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# THE Psychological Review

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## CONTENTS OF VOLUME XIV.

### *January*

- Definition and Analysis of the Consciousness of Value (I); W. M. URBAN, 1.  
Some Important Situations and their Attitudes. A. H. LLOYD, 37.  
Discussion: Genetic Modes and the Meaning of the Psychic. The late C. L. HERRICK  
54. Corrigenda, 60.

### *March*

- ✓ The Province of Functional Psychology. JAMES ROWLAND ANGELL, 61.  
Definition and Analysis of the Consciousness of Value (II). W. M. URBAN, 92.  
A Study of After-Images on the Peripheral Retina. HELEN B. THOMPSON and KATE  
GORDON, 122.  
Editors' Announcement, 168.

### *May*

- Studies from the Laboratory of the University of Chicago: Communicated by J. R.  
ANGELL. The Pendular Whiplash Illusion of Motion: H. CARR, 169.  
Thought and Language. J. MARK BALDWIN, 181.  
The Nature of the Soul and the Possibility of a Psycho-Mechanic: The late C. L.  
HERRICK, 205.

### *July*

- Studies from the Laboratory of the University of Chicago: Communicated by J. R.  
ANGELL. The Role of the Tympanic Mechanism in Audition. W. V. D.  
BINGHAM, 229.  
On the Method of Just-perceptible Differences. F. M. URBAN, 244.  
The Ultimate Value of Experience. S. S. COLVIN, 254.  
On Truth. J. MARK BALDWIN, 264.  
Discussion: A Further Application of a Result Obtained in Experimental Æsthetics.  
E. H. ROWLAND, 288. Experience, Habit and Attention. A. W. MOORE, 292.  
Comment on Prof. Moore's Paper: J. MARK BALDWIN, 297.

### *September*

- The Nature of Feeling and Will and their Relations. W. M. URBAN, 299.  
A Fourth Progression in the Relation of Body and Mind. R. W. SELLARS, 315.  
Sensory Affection and Emotion: HELEN T. WOOLLEY, 329.  
Discussion. An Experimental Course in Æsthetics. MAX MEYER, 345.

### *November*

- Apparent Control of the Position of the Visual Field. H. CARR, 357.  
Concerning Animal Perception. G. H. MEAD, 383.  
A Study in Vertical Symmetry. E. H. ROWLAND, 391.  
Logical Community and the Difference of Discernibles. J. MARK BALDWIN, 395.



# THE PSYCHOLOGICAL REVIEW.

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## DEFINITION AND ANALYSIS OF THE CONSCIOUSNESS OF VALUE.<sup>1</sup> I.

BY PROFESSOR WILBUR M. URBAN,  
*Trinity College.*

A cursory examination of the more general terms of worth description, good and bad, useful and useless, beautiful and ugly, noble and ignoble, etc., or indeed the terms worth and worthless, valuable and valueless themselves, and the manner in which they are applied, makes us immediately aware of the fact that for the unreflective worth consciousness they are at first tertiary qualities as much a part of the object as the so-called primary and secondary qualities are parts of the physical object of cognition. This is especially noticeable in the case of the ethical and æsthetic predicates but it is no less true of the unreflective use of the terms utility and value, as for instance when we say that iron has utility or value even when the conditions of its applicability are lacking. The intrinsic worth judgment is psychologically the more fundamental whatever may be inferred upon closer inspection and reflection.

But while they appear at first sight to be tertiary qualities of the object, on closer examination these predicates are seen to be acquired meanings of the object for the subject. Without inquiring too closely for the present into the question whether or not such qualities may be in some sense objective, it may be asserted

<sup>1</sup> This paper, part of a larger study now completed, was ready for publication six months ago. The appearance in July of Baldwin's *Thought and Things* showed such substantial agreement in general point of view and method, that it has seemed desirable to take advantage of the opportunity to make certain minor changes in terminology, most of which are specifically noted.

unhesitatingly that they are meanings pre-determined by antecedent psychological processes. As thus pre-determined, they may be described as selective and funded meanings. They are 'selective meanings'<sup>1</sup> in that they represent differentiation of aspects of objects acquired in processes of feeling and will. They are funded meanings in that they represent the accumulation of meaning of these processes. We may therefore define the worth predicates briefly as the selective funded affective-volitional meanings of objects.

For the purposes of our study the funded meaning of worth predicates should be distinguished from the 'founded' meanings or objects of cognitive experience. By a 'founded'<sup>2</sup> object in general we understand one built up by processes of presentation or judgment upon primary sensations and perceptions. Such a founded object is strictly speaking not the object of perception but of presentation or judgment and may be said to be pre-determined by these processes. Thus certain ideal objects of presentation and judgment, while themselves not sensed or perceived, may be said to be founded on sensation and perception. They are ideal constructions, and as such selective cognitive meanings. The objects of the funded meanings of worth predication may be either primary or founded objects, objects of perception or of ideal construction. Thus to take a single illustration, the processes of sympathetic realization of the feelings of another, are in the first place perceptual in character, but upon the basis of these processes certain ideal objects, the self and its dispositions are built up which become the objects of imputed values. To them is imputed the funded meaning of the processes of feeling and conation involved in their construction.

The worth predicates are then the funded meanings of primary and founded objects. When, now, we attempt a further analysis of the predicates, we are confronted with peculiar difficulties, which arise from equivocations in their meaning, equivocations so confusing upon first appearance that more

<sup>1</sup> This use of 'selective meaning' as in contrast to 'recognitive meaning' is suggested and developed by Baldwin in his *Thought and Things or Genetic Logic*, I., Chap. VII.

<sup>2</sup> The term 'founded' is a translation of Meinong's expression *funderverte* (Gegenstand, Inhalt) wrongly translated by some *funded*.

than one thinker has counseled entire scepticism in the matter, not without a show of reason, it must be admitted. But that this initial scepticism is merely a salutary warning will become apparent as we follow these equivocations to their sources for it is precisely in this process, this study of the grammar of the worth consciousness, that we shall find both the nature of the processes through which these founded meanings are acquired and the basis of their classification.

These worth equivocations make themselves felt, precisely as certain contradictions in cognitive predication, through abstraction of the predicates, as qualities of the objects, from the processes of acquirement of meaning through which the founded meanings and founded worth objects arise. The character of the confusion may be seen at a glance by observing the distinctions which worth analysis has developed (in all the concrete worth sciences, economics, ethics, æsthetics) for the removal of the equivocations. Worths are said to be subjective or objective, real or ideal, actual or imputed, intrinsic or instrumental.

The first distinction, between subjective and objective worths or values, gives the key to the situation. The same objects, let us say diamonds, may have little worth or indeed be distasteful to me personally, although in another attitude I may ascribe great value to them and, indeed, think of them as intrinsically valuable. My friend's action may be sanctioned by me in immediate appreciation, although from an objective, moral point of view I must needs condemn it. Such contradictions can only be resolved by a distinction between subjective and objective values. Closely connected with this equivocation is that which arises when the distinction between intrinsic and instrumental values is ignored. An object which is worthless, or indeed the object of negative worth judgments of harmful or bad, may acquire the predicate worth when it becomes instrumental to some object of immediate or intrinsic worth. And within the sphere of instrumental values or utilities, *i. e.*, the economic, we find an equivocation which can be removed only by the use of the distinction between subjective and objective. On the one hand, if any thing is of worth because it is utilizable, it is always so for a subject and with reference to concrete conditions. But on the

other hand, we are led to ascribe value to an object (for instance when we say that iron has value) irrespective of its relation to an individual subject and to concrete conditions; by a process of abstraction we give the object value in itself. For these differences in meaning the economists have used the terms subjective and objective value, or the latter is sometimes called objective exchange value. From these illustrations we see that the attitude expressed by a worth judgment, whether the worth be described as subjective or objective, is an attitude of a subject, but the difference in attitude is determined by the inclusion or exclusion of certain presuppositions, the nature of which is to be determined.

The other distinctions, between real and ideal, actual and imputed, values show the same desire to remove the equivocations inherent in worth predicates. Sometimes we attribute worth to an object when we mean that it deserves to be valued irrespective of its actual valuation by any person or groups of persons. Such value is said to be ideal. Again there are objects of valuation, the existence or non-existence, or the possibility or probability of realization of which, are not inquired into, but which are abstractly valued and said to be ideal values in contrast to the real value of objects where the judgments of existence or possibility are true or grounded judgments. In both cases the real and the ideal values are equally functions of the relation of the object to the subject. The difference lies in the attitude of the subject, in the different presuppositions of the feeling, in the two cases. Confusion of meaning arises only when these presuppositions are not made explicit.

The distinction between actual and imputed values, like the other distinctions considered, is one which is found not in the immediate worth experience itself but which develops when the presuppositions of the worth judgment are made explicit through reflective analysis. The total worth predicated of an object is often seen to have more than one determinant and, under certain circumstances, the element in the total value corresponding to one subjective determinant will be described as actual, while the other element will be described as imputed.

Thus the elements of a total complex (food for instance) will each be said to have its actual value arising from its capacity to satisfy separate desires, or to satisfy desire when consumed separately. Such worth as an element may get from its combination with the other elements is said to be, on the other hand, an imputed value. In a similar way, when an act of a person has value as manifesting a disposition instrumental to the fulfillment of social ends, this is described as its actual value, while an additional value attributed to it as a part, or manifestation of the total personality, is described as an imputed value over and above the actual value of the act. It is obvious from these illustrations that the different moments in the total worth of the object have different subjective determinants and that these go back to the different objects or aspects of the object upon which judgment is directed, to the cognitive presuppositions.

The selective meanings thus differentiated may be described as the *existence-meanings* of the worth predicates and, as distinguished from the purely appreciative meanings previously considered, represent modifications in worth predication determined by differences in cognitive attitude toward the object. The necessity of such distinctions arises from the fact that the appreciative meanings are not wholly independent of the reference to reality involved. As simple acts of appreciation, the presupposition of existence may not be explicit, and indeed the most primitive judgments of worth are assertorial—without any conditional element whatever. But as soon as the question of *evaluation* of the worth predicates themselves is considered, as soon as the axiological<sup>1</sup> problem of the differentiation of subjectively conditioned values from objectively conditioned, is raised, then the presuppositions of reality must be made explicit.

## II.

From this study of the various selective meanings of the worth predicates, it becomes clear that the worth judgments

<sup>1</sup>The term *axiological* (constructed on the analogy of the term *epistemological*), is here used to distinguish the problem of validity or evaluation of worth predicates from the psychological problem of their description and genesis. Its value and use become more apparent as the general theory of value is developed.

express not attributes of objects apart from the subject (even when the value is described as actual and objective) but rather functions of the relation of subject to object. When we speak of an object as having absolute or objective value it is only by a process of temporary abstraction from the subject in some specific attitude, not from the subject itself. The other differences of meaning in the worth predicates reflect the same fact. Thus when I attribute value to an object, meaning that it is actually valued, my attitude is determined by certain presuppositions of judgments, which are the product of participation in the worth judgments of others. When, however, my judgment means that the object is ideally of worth, deserves to be valued, that judgment expresses a modification of attitude brought about either by the exclusion of certain partial determinants of my attitude, as when I pass my judgment in opposition to actual worth judgments about me, or by inclusion of other presuppositions, as when, for instance, I appeal from a narrower actual worth judgment to a possible more universal judgment. The situation is the same in the case of the distinction between actual and imputed values. The actual value is always the meaning of the object for a subject in some attitude—never an attribute of the object itself. The imputed value added to the actual value arises from attitudes of the subject, negligible or irrelevant from the standpoint from which the actual value is determined.

Two important consequences follow from this conception that worth or value is the meaning of the object for the subject in different attitudes, or as predetermined by different dispositions and interests. In the first place, while the distinctions we have been discussing are developed from the axiological standpoint of the determination of the relative validity of worth judgments, we have in the analysis underlying these distinctions at the same time a clue to the psychological analysis and classification of the different attitudes. In all these differences of meaning the sources of the difference were found in the nature of the cognitive presuppositions. All valuation, as attitude of the subject, is primarily an act of immediate appreciation; but this primitive attitude may be modified to give various meanings by the inclusion of various types of judgments, existential, instrumental,



judgments referring the object of the self or to others, judgments of possibility or probability of acquisition and possession, etc. While for the axiological point of view the truth of these presuppositions is significant, for psychological analysis their significance lies in the changes in worth experience, which follow upon changes in these presuppositions.

In the second place, as a result of this conception of worth as the affective volitional meaning of the object for the subject in different attitudes, the way is now open for an analysis of the worth subject and for a classification of the fundamental worth attitudes. The equivocations in the meaning of the worth predicates already considered, indicate certain fundamental differences in the subject of the experience. The distinctions between subjective and objective worth, between actual and ideal, are reducible to differences in the judging subject. These differences have led to the conception of different subjects for different types of worth judgments. Thus Kreibig<sup>1</sup> distinguishes between a primary and secondary worth subject, the primary being the individual as such, the secondary being the group or race consciousness. So also Meinong,<sup>2</sup> in treating of the difference between ethical and moral judgments distinguishes the more personal ethical from the impersonal, moral subject. The former is the concrete ego in his relation to the alter; the latter is neither the ego nor the alter but an abstraction, a third person, the impartial spectator which sits in judgment upon both. These distinctions, appearing as they have in the effort to do justice to fundamental differences in worth predication, point in the right direction. But they are nevertheless open to the criticism which attaches to all conceptual constructions employed as instruments of analysis, that they are in danger of being hypostatized into separate realities and conceived as real even when abstracted from the individual subject. For certain purposes of social and ethical philosophy, we may, perhaps, speak of a group consciousness, of an over-individual

<sup>1</sup>Kreibig, *Psychologische Grundlegung eines Systems der Wert-theorie*, Wien, 1902, p. 5.

<sup>2</sup>Meinong, *Psychologische-Ethische Untersuchungen zur Wert-theorie*, pp. 72, 163, 216.

will, without a serious distortion of the facts, but for the empirical analysis of worth judgments it is nearer the truth to say that the subject in the rôle of the individual, of the group or race, or of the impartial spectator, is the individual in different attitudes. The problem is then to account for the origin, differentiation, and fixation of these relatively permanent attitudes, and, in the light of the preceding discussion, such attitudes of the subject represent changes in affective-volitional meaning, as determined by changes in cognitive presuppositions (the subject-matter).

The worth judgment of an individual may then express the affective-volitional meaning of an object for the subject, as qualified by the subjects (*a*) participation in, and (*b*) explicit cognition of, the worth attitudes of others, of single persons, of social groups, or perhaps of an over-individual worth consciousness which transcends even group distinctions, giving the impersonal attitude of the 'impartial spectator.' The difference in attitude is determined by the inclusion or exclusion of judgments as part presuppositions of the meaning. The psychological problem is the tracing of the processes by which this participation in, and cognition of, the attitudes of others is realized, the more specific problem of worth analysis itself being to determine how this modification of the attitude of the subject modifies the worth predicated of the object.

