychology by persons of inadequate equipment therefor, involving improper risk to the persons whom they examine, and to the social agencies responsible for them. Psychological criteria, however valuable, are not sufficient guides in the detailed treatment and final disposition of pathological cases.

It is usually impracticable to determine for the occasion the qualifications of persons attempting so to practise. The American Psychological Association is the body properly responsible for the scientific and ethical standing of this division of the problem. With the expectation that such action by the association will better coordinate the psychological factor in the interest of the patient, it is considered that this association should formulate the requirements which it regards as essential to the proper functions

of the clinical psychologist; and should upon application issue to those whom it finds thus qualified, documentary evidence thereof.

WALTER E. FERNALD, M.D.,
Superintendent of the Massachusetts School for the Feeble-minded, Waverly, Mass.,

ARNOLD GESELL, Ph.D., M.D.,
Professor of Child Hygiene and Director of the Psychological Clinic, Yale University,

C. MACFIE CAMPBELL, M.D.,
Professor of Psychiatry, Harvard Medical School

TO THE AMERICAN PSYCHOLOGICAL ASSOCIATION:

Mental examination, interpretations of the results of psychological tests and recommendations based on these are sometimes made in the name of clinical psychology by persons with inadequate equipment for such an important task. This involves improper risk to individuals examined and possible mismanagement of the case by families and all sorts of social agencies. We feel that on account of this there is the greatest need for thorough training of clinical psychologists in both normal and abnormal psychology, since problems presented to them lie in both fields.

To insure even approximation to the proper standards it is necessary to have some authoritative recognition of fitness. The American Psychological Association is the body logically responsible for scientific and ethical standards in this branch of professional work. With this in view we consider that this Association should formulate the requirements which it regards as essential to the training of the clinical psychologist, and should, upon application, issue to those whom it finds thus qualified, documentary evidence thereof.

WILLIAM HEALY, M.D.,
Director of the Judge Baker Foundation, Boston, Mass.,
PEARCE BAILEY, M.D.

EDITORIAL ANNOUNCEMENT

Beginning with the January, 1921, issue the policy of the BULLETIN will change to the extent that six numbers will be devoted to abstracts, one number will contain the proceedings of societies, and the annual summaries will be replaced by reviews of special topics in five numbers. The reviews will be three, four and five year critical evaluations of the literature of the special topics. Critical reviews of books will also be published in the review section of the BULLETIN.

NOTES AND NEWS

DR. ERNEST H. LINDLEY has been elected chancellor of the University of Kansas.

ANNOUNCEMENT is made of the forthcoming consolidation, beginning January 1, 1921, of *Psychology* and the *Journal of Animal Behavior*, under the joint editorship of Professors K. Dunlap and R. M. Yerkes.

PROFESSORS R. M. YERKES and SHEPHERD IVORY FRANZ have returned from abroad where they took part in the London conference relating to the *International Catalogue of Scientific Literature*.

PROFESSOR G. F. STOUT has resigned the editorship of *Mind*, and Professor G. E. Moore, 19 Magdalen Street, Cambridge, England, has been appointed editor in his stead.

DR. WALTER DILL SCOTT, professor of psychology at Northwestern University and president of the Scott Company, has been elected president of Northwestern University.

DR. FRANCIS N. MAXFIELD, formerly psychologist of the schools of Newark, N. J., has accepted the position of director of the bureau of psychology of the Pennsylvania Department of Public Instruction at Harrisburg, Pa.

INDEX OF NAMES

ALPHABETICAL INDEXES OF NAMES AND SUBJECTS WILL BE FOUND AT THE END OF
THE VOLUME

Names of contributors are printed in SMALL CAPITALS, and the page numbers of the contributions in Full Face type. In the case of authors reviewed or summarized the page numbers are in *Italics* and in the case of mention in the notes and book lists they are in Roman type.

- | | |
|---------------------------------|---------------------------------|
| Abbott, E. S., 372 | Bailliant, 224 |
| Abderhalden, E., 200 | Ball, J. D., 344 |
| Abelsdorff, G., 224 | Bancel, J. L. de., 14, 101, 127 |
| Abraham, K., 348 | Baldwin, S. P., 176 |
| Abramowski, E., 13 | Baratt, H. G., 329 |
| Ackerman, H. C., 101 | Bard, L., 121, 184, 224 |
| Adams, G. P., 263 | Barenne, J. G. D. de., 159, 167 |
| Adrian, E. D., 159 | Barnils, P., 253 |
| Ahlborn, F., 175 | Barrie, T. S., 224 |
| Aimé, H., 121 | Bartlett, F. C., 237, 263 |
| Allen, F., 224 | Barton, E. M., 224 |
| Allen, H. S., 224 | Bartram, C. O., 18 |
| ALLPORT, F. H., 75, 85, 93 | Bateson, W., 299 |
| Almack, J. C., 253 | Baumgarten, W. J., 225 |
| Amar, J., 328 | Bawden, H. H., 9, 13, 196 |
| Ames, W. R., 116 | Bayliss, W. M., 237 |
| Ammann, R., 253 | Beaunis, B., 334 |
| Amsden, G. S., 299 | Begbie, H., 416 |
| Anderson, B. M. Jr., 263 | Bell, L., 224 |
| Anderson, J. B., 101 | Benary, W., 238 |
| Anderson, J. E., 43, 360 | Benedict, F. G., 115, 328 |
| Anderson, J. R., 383 | Benussi, V., 121, 280 |
| Anderson, V. V., 105, 416 | Berblinger, W., 159 |
| Angell, J. R., 200 | Berguer, G., 101, 107, 115 |
| Angell, J. R., 200, 240, 279 | Berle, A. A., 406 |
| Angier, R. P., 116 | Berliner, A., 328, 334 |
| Anrep, G. V., 199 | Berze, J., 298 |
| Arey, L. B., 176, 184, 224, 225 | Best, F., 224 |
| Arlitt, A. H., 196 | Betchov, N., 159 |
| Armstrong, J. R., 406 | Bethe, A., 200, 328, 426 |
| Armstrong-Jones, R., 348 | Bikeles, G., 420 |
| Arnett, J. H., 427 | Billingsley, P. R., 167, 168 |
| Arnold, V. P., 105 | Binet, L., 167 |
| Aronovitch, B., 329 | Bingham, W. V., 57, 344, 352 |
| Arps, G. F., 328, 361, 385 | Binnefeld, M., 121 |
| Arthur, G., 360, 383 | Binswanger, O., 298 |
| Ashford, D., 406 | Birnbaum, K., 298 |
| Ashman, R., 159 | Blanc, 426 |
| Averill, L. A., 372 | Blatz, W. E., 427 |
| Ayres, L. P., 395 | Bleckmann, N., 263 |
| Azoulay, L., 237 | Blees, G. H. J., 184 |
| | Bleuler, E., 299 |
| | Blondel, A., 224 |
| | Bock, C. W., 249 |
| Bagg, H. J., 395 | |
| Bailey, P., 434 | |