In a preliminary way we may distinguish three fundamental attitudes of the self or subject of worth judgment: (1) Simple appreciation of the affective-volitional meaning of an object for the self; (2) the personal attitude in which the worth of the object is determined by explicit reference of the object, whether a physical possession or a psychical disposition, to the self or the alter, and in which characterization of the self or the alter is presupposed, and (3) the impersonal attitude, in which the subject of the judgment is identified with an impersonal over-individual subject and the value of the object is determined by explicit reference to the over-individual demand.<sup>1</sup>

<sup>1</sup>This classification corresponds in principle with Baldwin's classification of cognitive meanings in the first volume of his *Genetic Logic*, Chap. VII., p. 148, where he distinguishes: (1) Simple and private; (2) aggregate and con-aggregate; (3) social and public, meanings.

As the subject of value experience, one of the moments in the value function, is constantly changing, expanding and contracting through inclusion and exclusion of presuppositions of judgment, so also the object of valuation undergoes modification. Broadly speaking, the object of worth belongs to the presentational side of consciousness, is the object of immediate apprehension with its implicit presupposition or explicit judgment of existence. It is, therefore, in the first place, the not-self external object of feeling and will, those aspects of experience which are from the beginning presentational. But there is scarcely any aspect of consciousness which cannot become presentational, cannot be presented to consciousness as object, and become the object of judgment. Even the attitude of valuation itself which we may describe as the 'psychical' preëminently, is susceptible of representation, translation into ideal terms and of thus taking its place on the objective side of the value function.<sup>1</sup> The psychology of this representation of the psychical will engage our attention at those points where we shall make use of the principle. Here it is merely important to insist that the general class, worth objects, includes physical and psychical and, among the latter, the attitude of valuation itself.

A more significant distinction among objects of valuation is that between primary and secondary or between simple and *founded* objects already considered. These founded objects may be of two kinds, according as they are founded in processes of perceptual or ideational activity. Illustrations of the former are: (a) Beauty or grace of form in objects of perception; (b) founded qualities acquired in the sensational and perceptual activities of consumption of food (or more broadly of various instinctive activities), such as cleanliness, manners. Any harmonious grouping or arrangement of the activities of living creates secondary objects of worth, founded upon the primary. As illustrations of the secondary worth objects founded in processes of ideation and judgment, we may take the *person* and

<sup>1</sup>As was pointed out in another article, *Appreciation and Description and the Psychology of Values*, *Philosophical Review*, November, 1905, the capacity of feeling attitude of becoming the object of presentation and judgment is the condition of there being appreciative description and communication of attitudes.

his affective or conative dispositions built up conceptually on the basis of immediate appreciations, as in sympathetic *Einfühlung*, or by a process of inference, which, then in turn, become the objects of secondary judgments of merit and demerit, etc. To these may be added a third group of founded worth objects which may be described as over-individual. These are the products of the ideal reconstruction of objects of primary worth as determined by participation in the worth processes of larger social groups or of society at large. To this class belong the ideal moral and culture goods of society, economic goods as objects of exchange, including the medium of exchange which has over-individual worth exclusively. In distinguishing thus between founded objects as products of perceptual and ideational activities, we cannot of course make the distinction absolute, for in the case of many such objects both activities have been at work in their construction.

A preliminary classification of worth objects would then include the following groups: (1) Objects of simple appreciation or of condition worth. These objects may be either physical or psychical and include the founded psychical objects built up in perceptual activity. (2) Objects of personal worth such as qualities and dispositions of the person (the self or the alter) objects founded in the processes of characterization of the person. (3) Objects of over-individual or common worth founded in processes of social participation, ideal constructions developed in the interest of social participation, utilization and exchange of objects. In general these objects of worth correspond to the fundamental attitudes of the subject of the value experience.

### III.

The analysis of the meanings of worth predicates, and the consequent differentiation and classification of the fundamental types of the subject and object of the judgment of value, bring us to a third problem of analysis, namely a more definite characterization of the term affective-volitional meaning and an analysis and classification of the modes of consciousness corresponding to these meanings. As long as we were concerned merely with a preliminary differentiation of cognitive meaning

from that aspect of meaning described as worth or value, it was sufficient to describe the latter as a meaning predetermined by processes of feeling and conation and the judgment of value as an appreciation or acknowledgment of that funded meaning. But when this criterion is examined more closely and the attempt is made to determine more precisely just what aspect of meaning is represented by the different types of worth judgment (appreciation, characterization, participation and utilization) just what the determining processes of feeling and conation are in each case, more detailed psychological analysis becomes necessary.

When we seek to make more specific this very general description of the worth relation we are confronted with two possible views of the worth moment which may be described as a broader and a narrower view. The narrower view recognizes only two types of value judgment, the ethical and economic, thereby limiting the term value to such feeling attitudes as follow upon the *judgmental affirmation* of the existence or non-existence as an object for the self or its purposes. This limitation denies, therefore, the character of worth attitude to all immediate feeling of the meaning of the object for the subject prior to the distinctions which we describe as economic and ethical, and likewise to all forms of higher immediacy of feeling attitude as we have them primarily in the æsthetic consciousness. This view, which has been presented most definitely by Witasek<sup>1</sup> and Stuart,<sup>2</sup> logically excludes the æsthetic from the sphere of values, in the view of the former because the æsthetic is pre-judgmental, *i. e.*, is feeling which has merely presentations as its content, for the latter because he conceives it to be post-judgmental, an appreciative state where all judgment subject-matter has lapsed. Either mode of cutting the æsthetic attitude off from its closely related ethical and economic attitudes is, we shall find, open to serious criticism and must necessarily discredit this limitation of the term value.

The reasoning which underlies this the formulation of this criterion is well expressed by Stuart in the following paragraph :

<sup>1</sup> Witasek, *Allgemeine Æsthetik*, Leipzig, 1904.

<sup>2</sup> Stuart, *Valuation as a Logical Process*, in Dewey's *Studies in Logical Theory*, Chicago, 1903.

“Our general criterion for the propriety of terming any mode of consciousness the value of an object must be that it shall perform a logical function and not simply be referred to in its aspect of psychical fact. The feeling or emotion, or whatever the mode of consciousness in question may be, must play the recognized part, in the agent’s survey of the situation, of prompting and supporting a definite practical attitude with reference to the object. If, in short, the experience enters in any way into a conscious purpose of the agent, it may properly be termed a value.” Now, in examining this criterion one recognizes immediately that it provides a good definition of a certain type of reflective value judgments which we may call secondary. A very large group of our worth judgments are determined by the conscious (recognized) inclusion of the worth feeling or emotion as presented content, as partial determinant of the judgment. The typical economic judgment takes place only upon the occasion of adding to or taking from our store of objects and is motivated by a reflective inclusion of the worth feeling in our total practical attitude. The ethical judgment, in its typical reflective form, may be shown to be of the same character in that the subject’s own mode of experience, way of feeling, presented in terms of disposition or quality of the self, enters as a determinant in the total situation. But the secondary and derived character of these reflective judgments soon becomes evident. How can the feeling or emotion as presented content, ‘play a recognized part’ as a value ‘in the agent’s survey of the situation’ unless, as a motive to previous unreflective judgments, before it was presented as a conscious determinant, it was also a value or at least value-suggestive. We may say, then, that, while much of valuation is a logical process in this sense, nevertheless valuation has its roots in experiences of simple appreciation where the emotion, while determinative, is not so consciously, as object of presentation or judgment and must, therefore, be referred to simply in its aspect of psychical fact.

We must, accordingly, interpret our definition of value as affective-volitional meaning in the broader way already suggested, so as to include modes of consciousness, of feeling (or

desire) which are merely appreciative of the object, which merely apprehend the object with its funded meaning. We cannot confine it to attitudes in which this meaning, abstracted from the object, becomes a motive in the subject's survey of the situation. We shall then be enabled to include both the attitudes of lower immediacy, which are pre-judgmental, and those of higher immediacy, which are post-judgmental, recognizing the intermediate rôle of the reflective judgments (existential, instrumental, possessive, etc.), and recognizing also that the reflective and the unreflective, the intrinsic and the instrumental, are constantly passing over into each other, a phenomenon which we shall later describe as value-movement.

In close relation to this first problem which arises in the attempt to make more specific the general definition of worth as affective volitional meaning, a second problem arises, namely, the question of the specific manner in which we shall set the worth moment in relation to its psychological equivalents, feeling and conation. Already, in the use of the double term *affective-volitional* in our preliminary demarcation of worth experience, a certain vagueness inheres, which, while excusable when viewed in the light of the purpose of the term, must give place to explicit psychological analysis if we are to find equivalents for the worth moment which shall form the basis for a scientific reconstruction of the processes of valuation. The significance of this double term lay in the fact that it marked off a species under the generic term, meaning. Not that there could be cognitive meaning without worth references or affective-volitional meaning without cognitive presuppositions. Indeed, we shall see that these terms are not very clear at the limits. Merely to indicate a relative distinction, by means of emphasis of different aspects of meaning, was the purpose of this differentiation.

In the second place, the double term was necessary for the reason that only in such a definition could all the attitudes toward objects, recognized as worth attitudes, be included. For our ordinary usage, at least, makes a clear distinction between feeling and will and recognizes, as objects of worth, objects upon which both types of attitude are directed, and, prior to more scientific analysis, this double relation must be taken as descrip-

tive of the worth attitude. But here again, when this general definition gives place to psychological analysis, we find that the distinction between feeling and conation in some of its forms is not very clear at the limits, and it is consequently difficult to say under which of these terms the immediate experience which is the bearer of these meanings, is to be subsumed. On the one hand, we find experiences of preference and obligation where feeling, if it is described as passive pleasantness and unpleasantness is at a minimum, is scarcely present, or, if present at all, is irrelevant, so irrelevant in fact that some theories of worth experience (the voluntaristic theories of Brentano and Schwartz) find the psychological fundamental in what they describe as 'intensitiless acts of preference,' denying the worth moment to feeling and its intensities. On the other hand, we find worth experiences, such as the æsthetic, apparently purely affective, where desire, conation in all its forms is at a minimum, and appears to be significant, if significant at all, merely as a disposition or presupposition. While, then, in view of these facts the general term affective-volitional meaning was necessary to define the various meanings of objects included under the term values, it is nevertheless evident that the definition can become serviceable for further psychological analysis and explanation only when it is determined which of these moments, the affective or conative, is primary and which secondary — that is, which is always present actually as conscious experience and which as a merely dispositional determinant. But if our general definition is to hold, in every attitude which we describe as a mode of worth experience both aspects of experience must be present either actually or germinally.

In the light then of these considerations, it would appear that the course of our further analysis is clearly and necessarily determined. We are compelled, on the one hand, to include both concepts, of feeling and conation, in our psychological equivalents for the worth moment; otherwise we should not have a true equivalent for the funded meaning of the object described as worth. On the other hand, when from the standpoint of the analysis of content we look for an experience which shall be a common equivalent for all phases of worth determination, one



of these moments must assume the role of actual experience and the other of dispositional presupposition. One must constitute the worth fundamental. Is then the worth fundamental feeling or desire?

In the second place whichever of these two aspects be taken as fundamental, a second question necessarily arises — is worth coextensive with feeling or desire, or is there a further demarcation within the sphere of feeling or desire, respectively? In other words, have all feelings or desires, whatever their conditions, however fleeting and however caused, the transgredient and immanent references which characterize the worth attitude of the subject toward the object?

#### IV.

Both of these problems have been in the forefront of recent psychological analysis of worth experience. They are questions which are forced upon the attention as soon as we attempt to coördinate and reduce to common terms the varying attitudes which have been included under worth experience, within the worth definition. It is true that there is a point of view from which these finer distinctions are irrelevant. One can see that for the limited purposes of economic analysis, which requires but a short excursion into psychology, we might speak of the worth moment now as feeling, and now as desire. Ehrenfels is also probably right in saying that the general laws of valuation and the forms of mutation of values, value movement, hold true whether we define worth experience as feeling or desire, and changes in judgments of value as due to modifications of feeling or desire. It remains true, nevertheless, that a complete analysis of the worth consciousness, in all its phases, requires the solution of both these problems.

It is in connection with the first problem that the first divergence in definition appears, as typified in the different formulations of Meinong and Ehrenfels. Ehrenfels defines the worth of an object as its desirability and makes actual desire the worth fundamental, assigning to feeling the conceptual, dispositional rôle, while Meinong, on the other hand, identifies actual worth experience with feeling, desire appearing in his definition only

as presupposed disposition. In some sense, we have seen, both terms, feeling and conation, must enter into our psychological definition; the question is which shall be given the rôle of fundamental, *actual* experience and which the dispositional rôle.

Ehrenfels<sup>1</sup> takes desire as the actual psychological worth fundamental. Value, we are told, is proportional to the desirability of the object — and he continues, as though it were self-evident, — ‘*i. e.*, to the strength of the actual desire which corresponds to it.’ The first part of the definition is certainly true. The funded meaning of an object is its desirability, its capacity under certain circumstances of calling out desire. The second part does not, however, necessarily follow. It does not follow either that judgments of worth are determined by actual desire, or that the worth of the object is proportional to the strength of the actual desire. As to the identification of value or desirability with actual desire, a consideration of certain simple but typical worth experiences, indicates that it is not exclusively an actual, but, ultimately, merely a possible desire or desire disposition with which worth is to be equated, a modification of his earlier definition which Ehrenfels himself accepts. When I think of an absent friend I may feel his worth to me without the slightest trace of actual desire for his immediate presence, although the presupposition of that feeling is a desire disposition. Or again my consciousness of the objective value of objects of economic use may be independent of any actual desire, although not of my cognition of their desirableness under certain circumstances. It is equally true that the degree of worth or desirability of an object cannot be straightway identified with the degree of actual desire. It is undoubtedly proportional to the strength of desire disposition presupposed, but the strength of a conative tendency or disposition is not measured by the intensity of actual desire but is inferred indirectly from its effects in volition, or through the intensity of the emotional disturbance following upon arrest. The assumption that the strength of a desire disposition is given directly in immediate modifications of consciousness is one which introspection makes highly improbable and Ehrenfels,

<sup>1</sup> Ehrenfels, *System der Wert-theorie*, Leipzig, 1897, Vol. I., Chap. I., especially p. 35.

with whose definition we are here concerned, at least does not admit it.

It is clear, then, that while desire, and conative tendency in general, must find a place in our worth definition, it cannot be taken as the psychological fundamental in the sense that it is the conscious correlate of the funded meaning of the object. This conscious correlate is feeling. Ehrenfels thus brings feeling into his definition. Desire is not determined by mystical qualities of objects but by aspects of our consciousness which can be reduced to psychological terms. "All acts of desire are determined, in regard to their direction as well as their strength, by the relative increase of pleasure which they, according to the affective dispositions of the individual in question, bring with them upon their entrance into, or continuance in, consciousness." Feeling is, therefore, after all, primary. The worth of an object is directly proportional to the strength of desire, but this strength of desire is determined by the difference between the places of the object in the hedonic scale.