- Boer, S. de., 159
 Boirac, E., 9
 Boodin, J. E., 93
 BORING, E. G., 39, 84, 128, 271, 320, 395,
 426
 Bosanquet, B., 13, 93
 Bottazzi, F., 159
 Botti, L., 280
 Bourdon, B., 320
 Bowman, A. M., 259
 Bowman, E., 279
 Braendle, E. W., 330
 Brandeis, J. W., 309
 Brandenburg, G. C., 362, 386
 Breinl, A., 330
 Bretscher, K., 176
 Bridges, J. W., 29, 69, 383, 395
 Brierly, S. B., 344
 Brigham, C. C., 239
 Brink, L., 335
 Brischar, K. M., 406
 Broad, C. D., 13
 Brockbank, T. W., 196
 Broman, I., 184
 Bronner, A. F., 65, 105
 Brooks, S. S., 383
 Brown, F. G., 426
 Brown, H. A., 383
 Brown, W., 84, 426
 Browning, H. M., 224
 Bruce, H. A., 93
 Brücke, E. T. von., 159, 168
 Buck, P. C., 237
 Buckingham, B. R., 383
 Buddenbrock, W., 184, 185
 Buisson, H., 224
 Bullough, E., 334
 Bunch, C. C., 18
 Burge, W. E., 159, 167
 Burgess, E. W., 406
 Burgess, W., 416
 Burke, A., 407
 Burnham, W. H., 328, 372
 Burns, H. F., 93
 Burroughs, J., 13
 Burt, C., 372
 Burt, H. E., 18, 121, 344, 395
 Bury, J. S., 426
 Busch, A. D., 406
 Bush, W. T., 263
 Buytendijk, F. J. J., 196
 Cady, F. E., 226
 Cajal, S. R., 185
 Caldwell, H. H., 360
 Calhoun, A. W., 416
 CALKINS, M. W., 13, 429
 Campbell, C. M., 351, 372, 434
 CAMPBELL, I. G., 101, 421
 Cannon, G., 309
 Cannon, W. B., 128
 Cantley, E., 406
 Cantonnet, A., 224
 Carlini, A., 350
 Carlson, A. J., 167, 168
 Carney, C. S., 344
 CARPENTER, F. W., 161, 167
 Carr, H. A., 249
 Carr, H. W., 13, 196, 197
 Carver, A., 127
 Casotti, A., 350
 Castelain, 227
 Cather, K. D., 372
 Cattell, J. M., 200, 240, 334, 406
 Chambers, C. R., 361
 Chapin, F. S., 93
 Chapman, J. C., 344, 395
 Charters, W. W., 383
 Chase, H. W., 200
 CHASE, J. M., 397
 Chassell, L. M., 406
 Chrisman, O., 372
 Clarke, E. L., 406
 Clarke, J. M., 426
 Clow, F. R., 93
 Cobb, P. W., 44, 224
 Cobb, S., 159
 Coblentz, W. W., 224, 225
 COE, G. A., 95
 Coen, A. M., 279
 Cohen, J., 383
 Cohen, M., 225
 Cohen, M. R., 13
 Cohen-Kysper, A., 116
 Colcord, J. C., 93
 Collins, M., 310
 Colucci, C., 280
 Colvin, S. S., 58, 383
 Conklin, E., 372
 Conkling, H., 406
 Conner, W. L., 383
 Cooke, G. W., 101, 109
 Cooper, S. G., 384
 Copeland, M., 176
 Coriat, I. H., 279, 348
 Cory, C. B., 13
 Costello, H. T., 263
 Court, S. R. A., 372
 Courtis, S. A., 384, 395
 Couvreur, A., 426
 Cowdery, K. M., 361
 Cowdrick, M., 225
 Cowles, R. P., 176
 Coy, L. G., 406
 Craig, K., 348
 CRAIG, W., 169
 Crathrone, A. R., 384
 Crozier, W. J., 176, 185, 225
 Cummins, H., 185
 Cummins, R. A., 384
 Cunningham, H. E., 115
 Cutolo, F., 121
 Dadourian, H. M., 237

- DALLENBACH, K. M., 259, 313
 Dallinger, V. M., 383
 Dalman, 384
 Dana, C. L., 426
 Dashiell, J. F., 73, 197, 258, 395
 DAVENPORT, C. B., 299, 300, 310, 406
 David, Q. J., 29
 Davidson, 348
 Davis, K. B., 105
 Dawson, M. K., 237
 Dawson, P. M., 328
 Dean, L. W., 18
 Dearborn, G. V. N., 13, 39
 Deardorff, N. R., 416
 Dearmer, P., 101
 Decker, G., de, 330
 Dejerine, 116
 Delacroix, 351
 Delage, Y., 185, 406
 DE LAGUNA, G. A., 10, 13, 113
 Delgrado, H. F., 83
 Dell, F., 373
 Demoll, R., 185
 Denis, H., 83
 Dercum, F. X., 298
 Dessoir, M., 115
 Dewey, J., 200, 263
 Dickson, V. E., 384
 Dittler, R., 116
 DOCKERAY, F. C., 76, 322
 DODGE, R., 240, 384, 418
 Doi, T., 159
 Dolch, E. W. Jr., 384
 Doll, E. A., 58, 360
 Dolley, W. L., 185
 Dollinger, V. M., 395
 Dooley, L., 406
 Dostoyevsky, F., 298
 Douglass, H. P., 93
 DOWNEY, J. E., 250, 384
 Downey, J. W. Jr., 225
 Drake, D., 10, 17, 101, 102, 127
 Dreyer, N. B., 159
 Dryfoos, A. D., 13
 Dumas, 351
 DUNLAP, K., 13, 18, 40, 144, 335, 435
 Dunn, C., 373
 Duroux, E., 426
 Eaton, E. M., 225
 Edinger, L., 159
 Edman, I., 350
 Edridge-Green, F. W., 186
 Eisler, J., 348
 Eldering, 197
 Elkus, S. A., 13
 Ellis, H., 406
 Ellwood, C. A., 93, 111
 Elsberg, C. A., 426
 Eltringham, H., 185
 Emerson, L. E., 13
 Engelking, E., 225
 English, H. B., 279
 Enjalran, L., 242
 Esclangon, E., 237
 Escott, T. H. S., 406
 Etringham, H., 225
 Evans, A., 428
 Evans, E., 144, 373
 Evans, J. E., 384
 Feingold, G. A., 14
 Feldkeller, P., 335
 Fellows, A. P., 159
 Ferenczi, S., 348
 Fernald, W. E., 434
 Fernberger, S. W., 45, 256
 FERREE, C. E., 46 77, 134, 225
 Filehne, W., 225
 Filler, M. G., 360
 Finch, C. E., 384
 Fischbein, E. C., 310
 Fischer, O., 14
 Fite, W., 14
 Flanders, K. J., 344
 Flaubert, G., 298
 Flexner, A., 416
 Flood, E., 310
 Foix, C., 427
 Follett, M. F., 14
 Follett, M. P., 93
 Forbes, H., 373
 Foster, J. C., 361
 Forsythe, W. E., 225, 226
 Franz, S. I., 84, 351, 435
 Franz, V., 185
 Frasier, G. W., 373
 Frazier, C. H., 427
 Freeman, A. S., 197
 FREEMAN, F. N., 353, 384
 French, J. W., 225
 Freud, S., 238, 348, 407
 Frey, M., 240, 250
 Frisch, K., 185
 Fröbes, J., 29, 115, 238
 Fröhlich, A., 159
 Frost, E., 78, 344
 Frost, H. B., 17
 Frouin, A., 427
 Galbraith, A. M., 94
 Galletti, H. R., 159
 Galleotti, G., 328
 Galli, E., 350
 GARDINER, H. N., 122, 127
 Garnett, J. C. M., 395, 407
 Garrison, C. G., 407
 Garth, T. R., 116, 328, 384
 Gatewood, E. L., 330
 Geiger, M., 335
 Geissler, L. R., 47, 351
 Geley, G., 14
 Gemelli, A., 280, 329
 Gemmill, S. N., 407

- Gentile, G., 279
 George, W. H., 94
 GESELL, A., 66, 131, 434
 Gibson, C. R., 225
 Gibson, K. S., 225
 Giddings, F. H., 94
 Giese, F., 407
 Gilbreth, F. B., 345
 Gilbreth, L. M., 345
 Gilchrist, E. P., 384
 Gillette, J. M., 407
 Gillingham, A., 407
 Gilmore, G. W., 111
 Ginnell, L., 83
 Githens, T. S., 176
 Givler, R. C., 41
 Glascock, J., 334
 GLEASON, J. M., 256, 264
 Glueck, B., 105
 Goddard, H. H., 29, 131, 310
 Goerrig, M. A., 121
 Goldstein, M. A., 18
 Gordon, J. H., 329
 Gowin, E. B., 407
 Grave, C., 176, 185
 GRAY, C. T., 375
 Gray, P. L., 373
 Gray, W. S., 384
 Greene, H. A., 384
 Greenwood, M., 329
 Gregory, J. C., 14
 Griffith, C. R., 176
 Griffiths, C. H., 225
 Grossmann, J., 348
 Groszmann, M. P. E., 407
 Groves, E. R., 94
 Gruber, C. M., 159, 329
 Gruenberg, B. C., 407
 Gruender, H., 279
 Guglielmetti, J., 329
 Gunzberg, I., 160, 329

 Haggerty, M. E., 31
 Haines, T. H., 31, 144, 361
 Hall, G. S., 14, 200, 238, 239, 407, 416
 Hamann, R., 335
 Hanauer, 407
 Hardy, M. C., 249
 Harris, D. F., 237
 Harris, J. J., 330
 Hartley, R. V. L., 237
 Hartman, F. A., 427
 Hartman, R., 395
 Hartmann, H. G., 335
 Hartridge, H., 185, 225, 226
 Hartshorne, G., 102
 Harvard, J., 14
 Hashimoto, M., 160
 Hasse, H., 238
 Hayes, S. P., 59
 Haynes, G. E., 94
 Head, H., 160

 Healy, W., 105, 434
 Hecht, S., 185, 226
 Heckes, J. W., 427
 Heinemann, O., 427
 Hemstreet, W., 31
 Henke, F. G., 14
 HENMON, V. A. C., 330, 361, 384
 Henning, H., 185, 226, 238, 242
 Henry, T. S., 407
 Herring, J. P., 320, 361, 384
 Herrman, C., 310
 Hertz, A., 253
 Herzfeld, E., 160
 Hess, C. von, 185, 226
 Hicks, G. D., 14
 Higier, H., 160, 167
 Hill, D. S., 256
 Hirst, E. W., 94
 Höber, R., 200
 Hoch, A., 298, 299
 Hodson, C., 329
 Hoeve, J. van der, 226
 Hoffman, C. W., 105
 Hoffmann, C. G., 127
 Hoffmann, P., 160, 329
 Hoffmans, J., 31
 Hollander, B., 407
 Hollingworth, H. L., 66
 Hollingworth, L. S., 373, 407
 Holt, E. B., 145
 Holton, E. L., 384
 Hooker, H. D., 176, 186
 Horton, L. H., 348
 Hoshino, T., 176
 Hosic, J. F., 384
 Houstoun, R. A., 226
 Howard, H. J., 226
 Huber, G. C., 427
 Hughes, W. H., 384
 Humphrey, G., 42
 Humpstone, H. J., 351
 Hunt, J. R., 160
 Hunt, R., 427
 Hunter, H. T., 361
 HUNTER, W. S., 29, 185, 197, 198
 Hurst, A., 427
 Hyde, E. P., 226
 Hyde, I. H., 167, 335
 Hyslop, J. H., 279