In this conception of Ehrenfels the whole psychological problem of the nature of feeling and desire and of their relations, is involved. Into that larger question we cannot here enter. It will be sufficient to notice certain fundamental difficulties which have been generally recognized by the critics of the position. The criticism turns upon the concept of the *determination* of desire by feeling, upon the idea of the causal relation involved. It is maintained with justification that for a feeling to be a cause of desire it must be actual, that is a present state of consciousness. But according to Ehrenfels' conception it is not merely a present state, but a state which does not yet exist, which is the cause. It is the existence of an object not yet realized or the non-existence of a present object, which is desired. The hedonic accompaniment of a not-yet existent object, itself therefore not existent, cannot in any causal sense be the determinant of desire. But it may be said that it is the difference of these two states that is the cause. In that case it must be either the unfelt, uncognized difference, an abstraction, which is the cause, or else a new feeling following upon the judgment of the difference between the actual present feeling

and an imagined feeling arising from the assumption of the existence or non-existence of the object. In the first case we have a conceptual abstraction made the cause—which is impossible. In the second case a feeling difference has become the object of judgment and a value moment is already present prior to desire. It is clear that in some sense feeling or feeling disposition is always presupposed by desire but the relation cannot be described as causal.

Ehrenfels recognizes that upon this causal view of the relation of feeling to desire, the proposition must be modified to read: desire is determined by feeling or feeling dispositions. But we have already seen that worth cannot, in every case be identified with actual desire, but only with the capacity of being desired, desirability. Thus Ehrenfels is finally left without any conscious correlate for the worth moment. Both the feeling and conative aspects tend to become dispositional.

For reasons of the nature of those developed in our criticism of Ehrenfels' worth definition, Meinong<sup>1</sup> makes feeling the worth fundamental. The sense of worth is given in feeling signs, Werth-gefühle, which are determined in character and degree by the nature of their *presuppositions* (Voraussetzungen).<sup>2</sup> These presuppositions he further conceives, in the case of worth feelings, to be always judgments (or according to his later formulation, judgments and assumptions—Annahmen) and are therefore distinguishable from feelings which have merely sensations or presentations as their presuppositions. With this limitation of worth feelings we are not now concerned; for the present our problem is the more general one of the suitability of feeling as the worth fundamental—as the psychological equivalent for the worth moment. The preferability of feeling as our description of the worth fundamental seems to me to be beyond doubt and for the following reasons. In general our argument would

<sup>1</sup> Meinong, *Psychologische-Ethische Untersuchungen*, Part I., Chap. I.

<sup>2</sup> In presenting Meinong's position I have translated Voraussetzung 'presupposition' rather than precondition, as better adapted to convey his meaning, and have retained this broader usage of presupposition throughout, although in the usage of Baldwin it is confined to the higher reflective level, if I understand his position correctly, that is, his presupposition is always a 'presupposition of belief.'

be: There can be no sense of worth without a meaning which may properly be described as felt meaning, while there can very well be a sense of worth without that qualification which we describe as desire and volition.

More specifically, even in those experiences which we describe as explicit desire or volition, the essence of the desire can be equally well described in terms of feeling without doing violence to our speech. The essence of desire is the feeling of lack or want. We '*feel* the need' of something. What further qualifies desire is the kinæsthetic sensations which are irrelevant accompaniments from the standpoint of the essential worth moment. But it is by no means in the same sense true that every worth experience involves explicit desire. We may actually feel the worth of an absent friend without the slightest trace of that qualification of our feeling which we describe as actual desire, although of course a conative disposition is presupposed and may become explicit under suitable conditions. The same is true of æsthetic and mystical states of repose where actual desire is in abeyance.

What this means for our worth definition is clear. In actual worth experience actual desire is not necessarily present although feeling is. The desire is present often merely as a dispositional moment which, however, may become actual under certain definite circumstances. In so far, therefore, as our definition is concerned with the desire moment, we must enlarge it to read — an object has worth in so far as it is either desired or has the capacity of calling out desire, has, in other words desirability. This definition includes the mystical and æsthetic states of repose already referred to, for no object can become the object of such feelings which has not been desired and may not under some circumstances be again desired. Conation is present dispositionally (how we shall see later) even in these states of repose. But the case is different with feeling. In defining worth as feeling with certain characteristic presuppositions we mean that every actual worth judgment implies actual feeling — even in those cases where the worth attitude is scarcely distinguishable from the cognitive.

Feeling having been taken as the actual conscious corre-

late of worth predicates, the second problem arises — whether worth feelings are coextensive with feelings in general or whether some further differentiation appears within the general class feeling. It is at this point that the definition of Meinong, the view that feelings of worth are exclusively ‘ judgment-feelings,’ becomes important. This view, which may be described as the intellectualistic theory of worth experience, has given rise to so many important developments in ethics and æsthetics that it demands the most careful consideration. Negatively viewed, it denies the character of worth experience to all feelings which have as their presuppositions mere presentations, to all feelings which may be adequately described as the mere feeling tone of the presentation or as the effect of the entrance of the presentation into consciousness. It differentiates ‘ worth feeling ’ from mere ‘ pleasure-causation,’ *e. g.*, pleasure viewed as mere reaction to stimulus.

Before considering in detail the psychological grounds for this view, it will be well to observe the more general fact that whether worth experience be defined in terms of desire or feeling, it cannot be made coextensive with either. Desire, in itself, does not constitute the experience of valuation: there are fleeting desires which do not attain to the level of valuation, a fact which leads Kruger in his definition, which is in terms of desire, to make the differentia of worth a certain constancy of desire. Again, as Meinong points out, illustrations are plentiful of valuation without actual consciousness of pleasure, while a fleeting pleasure does not necessarily involve valuation. Reflection upon these facts of experience leads to more strictly logical considerations such as those which appeared in our criticism of Ehrenfels’ definition. The sense of value cannot be identified the mere feeling of pleasure (although of course a feeling of with pleasure when it is made the object of judgment may become a value) for the feeling of value is conditioned not only by the presence of objects but also by their absence. The mere absence of the object is not the condition of the feeling, but the cognizance (in Meinong’s terms the judgment) of non-existence. The hedonic state which would be the effect of the presence of the absent object is not actual, and can therefore not be, in any

causal sense, the condition of the desire and of valuation. Moreover, the cause of the pleasure is often quite distinct from the object of the feeling of value, often physiological and unconscious. The feeling of value can therefore not be viewed as the effect or accompaniment of sensation or presentation of an object but is conditioned by the presupposition of the existence of the object. For the feeling to have that meaning called worth it must have an existence meaning.

The negative aspect of Meinong's position, the denial of the character of worth experience to mere presentation feelings, appears justified from this analysis of the facts. A fundamental distinction seems to exist between feeling which is a mere feeling tone, accompaniment or effect, of a sensation or revived image, and feeling attitude which is characterized by the direction of the feeling toward the object. Feeling attitudes alone seem to contain the worth moment. It is undoubtedly true that feeling tone of presentation, when it reaches a certain degree of intensity, gives rise to a feeling attitude, to the presentation of the cause as object and the direction of judgment upon it, and thus to feeling of worth. But this feeling (or desire, as the case may be) is distinguished from the feeling tone by the presence of additional presuppositions, whether exclusively judgmental or not, is a question to be determined.

A critical consideration of this positive aspect of Meinong's definition requires a closer examination of his use of the term presupposition (*Voraussetzung*). Under this concept he includes all those conditions of feeling which are psychical in character, as distinguished from other causes of feeling which may be dispositional and physiological. In this sense a presupposition may be any psychical process, presentation, judgment (of the various types, categorical, hypothetical, etc.) and other types of function, perhaps, such as assumption. In every case where the presupposition of a feeling is spoken of, the feeling is directed upon an object and is conditioned by some psychical act, of presentation, of imagination, with its assumption of reality, or of judgment, judgment being for Meinong a fundamental form of psychical process. The significance of this distinction is to be found in the fact that the characteristic meanings of

feelings which distinguish them as feelings of value, are not to be differentiated in terms merely of the objects toward which the feeling is directed, nor yet in terms of the causes of the feeling, but in terms of the cognitive acts or attitudes which relate the object to the subject.

## V.

Is then the presupposition of worth feeling exclusively judgmental, as Meinong maintains? To this question our answer must be negative. But we may admit, to begin with, that nearly all types of worth attitude do have existential judgments as presuppositions, and all secondary modifications of worth attitude are determined by the inclusion or exclusion of judgments, existential and relational, as part presuppositions of the feeling. But that there is no primary immediate consciousness of value without explicit judgment of existence or non-existence of the object, cannot be maintained. As was pointed out in our discussion of the equivocations in the worth predicates, ideal and imputed values may be attributed to objects when the question whether they exist or may be acquired is not raised, and where, accordingly, the attitude can never reach the point of explicit judgment. The activities of imagination and idealization abundantly prove that the feelings directed upon their objects are really feelings of worth and are determinative of worth judgments, although they presuppose mere passing assumptions of the reality of the objects.

Meinong has indeed found himself compelled upon further reflection to modify his definition of worth feelings as judgment feelings to the extent that he includes with the judgment feelings assumption feelings (*Annahme-gefühle*). He recognizes that 'often one values an object at a time when there is entirely wanting all chance for judgments of existence and non-existence, because it is not determined yet whether the object thought of as in the future will exist or not.' Moreover, 'it is possible, and it frequently happens that we value an abstractly presented object without inquiring after its existence.'<sup>1</sup> And in

<sup>1</sup> Meinong, "*Über Werthalten und Wert*," *Archiv für Systematische Philosophie*, 1895, pp. 327-346. Also his later work, *Über Annahmen*.



a later paper<sup>1</sup> he further qualifies his position by recognizing that it is *only some universe of reality* which is necessarily presupposed, in that the presuppositions are not necessarily categorical existential judgments, but may be hypothetical or disjunctive. Now in all these cases where the object is 'abstractly presented,' assumed to exist, or asserted to exist conditionally, reality is presupposed in some sense, there is some reference to reality. It is also clear that in all these cases the feeling, characterized as feeling of value, is in some way differently qualified from the feeling of pleasantness or unpleasantness—by this very reference to reality presupposed. The question at issue is really merely as to the proper characterization of the reality meaning, whether it rests exclusively upon existential judgment or not.

And this question is still more ultimately conditioned by a theory of the existential judgment. To this theoretical problem we shall presently turn, but it will be in the interests of clearness to seek a preliminary characterization of this presupposition of reality. There can be no question, in the first place, that wherever there is the feeling of value, there is reality feeling. Feeling is qualified by a reality meaning of some type. Thus, when once an object (the existence of which was what I desired or was what conditioned my feeling of value) is explicitly judged non-existent, the object undoubtedly loses its value for me. The essential condition of its being valued is eliminated. But my appreciation of the worth of an object does not necessarily, and in every case, rest upon such explicit judgment of existence, but at most upon a primary undisturbed *presumption* of reality. By this primary presumption of reality (of a reality, moreover, in which the more specific existence meaning has not yet been differentiated) is to be understood the mere act of acceptance, *taking for granted*,<sup>2</sup> prior to the ex-

<sup>1</sup> "Urtheilsgeföhle, was Sie sind und was Sie nicht sind," *Archiv für die gesammte Psychologie*. Vol. VI., 1905.

<sup>2</sup> The use of the term *presumption* to characterize this relation to reality is, I think, fully justified both linguistically and psychologically. Our ordinary speech, it is true, frequently fails to distinguish between presumption and assumption and has, moreover, read into the word presumption a certain ethical connotation which partially unfits it for the present use. On the other hand,

plicit *taking up* of the object into a pre-determined sphere of reality through the existence predicate, and prior to the assumption of existence of an object in the interest of continuity of any trend of activity, whether of the type of cognition or valuation.

As illustrative of this attitude of primitive presumption we may consider first the reality feeling which attaches to perception and presentation simply because of the 'recognitive meaning'<sup>1</sup> which they have, among which later, however, distinctions between existent and non-existent arise — more especially the presentations in the fancy or imagination mode where they are presumed to be real until the entrance of illusion-disturbing moments which require the presumption to pass over into explicit judgment and conviction either of existence or non-existence. The fairy world of the child is a world neither of pure presentation nor of existential judgment but of presumption. The same may be said of many ideals of the more developed mind, as for instance, religious, about which questions of existence and non-existence are not seriously asked. In all these cases some psychically pre-determined *demand*, whether arising from a more objective cognitive factor of recognition or a more subjective factor of conative disposition or interest, creates a presumption of reality.

Such presumption must be carefully distinguished from both *judgment* and *assumption*. The existential judgment arises, we shall see, only after disturbance in a sphere of reality already presupposed, it is an act which takes place only after some disposition, some tendency to recognition, or to renewal of attitude of feeling or will meets with opposition or arrest. It

the original meaning of the latin *praesumptio* is much nearer to the use that we have in mind — it had more the meaning of *taking for granted* prior to explicit judgment and was quite different from the conscious assumption of reality as we have it in hypothesis. The modern English dictionaries give as one of the renderings, *taking for granted*, the meaning here emphasized. The use of the term in formal logic (as in fallacies of presumption), while at first apparently against our usage, on closer inspection seems to favor it. A presumption is a material fallacy, an unconsciously pre-logical taking for granted. Finally, the great value of the introduction of this term for our immediate purpose is the possibility of using the prefixes *præ*, *sub* and *ab*, with the same root, to designate modifications of cognitive attitude.

<sup>1</sup> Baldwin's distinction referred to above.

must be equally clearly distinguished from the later, more derived, attitude of assumption of existence which presupposes dispositions already created by actual judgment. The assumption, except when it is what we describe as an unconscious assumption, (and then it is really an approximation to presumption) recognizes the possibility of the non-existence of the object, and in some modes of playful assumption (the 'semblant modes' of Professor Baldwin) is so to speak on the verge of explicit judgment of non-existence; but in the making of the assumption the act is determined by a subjective factor, a demand arising from already existing dispositions and interests. The assumption is an acknowledgment of this demand.

It is obvious, after this analysis, that the definition of feeling of value under consideration, that it is feeling with existential judgment as its presupposition, is possible only on the theory that the primitive form of judgment is the mere act of acceptance (acknowledgment) or rejection<sup>1</sup> and involves no relational aspect, no separation of two elements subject and predicate. The existential judgment is identical with acceptance and the non-existential with rejection. If this view of judgment (Brentano's)<sup>2</sup> can be maintained it follows necessarily that there can be no feeling of value without judgment presupposition for all attitude is primarily acceptance or rejection and the feeling of value is an *attitude*, not mere presentation plus feeling. But can mere acceptance or rejection be identified with judgment of existence and non-existence and at the same time any useful conception of judgment be retained? I think not, and for the following reasons.