 Ide, G. G., 373
 Ingebrightsen, R., 427
 Ingham, S. D., 427
 Ioteyko, J., 373
 Irle, K. W., 361
 Isaacs, E., 250
 Isaacs, S., 32, 76
 Isserlis, I., 395
 Ives, H. E., 226
 Ivy, A. C., 186

 Janet, P., 127, 351

- Jarrett, M. C., 105
 Jelliffe, S. E., 335
 Jennings, H. S., 14
 Jewell, J. R., 373
 Johnson, A., 328, 340
 Johnson, B., 373, 384
 Johnson, B. J., 280, 320
 Johnson, H. M., 48, 351
 Johnson, S. E., 160, 168
 Johnson, W. E., 14
 Jolly, P., 290, 310
 Joly, J., 226
 Jones, A. B., 298
 Jones, A. J., 240
 Jones, A. H., 84
 Jones, A. L., 384
 Jones, C. T., 407
 Jones, E. E., 385
 Jones, E. S., 361, 384
 Jones, F. W., 176, 427
 Jones, I. H., 121
 Jones, L. A., 49, 226
 Jones, R., 427
 Jong, H. de, 197
 Jordan, A. M., 361, 385
 Jordan, H., 160, 186
 Jordan, V., 94
 Kaila, E., 226, 242, 250
 Kallen, H. M., 32
 Kallom, A. W., 385
 Kantor, J. R., 10
 Kaploun, A., 29
 Kappers, C. V. A., 176
 Kardos, M., 349
 Karpas, M. J., 407
 Katuin, G. A., 263
 Keith, A., 237
 Kelley, C. M., 362
 Kelley, T. L., 361, 385, 395
 KELLOGG, A. L., 103
 Kelly, F. J., 385
 Kempf, E. J., 94, 160, 168, 407
 Kent, A. F. S., 329
 Kenyon, E. L., 373
 Kern, R. R., 94
 Kerr, J., 253
 Kidd, B., 111
 Kiernan, J. G., 407
 Kiesow, F., 280
 Kinzig, H., 186
 Kipfer, R., 250
 Kirby, G. H., 299
 Kirby, T. J., 385
 Kirkpatrick, E. A., 70, 373
 Kitson, H. D., 94, 345, 361
 Klinger, R., 160
 Klopsteg, P. E., 18
 Kneeland, G. J., 416
 Knipp, C. T., 237
 Knoche, F. E., 384
 Knowlson, T. S., 14, 407
 Koch, E., 237
 Koch, H., 197
 Koch, M. L., 176
 Koffka, K., 116, 226, 243
 Kohlbrugge, J. H. F., 407
 Kohs, S. C., 1, 361
 Kollarits, J., 121, 349
 Komine, S., 176
 Koos, F. H., 385
 Körner, O., 186
 Kornhauser, A., 79, 395
 Kovács, S., 237
 Kraepelin, E., 298
 Krass, 121
 Krauss, 299
 Kretschmer, O. S., 159, 329
 Kries, J. von, 160
 Kroeber, A. L., 407
 Krogh, A., 329
 Krueger, 299
 Kuile, T. E. ter, 226
 Kunkel, B. W., 176
 Kuntz, A., 176
 Kunz, L., 420
 Lacy, B. F., 350
 Laird, J., 14, 320
 Lalande, Q., 320
 Lalo, C., 102
 Lamb, H., 226
 Lameere, M. A., 94
 Lane, W. D., 416
 Langenbeck, M., 407
 LANGFELD, H. S., 19, 33, 84, 94
 Langley, J. N., 160, 427
 Langworthy, C. F., 329
 Larson, J. A., 122
 La Rue, D. W., 239, 385
 LASHLEY, K. S., 122, 178, 197, 427
 Laski, H. J., 14
 Laurens, H., 186
 Lawrence, E., 102
 Lee, F. S., 329
 Lee, V., 335
 Leighton, J. A., 115
 Leonard, C. M., 416
 Leonard, E. A., 373
 Lére, A., 298
 Lethaby, W. R., 335
 LEUBA, J. H., 76, 102, 107
 Levick, G. M., 329
 Lewis, D., 427
 Liddell, H. S., 226, 259
 Lincoln, E. A., 361
 Lindhard, J., 329
 Lindley, E. H., 435
 LINK, H. C., 29, 335, 345
 Lipmann, O., 29, 115, 116, 238
 Llewellyn, L. J., 298
 Lloyd, A. H., 14, 102
 Lockhart, A. V., 385
 Lockwood, R. M., 227

- Lodge, O., 227
 Lodge, O. C., 186
 Loeb, J., 373
 Loomis, A. K., 385
 Loomis, R. S., 14
 Lopez, J. N. Y., 168
 Lord, C. B., 329
 Love, B. F., 237
 Lowell, F., 361
 Löwy, M., 14
 Luckiesh, M., 227
 Lull, H. G., 94
 Lundborg, H., 310
 Luther, 299
 Lutz, B. R., 160
 Lyman, E. W., 102
 Lyon, D. O., 264
 Lysander, G., 102
 Lytle, E. B., 385

 Macintosh, D. C., 14
 Mackay, W. M., 102
 Mackenzie, J. S., 113
 Mackenzie, K. A. J., 427
 MacKenzie, W., 350
 MacWilliam, J. A., 160
 Madsen, I. N., 361, 385
 Magilot, 224
 Magmi, J. A., 373
 Mahoney, C. K., 102
 Malmberg, B., 106, 373
 Mansfeld, G., 160
 Manuel, H. T., 385, 408
 Marage, M., 237
 Marie, P., 427
 Marot, H., 345
 Marshall, H. R., 14, 29
 Martens, H. A., 116
 Marui, K., 160, 329
 MARVIN, W. T., 6
 MATEER, F., 67, 410
 Maudsley, H., 94
 Maxfield, F. N., 435
 Maxwell, S. S., 186
 May, E. S., 122
 Mayer, L., 428
 McCall, W. A., 385
 McClure, M. T., 14
 McCord, C. P., 105, 416
 McDonald, R. A. F., 407
 McDougall, W., 31, 200, 259, 350
 McEwen, G. F., 396
 McGeoch, J. A., 83
 McKeever, W. A., 416
 McNicholas, H. J., 225
 McPeck, C., 228
 Meadows, D., 186
 Meine, F., 395
 Meltzer, S. J., 176
 Mendenhall, W. L., 329
 Mercier, C. A., 106, 114
 Meriam, J. L., 373