The essentials of the view here under consideration are: (a)

<sup>1</sup> The use of the terms *acknowledgment* and *rejection* as correlative is most unfortunate, for it prejudices the whole question. Rejection, as any one who will consult the dictionaries will discover, is not the opposite of acknowledgment. Acknowledgment has as its opposite disavowal, while the opposite of rejection is acceptance. This linguistic relation corresponds precisely to the psychological. Acknowledgment and disavowal both represent the explicit judgmental acts by which a reality already presupposed is affirmed or denied. Mere acceptance or rejection of an object presupposes nothing more than a presumption of reality or disturbance of that presumption.

<sup>2</sup> For a presentation and discussion of Brentano's theory of judgment see Stout, *Analytical Psychology*, Vol. I., Chap. 5.

That presentation and judgment (acceptance or rejection of the existence of the presentation) are two different and irreducible elementary aspects of consciousness; (*b*) that while the affirmation or negation of *A* (as function) adds something to its mere presentation (as function), the affirmation or negation of *A*'s existence (as content) adds nothing to the affirmation or negation of *A* (as content). The first thesis is the key to the position. Is there such a thing as simple apprehension, presentation without acceptance, or does apprehension involve apprehension of existence? At first sight the former of the two possible alternatives seems to be true. From the standpoint of analysis alone, we seem to find cases where the element of affirmation is at a minimum, or even seems to be entirely lacking, and a merely presentational consciousness remains. Leaving out of account the case of doubt or suspended judgment where, although at a minimum, tendencies to judgment still remain, we may turn immediately to the typical case of æsthetic contemplation. Here it is said, we have, when the contemplation is pure, when the æsthetic is unmixed with other factors, a strictly presentational consciousness. This view we shall find it necessary to reject and for the following reasons: In the first place, æsthetic contemplation is an attitude—not mere presentation; in it there is at least a resting in, 'ein Haften an der Wirklichkeit,' either outer or inner reality. As such it is more than mere presentation. No total concrete state of consciousness is mere presentation for, while for the purposes of the psychologist the idea of a purely presentational consciousness is sometimes a useful abstraction, every actual experience presupposes a minimum of acceptance or rejection. The procedure therefore which takes this abstraction, made for purposes of analysis, as a picture of reality and from it infers, for instance, the unreality of the æsthetic object and experience and its exclusion from the sphere of worth experience, is vitiated by serious fallacy.

But if the merely presentational consciousness be but an abstraction, there still remains the question—to what extent, in actual concrete cases of æsthetic attitude, all acceptance and rejection may be seen to be excluded and the purely presentational

approached. Perhaps the difference is negligible. Most æsthetic attitudes, it is recognized by all, do not give us this contemplation pure. In the sublime and tragic, for instance, pseudo-æsthetic factors, so called, enter in, in the form of acknowledgments and rejections, judgments of various kinds, — and even beauty, in its narrower sense, contains, as partial moments, normative judgments. If we are to find any concrete æsthetic experience of 'pure contemplation,' presentation, it must be in the simplest perceptual forms and form qualities. These are indeed usually taken as the typical æsthetic objects when the æsthetic is thus defined, but even here it is doubtful whether the element of acceptance and rejection, of conation, can be excluded. It is true that these forms and form qualities, when abstracted from the elements in which they inhere, may be viewed as the objects of purely presentational activity; nevertheless their construction was the product of conative activity which involved spontaneous acceptance and rejection, presumption of reality. Viewed genetically, every æsthetic feeling of form presupposes a disposition created by preceding conative activity.

The distinction between simple apprehension and acceptance is then, even in æsthetic contemplation, a relative one. What shall be said of the second part of the thesis that acceptance or rejection of an object, *A*, is identical with the affirmation or negation of the existence of *A*, or, in other words, with judgment? Acknowledgment or rejection does undoubtedly presuppose the reality, in some sense of the presentational content. This is the same as saying that all conation is directed upon objects presumed to be real. It does not follow however, that explicit existential judgment is involved. We must, I think, look upon the existential judgment as derived from a simpler and more ultimate attitude toward a coefficient of reality presupposed in all conation, even on the perceptual level. Acknowledgment and rejection involves presumption of existence but not necessarily judgment.

Such a distinction between presumption and judgment involves of course a theory of the nature of judgment. Into the logical questions here raised we cannot go in detail, but this much at least may be said. The position maintained by Sig-

wart<sup>1</sup> (among other logicians) that judgment, if our conception of it is to retain any useful significance, 'must be regarded as establishing a relation, even in its existential form,' seems unassailable. When the relational aspect is allowed to lapse judgment becomes practically indistinguishable from conation. It is true that the existential judgment occupies a unique position. It does not establish a relation between its subject and the predicate being 'but between an object as idea and an object as intuited.' Affirmation of existence or non-existence presupposes, as mere acceptance or rejection does not, the beginning at least of the differentiation of subject and predicate.<sup>2</sup>

On the theory of judgment here developed, the existential judgment and the pure presentation (in so far as "contemplation" is pure presentation) are secondary, derived attitudes, derived from the primitive *presumption* of reality presupposed in all acceptance or rejection of an object. The difference between the presumption and judgment is that while in the former we have merely acceptance and rejection in the latter we have acknowledgment and disavowal, acceptance and rejection plus conviction and belief. Returning then to the question of the necessary presuppositions of the feeling of value, it is clear that there must be the presumption of reality for without it there can be no attitude toward the object, attitude involving either acceptance or rejection or disposition to accept or reject. But it is equally clear that the existential judgment cannot be the sole and necessary presupposition of the feeling, for there can be no such explicit judgment (acknowledgment and disavowal) except as there is already some reality meaning, some presupposition of reality. Again the hypothetical *pure* presentation, in so far as there is any such mode of consciousness, is equally secondary and derived.

<sup>1</sup>Sigwart, *Logic* (translation), Vol. I., p. 72.

<sup>2</sup>The following quotation taken, by permission, from the proofs of the second volume of Professor Baldwin's *Genetic Logic* (chapter on "Acknowledgment and Belief"), puts the situation admirably: "The existence meaning which the judgment always presupposes in the sense given, may, *when explicitly asserted, be called a predicate* but not *an attributive predicate*, not a separate element of presented context or of recognitive meaning, attributed to the subject matter. It is only the explicit assertion of the presupposition of belief in the sphere in which the subject matter is constituted an object of thought."

It is the result of abstraction from the primitive presumption of reality, the result of arrest of this presumption implicit in all conation. Meinong's use of the expression (abstractly presented) is significant in this connection; to abstractly present means to strip off the reality feeling involved in the first experience. This relation to reality feeling may however be partially restored by a further movement of conation in which the presented object is *assumed* to exist, an attitude we find characteristic of certain secondary contemplative æsthetic experiences.

This leads us finally to a consideration of the relation of the attitude of assumption to the primitive presumption of reality and the existential judgment. This is important for the reason that the special modification of the feeling which has assumption as its 'presupposition,' the feelings of the imagination (*Phantasie-gefühle*) of Meinong's school have been made much of in recent discussion. For one thing it has been asserted that these feelings are not real and therefore not feelings of value, although under certain circumstances they may stand for, or represent, real feelings. Our own view, which will be developed more fully later, is that they are real feelings in any sense which has significance for psychology that they have a presupposition of reality, although from the point of view of reflective evaluation of the objects of such feelings (the axiological point of view) the judgments which spring from these feelings may be invalid. But a more adequate characterization of this attitude is our first problem.

Assumption, as a cognitive attitude, has two meanings. According to its first meaning it is an acceptance, a taking as existent, of an object when there is an underlying sense of the possibility of its being non-existent. In this sense also it is a half way stage between the primitive presumption of reality and the existential judgment with its conviction. In this sense it is a secondary movement or act of cognition within a developing sphere of reality, bounded by the primitive presumption of reality and the existential judgment, affirmative or negative. From the point of view of conation, it is an act determined by the momentum of a subjective disposition or interest. In its second meaning it is not pre-judgmental but post-judgmental, that is a

permanent assumption is created by habitual judgment; it presupposes dispositions created by acts of judgment and is derived from the judgment attitude. In this case the assumption approaches closely to the presumption and for this attitude the two terms are often used interchangeably. It is important to emphasize these two meanings<sup>1</sup> for the feeling attitudes involved are in many respects quite different, and the confusion of the two has led to misinterpretation of worth experience. Thus the feelings which attach to assumptions of the first type may be described as feelings of the imagination; they belong to the mode of semblance or 'make-believe.' But those which attach to assumptions of the second type are more accurately described as feeling abstracts or feeling signs and represent the acquired funded meaning of past judgment feelings. To this class, we shall see later, belong all those feelings, funded meanings which inhere intrinsically in general concepts. Such terms as truth, virtue, duty, etc., have functioned in particular existential judgments and it was upon the basis of these judgments that the feelings of value for which these terms stand arose, but when they are thus formed they are abstractly valued without explicit judgments of existence or non-existence. They represent an assumption which has arisen through formation of habit. Explicit judgment is always the terminal of a process of adaptation. From the primitive presumption arises, through arrest, assumption, which in turn, passes into judgment and the later assumption.

We are now in a position to summarize our position as to the nature of simple appreciation, primary feelings of value, in so far as it is related to Meinong's criterion. We agree to the extent that we include among the feelings of value only such feelings as have reality meanings, that is, have some presupposition of reality. As to the nature of that presupposition of reality, we deny its limitation to existential judgment and include the two attitudes of presumption and assumption. This may be said to be the result of our critical analysis of the

<sup>1</sup> Baldwin's recently published theory of 'schematic,' function recognizes both these modes of 'assumption,' the existential judgment lying, genetically, between them. *Genetic Logic*, Vol. I.



meanings of experiences of worth. There remains still the question of the functional and genetic account of these different presuppositions. Before undertaking this we must glance briefly at another criterion of feelings of value recently developed, more especially by Lipps.

## VI.

It is maintained that all feelings of value are feelings of personality — that the analysis which finds the criterion of feeling of value in the nature of the attitude toward the transcendent object, really overlooks the significant moment, which is the reference of the feeling to the subject, the personality. Feelings of value are feelings of activity of the subject, the acts of judgment, etc., being of only secondary importance. Such a criterion is presented in the formula of Lipps:<sup>1</sup> “Der Wert jeder Lust ist bedingt durch einen Persönlichkeits wert.” Now, while it is undoubtedly true that there are types of feelings of value which have as their presupposition explicit reference to the personality, — those feelings which we have described as values of characterization, including feelings of obligation, desert, etc., — it must nevertheless be recognized that these values are secondary and acquired, that they presuppose judgments referring the attitude to the presented self, the self being a founded object, the product of an ideal construction based upon preceding experiences of value. The only sense in which this statement may be said to be true is that in primary feelings of value (as distinguished from simple pleasure), there are certain modifications, certain implicit meanings which, when reflected upon, lead to their reference to the self. Such a modification of Lipps’ view we may accept.

These meanings which appear on the level of simple appreciation prior to reference to the self, Kruger<sup>2</sup> has described as depth and breadth of the feeling in the personality and he conceives them to constitute a third dimension of feeling, beside its intensity and duration, a dimension which is determined by a relative constancy of desire disposition. His development of

<sup>1</sup>Lipps, *Die ethischen Grundfragen*, Chapter I.

<sup>2</sup>Kruger, *Der Begriff des absolut Wertvollen als Grundbegriff der Moralphilosophie*, Leipzig, 1898, Chapter 3 (‘Zur Psychologie des Wertes’).

the criterion is both analytical and genetic. Valuation is distinguished from mere desire and simple-pleasure 'causation' by a moment of relative constancy of desire. Desire of itself does not constitute valuation and valuation is never mere desire or a series of desires. He further conceives the relation of this 'desire-constant' to the individual desire on the analogy of the relation of concepts to individual sensations and percepts. A valuation always presupposes a relatively constant disposition. As a totality this disposition appears as an actual moment in consciousness only in a corresponding judgment. Yet the judgment of value is not the valuation itself. This is given rather in the characteristic modification of the experienced desire and feeling which he conceives to grow in depth with the development of the 'desire-constant.'<sup>1</sup> He suggests that it is probable that in the first stages of conscious life only that was consciously striven after which brought with it relative increase of pleasure and value formation has probably taken its rise in such strivings but every desire has a tendency to develop a relative constancy and thus to pass into a valuation. It leaves behind in the personality constant dispositions, and with them traces of value. The mechanism of pleasure-causation is thus broken through by the formation of values; and, as soon as the function of valuation is formed at a single point, the will is no longer exclusively determined by the intensity and duration of expected pleasure. Through the fact of valuation the affective-volitional life gets, so to speak, a third dimension, the value of a constant desire is determined by its breadth and depth in the personality.

The interest of this definition of Kruger's is to be found in the fact that it is an attempt to connect the appreciative distinc-

<sup>1</sup> One point, however, he has left undetermined. Is the worth experience given in feeling or desire? In some passages he speaks as though the sense of worth were given in feeling as determined by or as determining desire, in others as though it were given in the experiences of desire themselves. As a matter of fact he does not seem to have faced this question of psychological analysis, as the following passage indicates: "Where the capacity or function of valuation is to some degree realized, there the individual experiences of feeling and desire are in a peculiar manner heightened and deepened, they have a personal character. They find, so to speak, in the personality a fuller and more individual resonance. We can in such a case speak of a more highly developed 'Gemütsleben'" (p. 50)

tions which differentiate feelings of value from other feelings (and which lead ultimately to the characterization of the self and to the explicit reference of the object to the self) with the functional, dispositional conditions of the feeling, and it has been presented here at some length because this concept of conative constants or dispositions as the necessary conditions of feelings of value, feelings with depth and breadth, is precisely the concept which we need to connect these appreciative meanings with the reality meanings which the preceding analyses have distinguished. At an earlier stage in the development of this paper it was seen that both the concepts of feeling and conation must find a place in the definition of worth experience. It is now seen that feelings of value are not completely characterized by reference to their presuppositions of reality (presumption, judgment and assumption) but that we must go more deeply into the conative dispositions which determined these acts of presumption, judgment and assumption.

How then shall we conceive this relation of the two determinants of feelings of value? If we describe the acts of cognition as the *actual psychical presuppositions* and the conative tendencies as the *dispositional conditions*, our problem would read: What is the relation of the actual presuppositions to the dispositional conditions as determinants of feelings of value? The answer to this question must be in genetic terms. We have already seen that there is a certain genetic relation between the attitudes of presumption, assumption and judgment. Each, in its way, represents a functional attitude toward a psychically predetermined object, the acceptance of a demand, acquiescence in a control factor, and therefore each is a type of reality meaning. But the demands, the controls, vary at different stages of the genetic series. An analysis of the manner in which the dispositional factor functions at the different stages of development should give us a point of view from which to unify the results of our study.