 Merrill, A. A., 14
 METCALF, J. T., 117, 280
 Meumann, E., 408
 Meyer, A., 299
 Meyer, O. B., 249
 Meyer, P., 243
 Michael, E. L., 396
 Miles, 328
 Miles, W. R., 50, 115
 Millard, B., 408
 Miller, D. C., 237
 MINER, J. B., 60, 106, 388
 Miner, M. E., 416
 Minnich, D. E., 186, 227
 MITCHELL, D., 68, 258, 363, 373, 396
 Moede, W., 94, 345
 Mochlman, A., 31
 Monbrun, A., 227
 Monroe, W. S., 383, 385
 Montesano, G., 83
 Moore, A. R., 186
 Moore, A. S., 298
 Moore, C. R., 176
 Moore, G. E., 14, 435
 MOORE, H. T., 51, 260
 Moore, R. C., 385
 Moral, H., 160, 176
 Morax, V., 227
 Mordell, A., 115, 408
 Moreau, F., 227
 Morel, F., 102
 Morgan, C. L., 14, 280
 Morselli, E., 280
 Morselli, M., 14
 Mott, F. W., 299, 349
 Mottram, J. C., 186
 Mount, G. H., 408
 Mulford, H. J., 14
 Muller, M., 186
 Müller, R. T., 176
 Muncey, E. B., 310
 Murchuson, C., 396
 Murdock, K., 385
 Murray, E., 361, 385
 Murray, E. R., 373
 Mursell, J. L., 15
 Muscio, B., 345
 Myers, C., 361
 Myers, C. S., 116, 345
 Myers, G. C., 51, 361, 385, 396, 408
 Myerson, A., 127, 299

 Nearing, S., 408
 Neill, A. J., 159
 Nicoll, M., 349
 Noble, E. L., 361, 385
 Noon, P. G., 373
 Nordensson, J. W., 227
 Northcott, C. H., 94
 Norton, J. K., 416
 Nutting, P. G., 18, 408

- O'Brien, F. P., 385
 Ogata, 228
 OGDEN, R. M., 42, 228, 237
 Ohm, J., 420
 Oltramare, J. H., 177
 Orr, D., 160
 Orr, F. I., 209, 310
 Osborne, W. A., 227, 330
 Otis, M., 335
 Owen, T., 238

 Palcos, A., 350
 Pannenberg, H. J., 408
 Pannenberg, W. A., 408
 Pentel, J., 177
 Parker, C. H., 345
 Parker, DeW. H., 350
 Parsons, R. P., 361
 Partlow, W. D., 144, 361
 Partridge, G. E., 94
 Paschal, F. C., 48
 Pastine, C., 428
 Paterson, D. G., 80
 Patri, A., 373
 Pearce, R. M., 408
 Pearson, K., 306
 Pelletier, A. M., 31
 Pepper, S. C., 320
 Perrett, W., 83, 237
 Perrin, F. A. C., 52
 Perry, R. B., 84
 Peter, R., 409
 Peterson, J., 29, 92, 240
 Pfänder, A., 350
 Pfeifer, R. A., 253
 Philippe, J., 250
 Phillips, G. E., 351
 Picard, M., 263
 Pick, E. P., 159
 Piéron, H., 160, 177, 227, 237, 259, 351
 Pikler, J., 115, 227, 237, 350
 PILLSBURY, W. B., 30, 127, 259
 PINTNER, R., 60, 331, 335, 345, 361, 387, 396
 Piorkowski, C., 345
 Platt, C., 349
 Platt, W., 385
 Poincaré, H., 408
 Pollock, L. J., 428
 Pond, S. E., 335
 Ponzo, M., 280
 Poole, G. E., 385, 386
 Porter, C. A., 428
 Portigliotti, G., 127
 Power, L., 386
 Prantl, R., 227
 Pratt, J. B., 15, 102, 238, 243
 Pressey, L. W., 71, 361, 362, 286
 Pressey, S. L., 72, 320, 361, 362, 373, 374, 386, 396
 Preston, G. L., 428
 Prince, A. L., 122, 186

 Prince, M., 68
 Prince, W. F., 15
 Proctor, W. M., 386
 Purcell-Gould, J., 106, 416
 Pusey, W. A., 417
 Putnam, J. J., 349
 Pütter, A., 227

 Rabaud, E., 177, 351
 Race, H. V., 408
 Radhakrishnan, S., 15
 Ralston, R., 362, 373, 396
 Raman, C. V., 227
 RAND, G., 46, 77, 134, 225
 Randell, J. H. Jr., 102
 Ranson, S. W., 160, 167, 168
 Rayleigh, 237
 Read, C. M., 335
 Rebhuhn, H., 408
 Redfield, C. L., 408
 Reed, H. D., 186
 Reed, I. K., 408
 Reeder, J. C., 386
 Reeves, C. D., 186
 Reeves, P., 49
 Reicke, I., 335
 Révész, G., 408
 Reyburn, H. A., 15
 Reymert, M. L., 280
 Rich, G. J., 227, 279
 Richards, E. L., 373
 Richards, G. L., 386
 Richardson, C. A., 15
 Richardson, R. F., 127
 Riddle, O., 176
 Riddoch, G., 161
 Riedel, A. H., 186
 Riesser, O., 168
 Rignano, E., 350
 Rijnberk, G. van, 161
 Riley, C. F. C., 177
 Ritter, F., 408
 Ritter, W. E., 30, 177, 198
 Rivers, W. H. R., 83
 Roback, A. A., 53
 Roback, A. R., 329
 Robbins, S. D., 239
 Roberts, G. L., 362
 ROBINSON, E. S., 54, 243, 345
 Robitsek, P. A., 349
 Rochon-Duvigneaud, A., 227
 Roelofs, C. O., 227
 Rogers, A. K., 15, 127
 Rogers, A. L., 408
 Rogers, F. T., 177
 Rogoff, J. M., 168
 Rogues de Fursac, J., 299
 ROSANOFF, A. J., 281, 298, 299, 309, 310, 310
 Rosenow, C., 200, 396
 Rosenheim, O., 329
 Ross, E. A., 94

- Roth, P., 115, 328
 Rougier, L., 238
 Rouma, G., 350
 Roussy, G., 428
 Rows, R. G., 160
 Rüdin, E., 209, 310
 RUEDIGER, W. C., 254
 Rugg, E. V., 386
 Rugg, H. O., 386
 Ruml, B., 79, 80, 240, 321, 395, 396
 Rusk, R. N., 408
 Russell, B., 15
 Russell, L. J., 15
 Ruth, E. S., 186
 Ruttin, E., 420
 Ryan, A. H., 329

 Sachs, H., 238
 Sadger, J., 349
 Sageret, J., 94
 Salmon, T. W., 106
 Sanctis, S. de, 280
 Sanford, E. C., 239
 Scalapino, W., 167, 335
 Schaeffer, A. A., 240
 Schiller, F. C. S., 15, 263
 Schilling, R., 237
 Schleiter, F., 102, 110
 Schlessinger, G., 345
 Schmiedeberg, O., 161
 Schoen, M., 94
 Scholz, W. von, 408
 Schroeder, T., 15, 102
 Schöndorff, B., 200
 Schulte, R. W., 122
 Schut, L. W., 186
 Schwarz, O. L., 408
 Schweinitz, G. E. de, 227
 Scott, E. L., 329
 Scott, W. D., 39, 435
 SEASHORE, C. E., 17, 18, 30, 55, 115, 237, 335, 351, 386, 408
 Segar, L. H., 361
 Segond, J., 15
 Sellars, R. W., 15
 Seymours, G., 417
 Shand, A. F., 127, 263
 Shaw, C. G., 263
 Sheard, C., 228
 Sheldon, W. H., 15
 Shelton, H. S., 15, 256, 345
 SHEPARD, J. F., 187
 Shepherd, W. F., 72
 Shepherd, W. R., 94
 Sherrington, C. S., 159
 Shively, I. M., 362
 Sidis, B., 94, 373
 Siedlecki, M., 177
 Silbert, S., 427
 Simon, T. W., 299
 Sinéty, R. de, 177
 Sinnett, A. P., 15

 Skinner, C. E., 200
 Small, J., 177
 SMALL, M. L., 346
 Smith, 328
 Smith, E. M., 237
 Smith, F., 177
 Smith, H. B., 373
 Smith, H. M., 115
 Smith, J. A., 15
 Smith, K., 396
 Smith, M., 259
 Smith, W. R., 94
 Snyder, A. v. t. H., 177, 187
 Snyder, C. D., 177, 187
 Solomon, H., 17
 Solomon, H. C., 417
 Sonneberg, W., 15
 Southard, E. E., 69, 83, 345, 346, 417
 Spadolini, I., 161
 Spaeth, R. A., 345
 Spalding, J. A., 228
 Spargo, J., 94
 Spaulding, E. G., 15
 Spaulding, E. R., 106, 127
 Spearmen, C., 228, 396
 Specht, L. H., 409
 Spratling, W. P., 298
 Spriggs, N. I., 428
 Stanley, L. L., 106
 Starch, D., 30, 73, 253, 280, 386
 Stefanini, A., 228
 Steinberg, W., 239
 Steindler, A., 428
 Steinmetz, I. R., 238
 Stellwaag, F., 177
 Stern, E., 102, 409
 Stern, W., 409
 Stevens, H. C., 161, 428
 Stewart, G. N., 168
 Stewart, G. W., 237
 Stewart, P., 428
 Stewart, R. M., 426
 Stolzenberg, O., 238
 Stoner, W. S., 409
 Stookey, B., 428
 Stout, G. F., 435
 Störting, G., 31
 Stratton, G. M., 31, 259
 Strauss, H. H., 122
 Streeter, B. H., 102
 Strong, C. A., 10, 15
 Strong, E. K. Jr., 84, 286
 Stumpf, C., 237
 Sturt, H., 409
 Sumner, F. B., 177
 Sundberg, C. G., 420
 Sunne, D., 362
 Swenson, D. F., 256
 SWINDLE, P. F., 177, 197, 244, 250
 Sylvester, R. H., 361, 373, 386
 Symns, J. L. M., 122, 427
 Szymanski, J. S., 177, 187, 197

- Taft, J., 106
 Tanner, A. E., 409
 Taussig, F. W., 409
 Tawney, G. A., 15
 Taylor, G. A., 361
 Tead, O., 346
 Tebb, A. E., 329
 Teggart, F. J., 15
 TERMAN, L. M., 373, 386, 397, 409
 Teter, G. F., 362, 373
 Thalheimer, A., 15
 Theisen, W. W., 386
 Thomas, J. B., 362, 374
 Thomas, N. W., 102, 335
 Thompson, J. R., 396
 Thomson, G. H., 84, 321, 395, 396
 Thorburn, W. M., 15
 Thorndike, E. L., 81, 116, 200, 321, 329, 346, 362, 384, 386, 387, 395, 396
 Thurstone, L. L., 16, 321, 346, 362, 396
 Thurstone, T. T., 61
 Tildesley, M. L., 409
 Titchener, E. B., 84
 Todd, A. J., 409
 Tolfree, A. G., 94
 Tompkins, E., 374
 Toops, H. A., 344, 345, 387, 396
 Tracy, H. C., 187
 Tramm, R. M., 346
 Tridon, A., 31
 TROLAND, L. T., 55, 135, 201
 Tufts, J. H., 239
 Türck, H., 409
 Turner, J. E., 10, 16
 Tyndall, E. P. T., 225

 Uhlmann, R. F., 122
 Uhrback, R. S., 362
 Ulrich, J. L., 74
 Urban, F. M., 84
 Urban, W. M., 16, 239, 263
 Urquhart, A. R., 299

 Van Wagenen, M. J., 362, 387
 Vaughan, V. C., 144
 Vernon, H. M., 329
 Verworn, M., 200
 Vészi, J., 161
 Viale, G., 330
 Vorbrodt, G., 102
 Vorster, 298

 Wade, H. A., 409
 Wager, H., 228
 Wahl, M., 330
 Walcott, G. D., 362, 409
 Walker, H. C., 387
 Waller, A. D., 127, 330
 Wallin, J. E. W., 279
 Wallis, W. D., 127
 Walter, W., 420
 Ward, J., 16, 127, 429