The condition, determinant, of the primitive presumption of reality seems to be that the object shall have recognitive meaning for a conative tendency. At this point the cognitive and conative moments can be scarcely distinguished. As far back

as we may go in our analysis, interest, conation, seems to determine recognition, and recognition is the condition of the first reality meaning which characterizes feelings of value. In the primitive presumption of reality the dualism between subjective and objective control factors has not yet emerged. It is with the first arrest of a conative tendency, through the development of an independent cognitive interest, and differentiation of the recognitive factor from the conative, that the innocency of primitive presumption is disturbed and a differentiation of subjective and objective demands or controls appears. Here the attitude of assumption emerges, determined largely by the subjective control factor of the conative disposition, often in opposition to objective controls already established — but not necessarily so. Assumption of the existence of an object is the acceptance of a subjective demand, after arrest of primitive presumption, and constitutes a transition stage between presumption and explicit acknowledgment of a control as objective. I am inclined to agree with Professor Baldwin that a pure fancy mode, play of fancy, described by him as the first semblant mode, constitutes a genetic transition between presumption and assumption, but for our purposes it is negligible. From the assumption attitude emerges the existential judgment, either positive or negative. It represents not merely the acceptance or rejection of an object but the explicit acknowledgment or disavowal of a certain control factor. It is important to observe that the control factor may be either the original objective moment or the subjective moment determinant in assumption, that the existential judgment may be acknowledgment of either factor, but in that case the subjective has, by that very process, been transferred to the objective side of the equation.

## VII.

The material is now before us for a summary restatement of our original definition of value, as funded affective-volitional meaning, in terms of psychological equivalents. The psychological equivalent of the worth predicate is always a feeling, with certain meanings determined by actual cognitive presuppositions, types of cognitive reaction which actualize pre-existent

conative dispositions. The value or funded meaning of the object is its capacity of becoming the object of feeling and desire through actualization of dispositional tendencies by acts of judgment, assumption, etc.

The conative disposition is the fundamental determinant of the feeling of value or appreciative meaning of the object but the disposition may be *actualized*, represented in function by different cognitive attitudes, or acts, of the types described, and according as it is one or the other of these types are the feelings qualified in the manner described.<sup>1</sup> Underlying the feeling of value attached to the idea of my friend is the conative disposition, the interest created by former desires for his presence and satisfaction of those desires, but that feeling may now arise upon mere momentary assumptions of his existence without a trace of desire for his immediate presence. All 'disposition-feelings' however actualized, are feelings of value because they represent the funded meaning of affective-volitional process, although they have different reality meanings. From the standpoint of the extension of the term, the class, feelings of value, includes æsthetic feelings, feelings of the imagination, so called, as well as practical and ethical attitudes.

In general, then, we may conclude that feeling of value is the feeling aspect of conative process, as distinguished from the feeling tone of simple presentations. And by conative process we understand the total process of development by

<sup>1</sup>In the consideration of the relation of the actual presuppositions to the dispositional conditions there are still certain questions which have considerable bearing upon later discussions. Thus Witasěk maintains that while it is probably true that feelings of worth arise upon the mere presentation of an object related to desire dispositions, nevertheless, since desire presupposes judgment, and these dispositions have been formed by preceding judgments, the worth feeling is ultimately still a 'judgment-feeling.' Now it may be admitted that judgments enter into the formation of these desire dispositions but as dispositional they are merely conative tendency, for it is the essence of judgment to be explicit and actual. Again it is argued (by Saxinger) that the dispositions corresponding to judgment feelings are different from the dispositions correlated with assumption feelings and he bases his argument upon differences in the laws governing the two kinds of feeling. Into the consideration of this question we cannot enter here—that will be reserved for a later study. We may simply emphasize our own position that worth feeling is a function of conative disposition, whether conation expresses itself explicitly in judgment or assumption.

which affective-volitional meaning is acquired, the total process including actual and dispositional moments. How these dispositions, and with them the feelings which they condition, are modified, both qualitatively and quantitatively, at different stages of this development, by changes in presuppositions, and more especially by the inclusion of secondary judgments of relation, etc., is the problem of the second part of this study.

## SOME IMPORTANT SITUATIONS AND THEIR ATTITUDES.

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The 'situation,' already described by some as the absolute of a certain conspicuous group of thinkers, is in general taking such an important part in current philosophical discussion that to an outsider philosophy must seem very like to an employment bureau, if it does not appear at last to have become an intelligence office. Undoubtedly, too, the very commonplaceness or the plebeian character of the term is one of the most serviceable and hopeful tendencies of current thinking. In the present paper, then, only falling into line with so many others who have written and spoken, I would discuss, let me not be so bold or broad as to say advertise, four peculiarly interesting situations and their induced attitudes; namely, the moral situation, the artistic, the practical and the natural, and their four attitudes, respectively the ethical, the esthetic, the intellectual or cognitional, and the spiritual.

The situation, to begin with, whatever specific variations it may have, in general has its rise, which is to say also gets its widest meaning, in the fact that structure necessarily implies function. Back of this fact, then, I do not propose to go at the present writing. But, this admitted, another is immediately manifest. *Function necessarily implies conflict.* The conflict, moreover, which is the general situation, is between (1) an existing structure, describable either as the body of the individual agent's habits or as the established social environment, the body of the social institutions, to which just through his habits the individual is, as if conventionally or traditionally or unreflectively, always a part, and (2) the natural environment as distinct from the social or definitely and humanly organized environment. In other words the conflict is between man with

his life set to certain norms and nature; between 'second nature' and first nature; between the formal reason and sensation, or the legislative will and impulse. Also it is between one organization and another organization, the latter usually if not invariably being more inclusive than the former and necessarily rising into conflict with the former whenever, to use an annoying but concise and pertinent term, it 'functions' in any way. And, just once more, in order to avoid the serious mistake of even a suspicion that the 'natural environment,' here mentioned, is external to what is human, let me say of the conflict that it is describable also as being between the formal or structural in personal experience and the vital, even the most distinctively personal, in personal experience. Thus, there is a sense, important to a true understanding of what is here meant, in which the characteristically personal and the natural are identical or synonymous. Both the personal and the natural are always coming into conflict with the definite and formal, that is, the structural, in life or experience. The structural is not *distinctively* personal or natural; on the contrary it is 'factional' or socially corporate.<sup>1</sup> Accordingly, on the assumption of this identity of the personal and the natural, the situation, or its conflict, must be due not less to personal initiative than to any of the processes of mere 'natural selection' and of course too the conflict can never be with an external nature. Indeed, if the conflict could be with an external nature, then structure simply could not imply function.

So we see that the characteristic condition of the situation in general is conflict and we see too, although the foregoing statement has been very brief, the origin and the nature of this conflict. With this preliminary view, therefore, I turn now to my special task. I would show how, to the end of solving its conflict, which always is as specific and concrete in its terms and issue as the inducing structure is itself definite in character, the situation develops through the following principal moments.

<sup>1</sup> See an article: 'The Personal and the Factional (or formal or structural) in the Life of Society,' in *The Journal of Philosophy, Psychology and Scientific Methods*, June 22, 1905.



I. THE MORAL SITUATION.

The first moment is naturally that of a presumed sufficiency of the subject's or agent's existing structure or, as the terms are here used, of the formally human. The definite habits or the social institutions are taken and are asserted, not only as quite equal to the presented and confronted emergency, but also as possessing intrinsic worth and normative or structural finality, and the natural, in the sense of that which is formally external to these habits or institutions, is an object only of an unreasoning fear. The natural is feared, blindly feared, just because it is at once quite real and yet external at least to the formal reason, to the reason of the structure-bound human.

So I view the first moment in the development of the situation and it seems to me to present specifically the moral situation. Not, of course, that morality is confined to conditions such as these, but these are the characteristic conditions of the situation as moral. These distinguish the moral situation from other defined situations. In a sense, certainly important, all situations are moral, as also they are all artistic or practical, or natural, but this is only to say, in so many words, that the specific conditions which make distinct situations are themselves in their way functional as well as structural, and so are general to development while being at the same time particular and definable. Functionally any moment or situation, any structure must comprise all others.

Possibly the peculiarly moral character of this first distinct moment is best seen in what my account has certainly, although not openly stated, namely, in the conceit of the freedom of the will. The 'free will' is simply a name for the power of the agent to fulfil and exemplify the structural adequacy. Accordingly, to use now this name, the conceit and practice of a 'free will' and the accompanying unreasoning fear of what is external to this freedom, a fear which may often take the form of bravado, of what can be only an asserted indifference to danger, are the determining factors of the moral situation.

But this, somebody will at once object, makes the moral and the legal identical, and such an identity every reflective man must promptly and emphatically resent. At once I grant that

the moral and the legal are here made identical. I grant also that reflection must separate them. But it is to be said, also promptly and emphatically, that no situation as such is itself reflective. Situations are not attitudes, although they are always springing from attitudes and are also constantly induced by them. Situations, as said before, are structural in so far as definable at all, and the moral situation is in consequence determined by the formal law. But situations, being also functional, induce attitudes, and in the particular case at hand the moral situation induces the ethical attitude. The very difference between these terms, even as they are widely used, tells the story. The ethical is the moral, just by dint of the given legal structure becoming active or functioning, made reflective in an attitude. Again, any induced attitude involves a generalization and idealization of those formal conditions which make the inducing situation, and, although, as we shall see, the attitude itself must make a situation, it should never be confused with the particular situation whose functioning has given it rise. Thus the functional nature of a structure, which here and now means specifically those positive conditions that formally determine the moral situation, makes certain a movement out of formal bondage to those conditions into a state of only mediate dependence on them. They become only means to some relatively undetermined end. They are made mediately rather than immediately, ideally rather than materially, spiritually rather than literally significant. And thereupon the moral situation gives way to the ethical attitude, and by the same token morality is saved at least from a positive, uncompromising legalism.

But not from legalism altogether. The ethical attitude is still *characteristically* legalistic; in terms, however, not of the positive law, but of 'duty,' 'conscience,' or the 'moral ideal,' which is only an abstraction of its spirit or general functional value, from the positive, formal law. The ethical attitude, induced, as was said, by the functional character of the moral situation, asserts the existing structural formalism, the manifest legalism, to be worth cultivating, and a *cultivated* legalism must always value law as a general principle above law as a visible

program, the program becoming henceforth only instrumental to the unseen principle. Lawfulness, in short, rather than the specific law or structure, is the concern of the ethical attitude. How often ethics is called normative, and surely its normative character is nothing more nor less than its abstract legalism.

Further, the ethical attitude, just because, at least in spirit, still legalistic, is also in another respect like its inducing situation. Although not dogmatically indifferent to nature nor quite blindly fearful of her, it is nevertheless humanly conceited or anthropocentric. The principle of law is always more hospitable than a legal program; a structure in use is more widely sympathetic than a structure just *in statu quo*; but the ethical attitude still sees no positive worth in nature except as she is humanly, or humanely, disposed. So to speak the spirit of the fear of her still remains, as if to keep its congenial company with the surviving, albeit only spiritual or functional legalism.

Fear become a spirit loses much of its dread. Law become a principle loses much of its vigor. In a word, the normative, ethical attitude must mean an important modification in the actual situation. Ethical, as distinct from social or political legalism, by its very idealism, which is to say by its devotion to the spirit of law and its feeling only of the spirit of fear, makes man actively hospitable towards the organization of nature, with which morally he was in such dire conflict, and in doing this it induces, or initiates, the artistic situation. The ethical attitude *put in practice* is the peculiar life of art.

## II. THE ARTISTIC SITUATION.

So I pass to the second moment in the development of the general situation, and this I would call, not the moment of assumed and asserted human sufficiency, in which nature is an object of blind fear, but the moment of human condescension, assumed and asserted, towards the natural, towards nature's law, structure or organization. This, too, as already said, is the artistic situation. Art, let it be kept in mind, is characteristically a situation, not an attitude. It is just a living up to a humanly sympathetic nature and in just so far it actually is the practice of what the ethical attitude may be said to preach.

Once more, though I may repeat myself too much, it is, not the moral, which is politically legalistic, but the ethical, which is functionally, spiritually or personally legalistic, rendered incarnate, and as having such character it shows man actually in a truce with nature. In art the human is seen actively to have assumed a relation of equilibrium, necessarily more or less unstable, or of something very like an armed neutrality, between itself, its structure, the norms of its life, and nature's structure. Actively man moulds nature to his conceits. He makes her glorify his image. In her life, in her powers and processes, he realizes, or presumes to realize, only a deeper and fuller expression of himself. Art is thus, like morality, anthropocentric, but it is man big with nature. It is the little human swelling with the big natural, and as so conditioned it is what we call poetic or creative, all its activities being informed with analogies of the natural to the human and embodying, although never without a violence that only the poetic imagination can have made possible, nature's metaphors of the human. The necessary violence, too, imparts to art as strong a sense of comedy as of tragedy, as is shown in the readiness with which we laugh or weep whenever we see the little human swollen with the big natural. Simply in art, always as comic as tragic, man appears, not as teaching or seeking ideally, but as actually practicing a legalism that has lost the rigor of the formal law and a fear of nature that is tempered by a very real sense of humor.

But here comes an objector. I am accused of narrowing beauty, which is the recognized goal of art, to conditions that require accord, if not literal and prosaic, at least metaphorical, with the positive structure of the human agent, just as before I seemed to identify morality with legality. In a word, I seem to have left no room for objective or natural beauty. To the present objector, however, I have to make just the answer made before. A situation is not an attitude, although it always induces one. The artistic situation, as its structure becomes function, induces the esthetic attitude, by which the very conditions making the life of art are idealized. Thus, for the esthetic attitude, man is not, as in art, the determining center. He is the observer indeed, but only the passive observer. His

structure, losing its character of a sole measure for all other structures or for the structure of nature as a whole, becomes but one among the others, any one of which may be the center from which a judgment is passed. True, for the esthetic attitude, all structures, or all measures, by which nature, so to speak, is thus made to measure or judge herself, are *as if* sensitively human, but this only shows how humanly passive the esthetic attitude is, how for it nature, not man, is the artist. The characteristic object, therefore, of the esthetic attitude truly is beauty, sensibly manifested and sensitively measured, but, instead of the beauty of man to himself, as this is reflected in nature's metaphors just of his life, it is objectively natural beauty. The metaphors are no longer exclusively human, but nature objectively is just a sphere of metaphors, metaphor poised sensitively against metaphor and calling deeply and passionately each to each and through their poise and their passionate call she is beautiful. She is beautiful *to* man; not, as in art, *for* him and his structural conceits. For the esthetic attitude even the works of human art must meet the demands of natural beauty in that they must accord, or sensitively sympathize, with what surrounds them. The setting, or frame, of a work of art is thus an important factor in its beauty.

But where now are the law and the fear? The law, and with it, man's so-called freedom have been lost or merged, nay, they have been fulfilled in the law and the freedom of nature which an objective beauty reveals; and the fear is become awe. Nature is no longer fearful, but awful or sublime. Awe is not man fearing for his own safety; it is man sensitive to the fears of the whole world and in that sensitiveness feeling the lawless law of nature. Yet such terms as these and the seeming grandiloquence to which they lead may very easily obscure the meaning here in my mind. The meaning would take a view of life in its lowest as well as in its highest terms, in its simplest as well as in its grandest expressions. A psychologist could not be more minute or prosaic in his viewpoint than my meaning is intended to be. Simply any structure, whatever its size or its complexity, its significance or its dignity, being always functional, must come to this sensitiveness, which we know,

however grandiloquently, as awe towards the lawless law of nature. What is sensation but structure meeting the violence of nature. What is structure that nature is mindful of it.