 WARREN, H. C., 10, 16, 16, 17, 30, 115, 127, 143, 256
 Washburn, M. F., 10, 16, 239, 334
 Washburne, C. W., 362
 Wassenaar, T., 228
 Watson, F. R., 237
 Watson, J. B., 10, 30, 115, 127, 253, 266, 299, 346, 374
 Watt, J. H., 237
 Watts, F., 84
 Webb, F. L., 362
 Webb, L. W., 62, 387
 Weber, F. P., 349
 Weeks, D. F., 299, 310
 Weese, A. O., 178
 WEISS, A. P., 10, 10, 16, 56, 266
 Wells, F. L., 16, 63, 259
 Wells, W. R., 102
 Werner, H., 238, 250
 Wertheimer, J. E., 387
 Weston, H. C., 346
 Weve, H., 228
 Weymouth, F. W., 228
 Wheeler, R. H., 279
 Wheeler, W. M., 178
 Whipple, G. M., 256, 409
 White, E. M., 374
 White, G. M., 228
 White, W. A., 374
 Whiteley, O., 409
 Wieman, H. N., 16
 Williams, F. E., 127
 Williams, J. H., 106
 WILLIAMS, M. C., 241
 Williams, T. A., 127, 409
 Williamson, R. T., 122
 Willing, M. H., 387
 Wilson, G. M., 387
 Wilson, J. A., 228
 Wilson, R., 409
 Wiltbank, R. T., 116, 197
 Winch, W. H., 387
 Winfield, M., 225
 Wingender, P., 228, 243
 Wintrebert, P., 178
 Wirth, W., 350
 Witham, E. C., 387
 Witmer, L., 240, 374, 387
 Witte, K., 409
 Wittmaack, K., 238
 Wolf, R. W., 346
 Wölflin, E., 250
 Woodburne, A. S., 31, 102, 108
 Woodrow, H., 360, 374, 387
 Woodruff, R., 114
 Woods, A. H., 428
 Woods, E. L., 64, 409
 Woods, F. A., 409
 Woodworth, R. S., 116
 Woody, C., 387
 Woog, P., 228
 Wright, J., 102

Wrightson, T., 237

Wrinch, D., 259

Wundt, W., 351

Wyatt, S., 346

Yerkes, R. M., 240, 346, 362, 396, 435

Yoakum, C. S., 84, 346, 362, 396

Young, W. J., 330

Zeeman, W. P. C., 227

Ziehen, T., 31, 310

Znaniecki, F., 112

Zondek, 330

Zwaardemaker, H., 238

INDEX OF SUBJECTS

- Activities, Tropisms and Instinctive 169
- Affective Phenomena—Descriptive and Theoretical, 122
- American Psychological Association, Statistics of, 271
- Animals, Sensory Physiology of, 178
 - Habit Formation and Higher Mental Capacities of, 187
- Apparatus, 16
- Application of Psychology to Industry, 335
- Attention, 259
- Autonomic Nervous System, Physiology of, 161
- Body, and Mind, 6
- Child Psychology, 363
- Consciousness and the Unconscious, 10
- Constitutional Mental Disorders, 300
- Correlation, 388
- Crime and Social Psychology, 103
- Cutaneous and Kinæsthetic Senses, 117
- Dreams, 346
- Esthetics, 331
- Educational Psychology, 375
- Fatigue, 322
- Functions, Graphic, 250
 - Locomotor, 421
 - Visual Motor, 418
- General Methods, 313
- Genius, 397
- Graphic Functions, 250
- Habit Formation and Higher Mental Capacities of Animals, 187
- Hearing, 228
- Heredity of Mental Disorders, 300
- Higher Mental Capacities and Habit formation of Animals, 187
- Illusions, Space, 243
- Industry, Applications of Psychology to, 335
- Inhibition, 322
- Instinctive Activities and Tropisms, 169
- Introspection, 313
- Interest, 259
- Kinæsthetic, and Cutaneous Senses, 117
- Learning, 256, 264
- Locomotor Functions, 421
- Logic, 254
- Meetings, Proceedings of, 33
- Memory, 254, 256, 264
- Mental Disorders, Heredity of, 300
- Mental Tests, 353
- Methods, General, 313
- Mind and Body, 6
- Muscle, Physiology of, 145
- Nerve, Physiology of, 145
- Perception, Time and Rhythm, 244
- Personality, 281
- Physiology of Nerve and Muscle, 145
 - of Autonomic Nervous System, 161
 - Sensory, of Animals, 178
- Proceedings of Meetings, 33
- Prostitution, 410
- Psychiatric Experience, 281
- Psychology, Applications to Industry, 335
 - Child, 363
 - Crime and Social, 103
 - Educational, 375
 - of Religion, 95
 - Social, 85
 - of James Ward, 429
- Reaction Time, 330
- Religion, Psychology of, 95
- Rhythm, 244
- Sensory Physiology of Animals, 178
- Social Psychology, 85
- Space, Visual, 241
 - Illusions, 243
- Statistics of American Psychological Association, 271
- Subaverage Minds, Test Scores, 1
- Terminology, 16, 143
- Test Scores of Subaverage Minds, 1
- Tests, Mental, 353
- Text-books, 19
- Thirst, 128
- Thought, 254
- Time, Perception and Rhythm, 244
 - Reaction, 330
- Treatises, General, 19
- Tropisms and Instinctive Activities, 169
- Unconscious and Consciousness, 10
- Values, 260
- Vision, 134, 135, 201
- Visual Motor Functions, 418
- Visual Space, 241
- Work, 322

PSYCHOLOGICAL REVIEW PUBLICATIONS

Original contributions and discussions intended for the *Psychological Review* should be addressed to

Professor Howard C. Warren, Editor PSYCHOLOGICAL REVIEW,
Princeton, New Jersey.

Original contributions and discussions intended for the *Journal of Experimental Psychology* should be addressed to

Professor John B. Watson, Editor JOURNAL OF EXPERIMENTAL PSYCHOLOGY,
New York

Contributions intended for the *Psychological Monographs* should be addressed to

Professor James R. Angell, Editor PSYCHOLOGICAL MONOGRAPHS,
522 Fifth Avenue, New York

Reviews of books and articles intended for the *Psychological Bulletin*, announcements and notes of current interest, and *books offered for review* should be sent to

Professor S. I. Franz, Editor PSYCHOLOGICAL BULLETIN,
St. Elizabeth's, Washington, D. C.

Titles and reprints intended for the *Psychological Index* should be sent to

Professor Madison Bentley, Editor PSYCHOLOGICAL INDEX,
University of Illinois, Urbana, Ill.

All business communications should be addressed to

Psychological Review Company
Princeton, New Jersey.

A New Text for College Courses

HUMAN PSYCHOLOGY

By HOWARD C. WARREN

*Stuart Professor of Psychology, and Director of the Psychological
Laboratory, Princeton University*

THIS text supplies the facts upon which the usual undergraduate courses in psychology are based. It is adapted to introductory courses, as well as to the more advanced general courses where the introductory course has been elementary or philosophical. The text is accurately and clearly written. The author's meaning is constantly made clear by the use of illustrations from the familiar experiences of everyday life. The new behavior concept is here combined with the older introspective theory.

\$2.75 Postpaid

HOUGHTON MIFFLIN COMPANY

BOSTON **NEW YORK** **CHICAGO**

UNIVERSITY OF CHICAGO

DEPARTMENTS OF PSYCHOLOGY AND PHILOSOPHY

PSYCHOLOGY

The department offers *introductory courses* in general psychology, experimental psychology (both qualitative and quantitative), comparative psychology (theoretical and practical), educational and applied psychology, including work in psychological tests, genetic psychology, social psychology, folk psychology and the psychology of religion. The departments of neurology and physiology afford training courses of peculiar value to students specializing in either experimental or comparative psychology.

Advanced courses provide opportunity for research work in the various branches of psychology and also deal with such special subjects as the history of psychological theory, the relations of psychology to philosophy, the methodology of psychology, etc. A Journal Club enables students to keep abreast of the current literature.

PHILOSOPHY

Courses are offered in the general history of philosophy, history and theory of science, history of moral and social philosophy, Hindu philosophy, Greek philosophy, Kant, Hegel, and other modern authors, the history of logic including recent logical theories, recent metaphysics, including Pragmatism, the origins of morality, social and political philosophy, aesthetics. The departments of Education, Sociology, Economics, Political Science, Sanskrit, Comparative Religion, and Greek provide related courses.

EDUCATION

A graduate Department of Education has been organized in the School of Education. Courses of advanced grade will be given in History of Education, Educational Administration, Educational Psychology, including special courses on Mental Deficiencies, Educational Methods, and in special subjects such as Manual Training, Nature Study, History, Mathematics, etc., etc. Laboratory facilities for experiments on educational subjects are provided and an elementary school and a high school furnish opportunity for observation and experiments.

CORPS OF INSTRUCTORS

JAMES R. ANGELL	JAMES H. TUFTS	NATHANIEL BUTLER
GEORGE H. MEAD	ADDISON W. MOORE	H. C. MORRISON
EDWARD S. AMES	M. W. JERNEGAN	WALTER SARGENT
HARVEY CARR	FRANK N. FREEMAN	S. C. PARKER
RUTLIDGE T. WILTBANK	W. S. GRAY	J. F. BOBBITT
CLARENCE E. AYRES	MORTON SNYDER	F. S. BREED
	CHAS. H. JUDD	E. FILBRY

Attention is invited particularly to the work of the summer quarter, which begins June 21st and ends September 3d. For information regarding this and other work of the department, and also concerning fellowships, address

FOR PSYCHOLOGY, PROFESSOR JAMES R. ANGELL
FOR PHILOSOPHY, PROFESSOR JAMES H. TUFTS
FOR EDUCATION, PROFESSOR CHARLES H. JUDD

UNIVERSITY OF CHICAGO

DEPARTMENT OF CHEMISTRY

PHILOSOPHY

The Department of Philosophy is a part of the University of Chicago, and is one of the largest and most distinguished departments in the world. It is a department of the highest order, and is one of the most important departments in the University. It is a department of the highest order, and is one of the most important departments in the University.

The Department of Philosophy is a part of the University of Chicago, and is one of the largest and most distinguished departments in the world. It is a department of the highest order, and is one of the most important departments in the University. It is a department of the highest order, and is one of the most important departments in the University.

PHILOSOPHY

The Department of Philosophy is a part of the University of Chicago, and is one of the largest and most distinguished departments in the world. It is a department of the highest order, and is one of the most important departments in the University. It is a department of the highest order, and is one of the most important departments in the University.

The Department of Philosophy is a part of the University of Chicago, and is one of the largest and most distinguished departments in the world. It is a department of the highest order, and is one of the most important departments in the University. It is a department of the highest order, and is one of the most important departments in the University.

FACULTY		
Prof. J. M. G. Smith	Prof. J. M. G. Smith	Prof. J. M. G. Smith
Prof. J. M. G. Smith	Prof. J. M. G. Smith	Prof. J. M. G. Smith
Prof. J. M. G. Smith	Prof. J. M. G. Smith	Prof. J. M. G. Smith
Prof. J. M. G. Smith	Prof. J. M. G. Smith	Prof. J. M. G. Smith
Prof. J. M. G. Smith	Prof. J. M. G. Smith	Prof. J. M. G. Smith
Prof. J. M. G. Smith	Prof. J. M. G. Smith	Prof. J. M. G. Smith
Prof. J. M. G. Smith	Prof. J. M. G. Smith	Prof. J. M. G. Smith

The Department of Philosophy is a part of the University of Chicago, and is one of the largest and most distinguished departments in the world. It is a department of the highest order, and is one of the most important departments in the University. It is a department of the highest order, and is one of the most important departments in the University.

The Department of Philosophy is a part of the University of Chicago, and is one of the largest and most distinguished departments in the world. It is a department of the highest order, and is one of the most important departments in the University. It is a department of the highest order, and is one of the most important departments in the University.

BF
1
P68
v.17
cop.2

Psychological bulletin

For use in
the Library
ONLY

**PLEASE DO NOT REMOVE
SLIPS FROM THIS POCKET**

**UNIVERSITY OF TORONTO
LIBRARY**