But the esthetic attitude, induced, as has been shown by the artistic situation and ideally sensitive, not merely to the unity of man but also, as if actually feeling for them, to the unity of all things with nature, leads man out of the artistic into the practical situation.

### III. THE PRACTICAL SITUATION.

The practical situation, as the third moment to be considered, is the moment of the human structure, the whole body of habits and institutions become — but the right phrase is hard to find — merely a natural utility. Only, I would call it also, borrowing a word from the political vocabulary of the day, a ‘floating’ utility. So does man again put into practice the preaching of one of his attitudes. He comes actively to treat his formal life just as his esthetic consciousness has already revealed it to him, namely, as only mediate to an indeterminate nature, and, as he does this, the last traces of his esthetic sensitiveness disappear and the metaphors, human or objective, in which this had found expression, become only dead metaphors. Man no longer is even an interested observer of nature; he is just a mechanical incident within her unpurposed movement.

In social evolution, where the practical situation in all its phases is written large, the time is one of traditions and human conceits and devotions of all sorts become purely conventional, which is to say useful but not yet put in use, or treasured, as money is treasured, but not yet actually invested, and accompanying these conditions there is also, as if the last defense of the passing regimé, a blind fatalism. So long as this fatalism remains blind the old structure of life can at least seem to survive, although the immediate vitality once belonging to it has already gone.

Of course, further, when habits and institutions come, as said above, to be a mere formal utility, a floating utility, the personal in human life has virtually already separated itself from the structural and this separation as a positive condition or

status belongs to the situation now under review. But, although virtually separate, the personal has not yet so found itself. Thus, in social evolution, this condition shows itself in a blind individualism, always so assertive of independence of the existing structure, yet also so helpless without it: but, psychologically or biologically, how best to describe this virtual yet undiscovered or unappreciated separation I am at a loss to know. Certainly it shows the functional self, the vital nature in an agent, become at least blindly superior to the structural or morphological self, and it shows, too, whether psychologically or sociologically, that although nature seems to be on the point of taking to herself the formal life of man, allowing it to crumble or rather to assimilate to herself, man nevertheless really survives, rising in his vitality only to coöperate with her in the use of his establishments. Technically how the psychologist would wish this moment or situation in development, perhaps in the development of volition, described, I am quite unable to guess, and possibly he has no suitable term or phrase for it, but the situation, I am sure, is a real one. Here, however, a possible misunderstanding must be avoided. Thus, in the first place, as indeed already indicated, I am now describing only a situation and the situation comprises rather a division of the self in fact or condition, the structural self having become insensitive or mechanical, than a division of the self in consciousness. To just such a purely factual division the *blind* fatalism, or the *blind* individualism, mentioned before, was clearly an index. Moreover, in the second place, a division of the self, whether in bare fact or in consciousness, is rather logical than psychological or rather social than personal, and this one needs constantly to remember. Logically there may be two selves, the vital and the structural, and sociologically also, in so far as society is viewed abstractly in terms only of so much formal organization, there may be two selves, the individual and the citizen, but mere counting is never real seeing. Function and structure are truly two, but they are not truly two selves.<sup>1</sup>

<sup>1</sup> A question certainly worth asking, at least in a note, is here unavoidable to him that reads between the lines. Is logic, at least formal logic, even such a logic as Kant's 'transcendental' logic, true rather to experience as expressed.

So, to gather together what has been said so far, this third moment, the moment of the practical situation, is the moment of the human in a sense profaned and turned merely useful; it is the moment of life wholly without poetry, the once stirring metaphors being all dead, and subject to the qualification just made—it is the moment of a factual division of the self, the structural self still keeping up appearances through a blind fatalism or a blind individualism and the vital, functional self being as real and also as unseen or unseeing as the blindness.

And now, for the third time, an objector confronts me with a question. In reducing the formal structure of human life to a mere natural floating utility am I not confusing the practical with the economic? Well, let me concede that so far I have defined the practical situation in terms which directly suggest the sort of mechanicalism or hollow conservatism and naturalism in life that economics demands. Economics characteristically demands no interference with the 'credit of the country,' which is to say the *status in quo*, the existing structure or organization, but its loyalty to the organization is formal, not substantial. It requires mankind to be both morally and esthetically without emotion. Its typical man must be just a money making machine, and what is money but the incarnation of a floating natural utility. Thus, with its peculiar abstraction, economics knows only utility, and in the practical situation utility certainly seems supreme. It is so supreme that any purpose for it is quite forgotten! Accordingly, as already conceded, the objector is right; he is right, so far as he goes; and he has, in fact, as before, only assisted my exposition. But, to repeat the refrain, a situation is never an attitude, although it always induces one. For the case in hand, the practical situation induces the reflective attitude and this saves the situation from its bondage to a mere formal utility.

socially, which is to say, of course, structurally or formally, than to experience as personal, vital or functional? This question, as put, almost begs its own answer, an affirmative one. Only real logic, in the sense of a logic that, although recognizing form in experience, treats experience as also imbued with a vital superiority to its form or structure, as if with a 'legal supremacy,' can possibly satisfy the demands of what is characteristically personal. Moreover, in this fact it would seem as if the pragmatist must find the method in the reputed madness of his philosophy.



The reflective, which, as here understood, is also the cognitional attitude, only appreciates or idealizes the actual conditions of the practical situation. Thus, it takes as something real the end which the formal utilitarianism, the idle conventionalism of the practical situation has certainly implied but as certainly concealed in its blind individual or in its blind fate and just in recognizing or facing this end it shows the vital, functional self, on the one hand, become conscious — or seeing — and assertive independently of mere structure and the structural self, on the other hand, made positively mediative, that is, mediative of something quite real although formally external to it or ‘objective.’ The conscious reality of the vital self and the objective character of the mediation of the structural self are thus here considered to be just that which makes the attitude now in question reflective or cognitional. For so-called reflection structure is become only means, instrument or method and it is method to what is regarded distinctly real but is, in the words used before, ‘formally external.’ This phrase, let me say further, signifies (1) formally or structurally indeterminate,<sup>1</sup> a character clearly belonging to whatever is said to be objective, and yet also (2) real. The reality is not *necessarily* apart from the structure; it is so only in form, that is, only relatively; it may be, nay, I think it must be actually in the structure, in its very character as only means or method, just as any true end must be immanent in, or vital to, the means to it. But *as an attitude*, reflection naturally holds the conscious, vital self and the real end to their formal unlikeness or aloofness and so treats the now insensitive structure as the medium of what very commonly is known as an *abstract* idea, a universal, a principle, or — not to prolong the list further — a conception, that belongs, not to the world of sensation or body, but to the world of thought or mind.

So, to recall a mode of statement already employed, a conception, which is the typical ‘object’ of reflection, while in just the sense indicated negative only relatively to form or subjective structure, nevertheless, in so far as negative or outside, can be merely a logical rather than a psychological datum; although,

<sup>1</sup>That is, of course, so indeterminate relatively to the positive structure of the subject or agent.

as a matter of course, a psychologist may still be directly interested in the peculiar conditions that determine the data of the reflective attitude as thus amenable to logical treatment. In other words, psychologically, there can be no independent conception, and the supposed independence of the conception can spring only from the standpoint, essentially logical, that would view the reflective attitude wholly in terms of the dichotomy of what is formally structural and what is not.<sup>1</sup> Moreover, the reflective attitude itself is the psychological moment for logic, although the very dichotomy, on which it rests, makes the moment only a passing one, as we shall see.

But, the issues between logic and psychology aside, it is now apparent, I think, in what important way the dying of the metaphors in human art or in nature, or the accompanying birth of an insensitive human structure, or — once more — the development of that purely formal or floating natural utility was destined to serve the progress of the general situation and the solution of the conflict which we found characteristic of it. The insensitive structure, as if a medium, or more narrowly a language, without emotion or metaphor, made possible what somewhat technically is known as strictly scientific research. It made possible a free, thoroughly candid or open-minded, structurally or humanly unprejudiced study of nature instead of the more passive and more restrained observation that belonged to the esthetic attitude. Thus the esthetic attitude showed man not yet free from himself, although his fear had changed to awe; it showed him perhaps free in spirit, but not yet free in letter, not yet really free; whereas the reflective or cognitional attitude shows him at least very much nearer to a complete freedom. Has not his structure become a real instrument? Has he not distinctly found his vital self? Has he not acknowledged an 'objective' nature? The reflective attitude, then, shows him free, free from — or in? — himself, *in just so far as* his no longer sensitive structure has become a mere tool or method in real use; that is, in the use of his new-found self as this confronts nature.

<sup>1</sup> Witness the principles of identity and contradiction. Witness, also, the character of the independent concept as an abstract universal.

And yet, although there is this advance, it is necessary now to issue a caution. The reflective attitude must not be understood to involve any mere betrayal of the quondam metaphors; on the contrary, it is only a fulfilment of them. It cannot properly or honestly thank the absolute, I mean the general situation, that it is not as the esthetic attitude was; but, instead, it must realize that as the tool or structure is put to real use, as the utility is really invested, the experience which has gone before, sensitiveness, metaphors and all, is exactly what determines the momentum and efficiency of the activity. True, the 'objective' nature in the case is deepened beyond any mere conformity with man, beyond even the licentious conformity of the esthetic consciousness, but it is still nature, and the same nature too, and the metaphors, although all dead, are dead only as sensitive metaphors, and so to speak as insensitive metaphors are still active in the tool or structure. Indeed, however grandiloquently, I wonder if the method or the medium or the structurally mediated conception of the reflective attitude may not be said to be the very metaphors that died with the rise of the practical situation *spiritually* resurrected. Conception would then be definable as a sort of greatly deepened and spiritualized esthetic experience; an esthetic experience still dependent on metaphor, but so deepened or possibly so purely objective as to be, not human, but just natural. Is not the natural truth, which reflection seeks, I cannot say, which reflection observes, and which is always the peculiar content of the conception, even more awful or more deeply sublime than natural beauty? Indeed man, structural man, *almost* must be declared to be, not numb, but dead, in the presence of its sublimity.

I have just said 'almost,' and before, in speaking of the freedom that comes with reflection I used and emphasized the phrase 'in so far as,' declaring in so many words that the freedom was not necessarily complete but was proportional to the measure in which the structure of human life had come into real use. Now complete use, with that necessary death of the human before the sublimity of nature, is not possible in reflection. It is true that reflection is active and that reflection uses the medium or structure supplied to it, but its use is related to the ideal very

much as the psychologist tells us attention is related to volition. It is true, too, that reflection in its own nature somehow demands the complete use referred to, but reflection, characteristically, must keep means and end, language and idea, structure and meaning, at least somewhat apart. Accordingly the reflective attitude can fulfil itself, can realize its own demands, only by yielding to a new situation, namely, to the wholly natural situation, and to this I now turn.

#### IV. THE NATURAL SITUATION.

Of this fourth and at least for the present study last special situation I shall write somewhat more briefly, concluding my paper rather abruptly, as many stories are brought to an end, and, also as with the stories, at a point where possibly *the* situation is getting most deeply interesting and might seem to demand the longest chapter.

As the foregoing has already indicated, the physical situation belongs to the moment, not of any surviving conceit of human sufficiency, not of any slightest remnant of human condescension towards nature, and not of any merely formal naturalism or blind fatalism, but distinctly of the death or loss of the human structure in the natural. The structural man dies just in order that the vital and natural man may live or rather the death of the one is in and with the rising life of the other. Again, the natural situation is the moment, not of any merely miserly utilitarianism, but of the human structure become, instead of an aimless, formal, floating, hoarded utility, a real, positively natural utility. So, through reflection, has the practical been changed to the natural situation.

Manifestly the reflective attitude calls for this change. By its very 'self-consciousness,' that makes the human structure only mediative, by its conviction of the inner or vital self as well as of the outer nature being at once real and formally external to the structure, and by its own active use of the structural medium, it calls for just that fatal invasion or overwhelming assertion of nature which makes the natural situation. In history as in psychology the reflective attitude is always an invitation to nature to realize herself. It summons, or already it

has admitted and recognized, what seems barbarian into what has stood for civilization or what seems impulsive, sensuous and irrational into the well-controlled and rational, and being such an invitation or such a cordial recognition it is mainly occupied with a constant — what shall I say? — a constant offering of its humanly insensitive, now only mediative structure which possibly a Teufelsdröckh would call man's cast off clothing, to nature, the world of its 'objective' curiosity. So Alexander, pupil of Aristotle, sought to clothe the peoples of the eastern Mediterranean, and so the reflective life psychologically, as well as historically, would clothe the not less invaded than invading world of sense. The general process is often known as assimilation, more or less benevolent, often as experimentation, but under either name it shows nature trying on the human and it is conducted under the guidance of the dead, in the sense of the dehumanized metaphors of the esthetic consciousness. Perhaps these metaphors become wholly insensitive, should rather be called analogies, even objective analogies, as is suggested by the fact that the experimentation, or the assimilation, strives to use them the nature-end forward, not as with the esthetic attitude, the man-end forward. But certainly they guide the process and testify accordingly to the honesty of the invitation to nature or to the cordiality of the recognition of her, and in the natural situation one sees, again, that nature has only taken reflection at its word.

Nature takes reflection at its word with a new structure, a new organization. The content of this new organization and its form are determined, moreover, by the bounds of the inducing activity, or of what might also be called the functional capacity or versatility of the passing structure, and by the analogies that have constantly guided it. Simply, if there be definite structure at the start, and just this, as will be remembered, was the starting point for the present study, then also that structure is, *proportionally to its structural definiteness*, limited to a certain sphere of activity, or functional character, and the bounds of this sphere measure the extent of the new organization, while the inevitable analogies developed with its exploitation determine the new form. Structure, the definite, can of course be only 'relative,'

but being relative it must be complex and being complex it must be functional as well as structural, and being functional it must induce, through such moments as have been recounted here, new structure; new, because the original structure was relative and functional, and structure, because the definite can induce only the definite. Must not what is new be always true to its origin?

But, without further description or explanation of the natural situation, an objector must now be met; perhaps the same, who appeared before, although he gave no name. Thus, this time I am charged with having confused the natural with the physical. The spiritual attitude, however, for so I have to call it, although also it may be called volitional or even religious, is what I would now depend on to save the natural from being just physical. This fourth attitude arises in the following way. It is but an appreciation of the fact, suggested early in my narrative, that the natural must be also the characteristically personal. Natural and personal were said to be *both* external to, or in conflict with, the formal or structural. Moreover in the reflective process of experimentation must not that trying-on be as truly on the part of the inner vital self, as if the waiting will, as on the part of the outer and 'objective' — or physical? — nature? How often it has been pointed out that the natural was objective and could be objective only in the way of being, not essentially, but merely formally or structurally external to the human. Nature, then, truly is physical only in so far as she is 'objective.' External to the functional or vital in what is human she cannot be, and this being true, in just so far, she is spiritual; in just so far her reconstruction is man's volition; in just so far man says, religiously, of her activity: 'What she does, I will.' She may never appear literally in man's image, but her life is one with his life and the spiritual or volitional or characteristically religious attitude puts just this valuation upon her.

So this paper having accomplished its specific task must come to an end. Of course, as from any narrative, a score or more of 'morals' might be drawn. The distinction, moral or ethical, between good and evil, for example, evidently should be judged relatively to the specific situation or to the induced attitude, within which it manifestly belongs, and the distinction,

practical or reflective, between truth and error, relatively to what is a qualitatively different situation or attitude. Again the need, whenever discussion or explanation would become at all searching or vital, of always carefully distinguishing between the personal and the social, the functional and the structural, perhaps too the pragmatic and the dogmatic, and at the same time also of always making these distinct things work together is also evident. But such 'morals,' however urgent or numerous, may be left safely to the imagination.<sup>1</sup>

<sup>1</sup>The MS. of this article was received December 16, 1906.—ED.

## DISCUSSION.

### GENETIC MODES AND THE MEANING OF THE PSYCHIC.<sup>1</sup>

When we can *explain* chemical affinity we may attempt to explain instinct; when we have explained instinct we may attempt intelligence. The explanation offered by dynamic realism<sup>2</sup> of the 'meaning' of the simplest of natural phenomena will presumptively be the explanation of the principle underlying all reactions.

We may ask why a comet pursues a given course rather than another. The answer is two-fold. First, because of the nature of the forces constituting the comet; second, by reason of the combinations of energy existing in the universe through which it passes. In other words, the trajectory of the comet is determined by correspondences existing between the comet and its environment. We might say that the trajectory of the comet is its path of least resistance, but this is only part of the truth. The nature of the energetic structure of the comet is also a factor — the most important one. It has, we say, a certain mass of gravity. It has that which makes it a positive energetic element in a universe of energy. It might be considered fanciful to suppose that as the extrinsic pull which draws the mother to her child has also its intrinsic side called affection, so there is an intrinsic affection corresponding to the extrinsic pull of the planet. Nevertheless, all analogy would indicate that, if not an affection or instinct, there is nevertheless an intrinsic element in all these cases.

So with the chemical element, all that we know about it consists in reactions, *i. e.*, interferences of some type of energy with the energetic complex of the environment. One of the most important of these reactions is what we call chemical affinity. If we indicate the locus formula of sodium by Na and that of chlorine by Cl, then the expression NaCl (common salt) means that these two loci have certain

<sup>1</sup> A fragment found among the author's papers and submitted by C. J. Herrick. — ED.

<sup>2</sup> Some of the implications of this term as used by the author will be found in his late writings, particularly, 'Fundamental Concepts and Methodology of Dynamic Realism,' *Jour. Phil., Psych., Sci. Methods*, Vol. I, No. II, 1904; and 'The Law of Congruousness and its Logical Application to Dynamic Realism,' *Ibid.*, Vol. I, No. 22, 1904. — C. J. H.



compatibilities or correspondences which result, the energetic complex being what it happens now to be in this particular environment, in a closer articulation or assimilation in these particular loci than between the activities expressed by Na and  $H_2O$ , for example. Under other conditions of environment, say at a high temperature or in the presence of larger amounts of water, the chemical affinity, as this harmony is called, would not be apparent. Now the cube of salt deposited from saturated solution is an expression to eye and touch of a more or less permanent association of the types of energy labelled Na and Cl respectively. It is not true that Na and Cl are present in salt; they are potentially present in the sense that under certain conditions these two loci emerge from the complex with the same value they possessed when they entered it. NaCl is a new energy complex capable of reacting in its own appropriate way (dependent upon its own genetic mode) and is different from either Na or Cl. It is not an algebraic sum of the energies Na and Cl, but a trajectory resulting from their blending. Salt occupies a definite position in nature and is capable of impressing its energy upon other energetic units in a way peculiarly its own. Thus, no other substance tastes as salt does. Now if there be an intrinsic side of the activity, NaCl, that too may be totally unlike that of any other chemical substance. We say salt has an affinity for water. Does it thirst? When the human organism is dehydrated by evaporation due to exercise or the injection of water imbibing substances, the state of receptivity to water or disturbed equilibrium existing in the tissues of the body is converted into a special nervous affection which may even become an element in consciousness and build up the most elaborate system of associations. But at some early point in this process we may discover simply living tissue needing water and back of this certain chemical substances with an affinity for water — in other words, exactly the same thing that NaCl has.

This disposition to change its form by uniting with another element is illustrated by the formation of all solutions and it is a mistake to suppose that a substance in solution is the same as a substance in solid form. It has claims to be called the same substance only because it can be evaporated out. But in the course of this process there is always a complete change of properties. Solid salt is not salty to the taste, salt in solution is not cubical. In short, we must school ourselves to see in the so-called elements or substances energetic complexes whose form (nature) is at once determined by their primary locus formula and the impact or effect of the environment. So true is this that any substance can be fully understood only by knowing its pri-

mary form and also the totality of its reaction with the environment. This is perhaps quite unlike our naïve apprehension of objects which seem to have complete objective independence. The simplest experiment illustrates the error, however. We suddenly remove the support beneath the vase and instead of a thing-of-beauty in repose, we have a thing-in-motion and then a thing-in-a-hundred-pieces. The vase is just as really dependent, so far as being what it seems is concerned, on connections with the environment as the flower is which withers when removed from the parent stem.

Now the existence of any typical form of energy, say a crystal, in any energetic complex is a fact of interaction. If a broken crystal is plunged into a suitable medium, it will be restored (this process goes on in rocks in case of metamorphism). The presence of the crystal acts as a determinant for the aggregation of other masses. The extraneous energy associates itself with the preëxisting types in accordance with the types of energy already called into being. The most noted instance of this power is in the case of animate matter. The most astounding fact in nature is perhaps the power of a worm or a man to ingest the same materials and create in one case worm substance and in the other human tissue. In the case of the crystal there may be millions of microliths contained in one crystal and all are alike or similar. In the case of the man there are millions of cells and we are able to distinguish groups of coördinated types.

The harmony between a particular energetic type and its environment may be relatively stable or it may be dependent upon a high degree of constancy or invariability in that environment. Again, the energetic unit may be progressively alternating or cyclical. Such a condition is found in the individual life which, like the trajectory of a planet, passes through a variety of progressively adjusted relations to the environment or comes into relation progressively to different environments. That type of energetic unit which passes consecutively into relations with different energetic complexes will alter its locus formula. When water passes into a gaseous state it is no longer water.

Heré is a moving point. I, as a geometer, make 'cross-sections' of that point in relation to its environment and construct a locus (say  $y^2 - 2px$ ). But in doing all this I have not produced the concept of a parabola such as I get when I *see* one. I go on varying the locus formula and produce successively a circle, an ellipse, etc. You may say that these things can be predicted in advance. The series of locus formulæ might be, but no power would enable us to experience a

circle till I saw it. Each new form has a meaning (differentia) in experience peculiar to it.

Now, as a biologist, I have no doubt that the various sense organs arose by successive variations from some primitive type. As dynamic monist (or functional psychologist, if you prefer), I consider the psychical and physical to be two ways of expressing a real activity. But, as 'psychic' (Baldwin's limitation<sup>1</sup>), my subjective experience is very different when visual and tactual sensations respectively are evoked. As has so often been said, there is no reason why certain vibrations awaken sensations of green and others of sweet.

When eyes came in vogue, a new thing, a new 'genetic mode' arose. You could never have predicted it. You might have predicted the size and form of the rods and cones and the index of refraction of the lens but the subjective interpretation in intimate experience is not *a priori* predictable. It is conceivable that a child might, by unconscious movements, happen upon a sensation entirely new to it. The series of 'psychic' events is not subject to scientific analysis. The subsequent psychological construction is wholly synthetic and consists in relational redistribution and combination. These may be construed among themselves and with other facts which we do not call psychological.

It may be said that the modes of immediate consciousness are the only ones that could be genetic in this sense, that all others could be predicted from the earlier. These are doubtless the only ones we can know anything about. The power of prediction rests upon the presumption of the cyclical nature of action — 'uniformities' we call these cycles, whether heart-beats or eclipses. If we project these cycles on a 'cross-section' of experience, our predictions are valid in that plane. We may have as complete a system as possible plotted by our science, like a plot of hundreds of observations upon some movable star and may, on this basis, lay out the orbit fully upon the plane of experience, but this is not the same thing as the star moving in space. The 'meaning' of this we could perhaps only discover by being the star. All this may be another name for the limitation of knowledge, but it is a *necessary* limitation of knowledge and has to be reckoned with. But if a thing be truly genetic, every new stage is really new and not a repetition, nor can we know from the past what new value may attach to the progressive modifications. We must let go of the cause-and-effect traditions — never backward turn the wheels of time.

<sup>1</sup> Baldwin's *Dict. of Philos.*, art. 'Psychic or Mental.'

A corollary is that another stage of being is 'genetically' possible in which the energy of the present shall be elaborated in such forms as may present to experience something totally inconceivable to 'the heart of man.'

The further question arises, however, (and this is not so easy to answer) if genetic (psychic)<sup>1</sup> modes arise that have no predicaments in the past and no necessary determinants in the present, how do they cohere in a universe — how belong in an organic whole? The answer is, "*They do not.*"

The 'psychic,' as psychic, is neither parallel to anything nor set in any kind of serial, or other, nexus with anything else. Anything possessing such relations would necessarily be predictable, *i. e.*, to a being having complete knowledge. But no being can know what I feel. All the *generalizations* I make regarding the data furnished in immediate consciousness (everything psychological, in other words) I may relate or communicate, the *peculiar* tone or flavor of consciousness (its meaning) can neither be imparted nor anticipated. When we develop an organ for the ultra-violet rays we shall experience a new 'genetic mode,' but if the anticipations of science go far enough, we may not thereby get a single new psychological element; we shall simply find a value for this particular *x* and all is in.

This sphere of epiphenomena can only be interpreted by reference to the metaphysical predicate of individuality. The three necessary forms or categories of our thinking, time, space and mode, each contributes to the definiteness of experience by conditioning it. *Mode* is that condition which is indispensable to individuality. Time is the necessary *form* of inner experience, space of outer experience, mode is prerequisite to *all* experience — it is the form of all experience.

We do not expect to encounter space or time 'spazierend' by themselves. We do not try to line them up with the contents of special experiences and to make them cohere in a system with these. No more can we take the predicament of individuality in experience and set it in relations. I can say a great deal about green things. I can predict that they will arrive in April in special forms, but that which makes greenness different from sweetness or *b* flat belongs to the formal category of *mode*. We have a sense of spatial extension, of temporal limitation, and, in like manner of special peculiarity. This is the tag which gives rise to the sense of other-ness or difference.

<sup>1</sup> It does not appear that Professor Baldwin limits genetic modes to the *psychic*, but I am of the opinion that it is safe to use that term only within these limits, if non-predicableness is insisted on in their definition.

So far as we are concerned, then, the genetic modes find their illustrations in the psychic — in our own peculiar content of experience, but it may be that every form of self-centered experience — all forms of vector activity, at least — have their inner meaning and that this, again, is reflected upon the great centre of reference of the whole system as a total meaning. This form of self-interpretation of energy that we call consciousness may be one of an innumerable multitude of similar incommunicable experiences which taken together form the real 'meaning' of the world.

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<sup>1</sup>Deceased.

#### CORRIGENDA.

In Dr. Hughes' article, 'Categories of the Self,' THE REVIEW, Vol. VIII., 6, p. 405, line 1, read 'instinctive' for 'instructive'; p. 411, line 13, read 'the self is *not* homogenous.'

In Miss Vichelkowska's article, in the November issue also, p. 385, line 7 from the bottom, omit words 'and diagonal'; line 5 from bottom, add words 'See key to Fig. 4a.'

# THE PSYCHOLOGICAL REVIEW.

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## THE PROVINCE OF FUNCTIONAL PSYCHOLOGY.<sup>1</sup>

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Functional psychology is at the present moment little more than a point of view, a program, an ambition. It gains its vitality primarily perhaps as a protest against the exclusive excellence of another starting point for the study of the mind, and it enjoys for the time being at least the peculiar vigor which commonly attaches to Protestantism of any sort in its early stages before it has become respectable and orthodox. The time seems ripe to attempt a somewhat more precise characterization of the field of functional psychology than has as yet been offered. What we seek is not the arid and merely verbal definition which to many of us is so justly anathema, but rather an informing appreciation of the motives and ideals which animate the psychologist who pursues this path. His status in the eye of the psychological public is unnecessarily precarious. The conceptions of his purposes prevalent in non-functional circles range from positive and dogmatic misapprehension, through frank mystification and suspicion up to moderate comprehension. Nor is this fact an expression of anything peculiarly abstruse and recondite in his intentions. It is due in part to his own ill-defined plans, in part to his failure to explain lucidly exactly what he is about. Moreover, he is fairly numerous and it is not certain that in all important particulars he and his confrères are at one in their beliefs. The considerations which are

<sup>1</sup> Delivered in substantially the present form as the President's Annual Address before the American Psychological Association at its fifteenth annual meeting held at Columbia University, New York City, December 27, 28 and 29, 1906.

herewith offered suffer inevitably from this personal limitation. No psychological council of Trent has as yet pronounced upon the true faith. But in spite of probable failure it seems worth while to hazard an attempt at delineating the scope of functionalist principles. I formally renounce any intention to strike out new plans; I am engaged in what is meant as a dispassionate summary of actual conditions.

Whatever else it may be, functional psychology is nothing wholly new. In certain of its phases it is plainly discernible in the psychology of Aristotle and in its more modern garb it has been increasingly in evidence since Spencer wrote his *Psychology* and Darwin his *Origin of Species*. Indeed, as we shall soon see, its crucial problems are inevitably incidental to any serious attempt at understanding mental life. All that is peculiar to its present circumstances is a higher degree of self-consciousness than it possessed before, a more articulate and persistent purpose to organize its vague intentions into tangible methods and principles.

A survey of contemporary psychological writing indicates, as was intimated in the preceding paragraph, that the task of functional psychology is interpreted in several different ways. Moreover, it seems to be possible to advocate one or more of these conceptions while cherishing abhorrence for the others. I distinguish three principal forms of the functional problem with sundry subordinate variants. It will contribute to the clarification of the general situation to dwell upon these for a moment, after which I propose to maintain that they are substantially but modifications of a single problem.

### I.

There is to be mentioned first the notion which derives most immediately from contrast with the ideals and purposes of structural psychology so-called.<sup>1</sup> This involves the identification of functional psychology with the effort to discern and portray the

<sup>1</sup>The most lucid exposition of the structuralist position still remains, so far as I know, Titchener's paper, 'The Postulates of a Structural Psychology,' *Philosophical Review*, 1898 [VII.], p. 499. Cf. also the critical-controversial papers of Caldwell, *PSYCHOLOGICAL REVIEW*, 1899, p. 187, and Titchener, *Philosophical Review*, 1899 [VIII.], p. 290.



typical *operations* of consciousness under actual life conditions, as over against the attempt to analyze and describe its elementary and complex *contents*. The structural psychology of sensation, *e. g.*, undertakes to determine the number and character of the various unanalyzable sensory materials, such as the varieties of color, tone, taste, etc. The functional psychology of sensation would on the other hand find its appropriate sphere of interest in the determination of the character of the various sense activities as differing in their *modus operandi* from one another and from other mental processes such as judging, conceiving, willing and the like.

In this its older and more pervasive form functional psychology has until very recent times had no independent existence. No more has structural psychology for that matter. It is only lately that any motive for the differentiation of the two has existed and structural psychology — granting its claims and pretensions of which more anon — is the first, be it said, to isolate itself. But in so far as functional psychology is synonymous with descriptions and theories of mental action as distinct from the materials of mental constitution, so far it is everywhere conspicuous in psychological literature from the earliest times down.

Its fundamental intellectual prepossessions are often revealed by the classifications of mental process adopted from time to time. Witness the Aristotelian bipartite division of intellect and will and the modern tripartite division of mental activities. What are cognition, feeling and will but three basally distinct modes of mental action? To be sure this classification has often carried with it the assertion, or at least the implication, that these fundamental attributes of mental life were based upon the presence in the mind of corresponding and ultimately distinct mental elements. But so far as concerns our momentary interest this fact is irrelevant. The impressive consideration is that the notion of definite and distinct forms of mental action is clearly in evidence and even the much-abused faculty psychology is on this point perfectly sane and perfectly lucid. The mention of this classic target for psychological vituperation recalls the fact that when the critics of functionalism wish to be

particularly unpleasant, they refer to it as a bastard offspring of the faculty psychology masquerading in biological plumage.

It must be obvious to any one familiar with psychological usage in the present year of grace that in the intent of the distinction herewith described certain of our familiar psychological categories are primarily structural — such for instance as affection and image — whereas others immediately suggest more explicit functional relationships — for example, attention and reasoning. As a matter of fact it seems clear that so long as we adhere to these meanings of the terms structural and functional every mental event can be treated from either point of view, from the standpoint of describing its detectable contents and from the standpoint of characteristic mental activity differentiable from other forms of mental process. In the practice of our familiar psychological writers both undertakings are somewhat indiscriminately combined.

✓ The more extreme and ingenuous conceptions of structural psychology seem to have grown out of an unchastened indulgence in what we may call the 'states of consciousness' doctrine. I take it that this is in reality the contemporary version of Locke's 'idea.' If you adopt as your material for psychological analysis the isolated 'moment of consciousness,' it is very easy to become so absorbed in determining its constitution as to be rendered somewhat oblivious to its artificial character. The most essential quarrel which the functionalist has with structuralism in its thoroughgoing and consistent form arises from this fact and touches the feasibility and worth of the effort to get at mental process as it *is* under the conditions of actual experience rather than as it *appears* to a merely postmortem analysis. It is of course true that for introspective purposes we must in a sense always work with vicarious representatives of the particular mental processes which we set out to observe. But it makes a great difference even on such terms whether one is directing attention primarily to the discovery of the way in which such a mental process operates, and what the conditions are under which it appears, or whether one is engaged simply in teasing apart the fibers of its tissues. The latter occupation is useful and for certain purposes essential, but it often stops short of

that which is as a life phenomenon the most essential, *i. e.*, the *modus operandi* of the phenomenon.

As a matter of fact many modern investigations of an experimental kind largely dispense with the usual direct form of introspection and concern themselves in a distinctly functionalist spirit with a determination of what work is accomplished and what the conditions are under which it is achieved. Many experiments in memory and association, for instance, are avowedly of this character.

The functionalist is committed *vom Grunde auf* to the avoidance of that special form of the psychologist's fallacy which consists in attributing to mental states without due warrant, as part of their overt constitution in the moment of experience, characteristics which subsequent reflective analysis leads us to suppose they must have possessed. When this precaution is not scrupulously observed we obtain a sort of *pâte de foie gras* psychology in which the mental conditions portrayed contain more than they ever naturally would or could hold.

It should be added that when the distinction is made between psychic structure and psychic function, the anomalous position of structure as a category of mind is often quite forgotten. In mental life the sole appropriateness of the term structure hinges on the fact that any moment of consciousness can be regarded as a complex capable of analysis, and the terms into which our analyses resolve such complexes are the analogues — and obviously very meager and defective ones at that — of the structures of anatomy and morphology.

The fact that mental contents are evanescent and fleeting marks them off in an important way from the relatively permanent elements of anatomy. No matter how much we may talk of the preservation of psychical dispositions, nor how many metaphors we may summon to characterize the storage of ideas in some hypothetical deposit chamber of memory, the obstinate fact remains that when we are not experiencing a sensation or an idea it is, strictly speaking, non-existent. Moreover, when we manage by one or another device to secure that which we designate the same sensation or the same idea, we not only have no guarantee that our second edition is really a replica of

the first, we have a good bit of presumptive evidence that from the content point of view the original never is and never can be literally duplicated.

Functions, on the other hand, persist as well in mental as in physical life. We may never have twice exactly the same idea viewed from the side of sensuous structure and composition. But there seems nothing whatever to prevent our having as often as we will contents of consciousness which *mean* the same thing. They function in one and the same practical way, however discrepant their momentary texture. The situation is rudely analogous to the biological case where very different structures may under different conditions be called on to perform identical functions; and the matter naturally harks back for its earliest analogy to the instance of protoplasm where functions seem very tentatively and imperfectly differentiated. Not only then are general functions like memory persistent, but special functions such as the memory of particular events are persistent and largely independent of the specific conscious contents called upon from time to time to subserve the functions.

When the structural psychologists define their field as that of mental *process*, they really preëempt under a fictitious name the field of function, so that I should be disposed to allege fearlessly and with a clear conscience that a large part of the doctrine of psychologists of nominally structural proclivities is in point of fact precisely what I mean by one essential part of functional psychology, *i. e.*, an account of psychical operations. Certain of the official exponents of structuralism explicitly lay claim to this as their field and do so with a flourish of scientific rectitude. There is therefore after all a small but nutritious core of agreement in the structure-function apple of discord. For this reason, as well as because I consider extremely useful the analysis of mental life into its elementary forms, I regard much of the actual work of my structuralist friends with highest respect and confidence. I feel, however, that when they use the term structural as opposed to the term functional to designate their scientific creed they often come perilously near to using the enemy's colors.

Substantially identical with this first conception of functional

psychology, but phrasing itself somewhat differently, is the view which regards the functional problem as concerned with discovering how and why conscious processes are what they are, instead of dwelling as the structuralist is supposed to do upon the problem of determining the irreducible elements of consciousness and their characteristic modes of combination. I have elsewhere defended the view that however it may be in other sciences dealing with life phenomena, in psychology at least the answer to the question 'what' implicates the answer to the questions 'how' and 'why.'<sup>1</sup>

Stated briefly the ground on which this position rests is as follows: In so far as you attempt to analyze any particular state of consciousness you find that the mental elements presented to your notice are dependent upon the particular exigencies and conditions which call them forth. Not only does the affective coloring of such a psychical moment depend upon one's temporary condition, mood and aims, but the very sensations themselves are determined in their qualitative texture by the totality of circumstances subjective and objective within which they arise. You cannot get a fixed and definite color sensation for example, without keeping perfectly constant the external and internal conditions in which it appears. The particular sense quality is in short functionally determined by the necessities of the existing situation which it emerges to meet. If you inquire then deeply enough what particular sensation you have in a given case, you always find it necessary to take account of the manner in which, and the reasons why, it was experienced at all. You may of course, if you will, abstract from these considerations, but in so far as you do so, your analysis and description is manifestly partial and incomplete. Moreover, even when you do so abstract and attempt to describe certain isolable sense qualities, your descriptions are of necessity couched in terms not of the experienced quality itself, but in terms of the conditions which produced it, in terms of some other quality with which it is compared, or in terms of some more overt act to which the sense stimulation led. That is to say, the very

<sup>1</sup> 'The Relations of Structural and Functional Psychology to Philosophy,' *Philosophical Review*, 1903 [XII.], p. 203 ff.

description itself is functionalistic and must be so. The truth of this assertion can be illustrated and tested by appeal to any situation in which one is trying to reduce sensory complexes, *e. g.*, colors or sounds, to their rudimentary components.

## II.

A broader outlook and one more frequently characteristic of contemporary writers meets us in the next conception of the task of functional psychology. This conception is in part a reflex of the prevailing interest in the larger formulæ of biology and particularly the evolutionary hypotheses within whose majestic sweep is nowadays included the history of the whole stellar universe; in part it echoes the same philosophical call to new life which has been heard as pragmatism, as humanism, even as functionalism itself. I should not wish to commit either party by asserting that functional psychology and pragmatism are ultimately one. Indeed, as a psychologist I should hesitate to bring down on myself the avalanche of metaphysical invective which has been loosened by pragmatic writers. To be sure pragmatism has slain its thousands, but I should cherish scepticism as to whether functional psychology would the more speedily slay its tens of thousands by announcing an offensive and defensive alliance with pragmatism. In any case I only hold that the two movements spring from similar logical motivation and rely for their vitality and propagation upon forces closely germane to one another.

The functional psychologist then in his modern attire is interested not alone in the operations of mental process considered merely of and by and for itself, but also and more vigorously in mental activity as part of a larger stream of biological forces which are daily and hourly at work before our eyes and which are constitutive of the most important and most absorbing part of our world. The psychologist of this stripe is wont to take his cue from the basal conception of the evolutionary movement, *i. e.*, that for the most part organic structures and functions possess their present characteristics by virtue of the efficiency with which they fit into the extant conditions of life broadly designated the environment. With this conception in mind he

proceeds to attempt some understanding of the manner in which the psychical contributes to the furtherance of the sum total of organic activities, not alone the psychical in its entirety, but especially the psychical in its particularities — mind as judging, mind as feeling, etc.

This is the point of view which instantly brings the psychologist cheek by jowl with the general biologist. It is the presupposition of every philosophy save that of outright ontological materialism that mind plays the stellar rôle in all the environmental adaptations of animals which possess it. But this persuasion has generally occupied the position of an innocuous truism or at best a jejune postulate, rather than that of a problem requiring, or permitting, serious scientific treatment. At all events, this was formerly true.

This older and more complacent attitude toward the matter is, however, being rapidly displaced by a conviction of the need for light on the exact character of the accommodatory service represented by the various great modes of conscious expression. Such an effort if successful would not only broaden the foundations for biological appreciation of the intimate nature of accommodatory process, it would also immensely enhance the psychologist's interest in the exact portrayal of conscious life. It is of course the latter consideration which lends importance to the matter from our point of view. Moreover, not a few practical consequences of value may be expected to flow from this attempt, if it achieves even a measurable degree of success. Pedagogy and mental hygiene both await the quickening and guiding counsel which can only come from a psychology of this stripe. For their purposes a strictly structural psychology is as sterile in theory as teachers and psychiatrists have found it in practice.

As a concrete example of the transfer of attention from the more general phases of consciousness as accommodatory activity to the particularistic features of the case may be mentioned the rejuvenation of interest in the quasi-biological field which we designate animal psychology. This movement is surely among the most pregnant with which we meet in our own generation. Its problems are in no sense of the merely

theoretical and speculative kind, although, like all scientific endeavor, it possesses an intellectual and methodological background on which such problems loom large. But the frontier upon which it is pushing forward its explorations is a region of definite, concrete fact, tangled and confused and often most difficult of access, but nevertheless a region of fact, accessible like all other facts to persistent and intelligent interrogation.

That many of the most fruitful researches in this field have been achievements of men nominally biologists rather than psychologists in no wise affects the merits of the case. A similar situation exists in the experimental psychology of sensation where not a little of the best work has been accomplished by scientists not primarily known as psychologists.

It seems hardly too much to say that the empirical conceptions of the consciousness of the lower animals have undergone a radical alteration in the past few years by virtue of the studies in comparative psychology. The splendid investigations of the mechanism of instinct, of the facts and methods of animal orientation, of the scope and character of the several sense processes, of the capabilities of education and the range of selective accommodatory capacities in the animal kingdom, these and dozens of other similar problems have received for the first time drastic scientific examination, experimental in character wherever possible, observational elsewhere, but observational in the spirit of conservative non-anthropomorphism as earlier observations almost never were. In most cases they have to be sure but shown the way to further and more precise knowledge, yet there can be but little question that the trail which they have blazed has success at its farther end.

One may speak almost as hopefully of human genetic psychology which has been carried on so profitably in our own country. As so often in psychology, the great desideratum here, is the completion of adequate methods which will insure really stable scientific results. But already our general psychological theory has been vitalized and broadened by the results of the genetic methods thus far elaborated. These studies constantly emphasize for us the necessity of getting the longitudinal rather than the transverse view of life phenomena



and they keep immediately in our field of vision the basic significance of growth in mental process. Nowhere is the difference more flagrant between a functional psychology and the more literal minded type of structural psychology. One has only to compare with the better contemporary studies some of the pioneer work in this field, conceived in the more static and structuralistic manner, as Preyer's for example was, to feel at once the difference and the immensely greater significance both for theory and for practice which issues from the functional and longitudinal descriptions.

The assertions which we have permitted ourselves about genetic psychology are equally applicable to pathological psychology. The technique of scientific investigation is in the nature of the case often different in this field of work from that characteristic of the other ranges of psychological research. But the attitude of the investigator is distinctly functionalistic. His aim is one of a thoroughly vital and generally practical kind leading him to emphasize precisely those considerations which our analysis of the main aspects of functional psychology disclose as the goal of its peculiar ambitions.

It is no purpose of mine to submerge by sheer *tour de force* the individuality of these various scientific interests just mentioned in the regnant personality of a functional psychology. But I am firmly convinced that the spirit which gives them birth is the spirit which in the realms of general psychological theory bears the name functionalism. I believe, therefore, that their ultimate fate is certain, still I have no wish to accelerate their translation against their will, nor to inflict upon them a label which they may find odious.

It should be said, however, in passing, that even on the side of general theory and methodological conceptions, recent developments have been fruitful and significant. One at least of these deserves mention.

We find nowadays both psychologists and biologists who treat consciousness as substantially synonymous with adaptive reactions to novel situations. In the writings of earlier authorities it is often implied that accommodatory activities *may be* purely physiological and non-psychical in character. From

this view-point the mental type of accommodatory act supervenes on certain occasions and at certain stages in organic development, but it is no indispensable feature of the accommodatory process.<sup>1</sup>

It seems a trifle strange when one considers how long the fundamental conception involved in this theory has been familiar and accepted psychological doctrine that its full implication should have been so reluctantly recognized.<sup>2</sup> If one takes the position now held by all psychologists of repute, so far as I am aware, that consciousness is constantly at work building up habits out of coördinations imperfectly under control; and that as speedily as control is gained the mental direction tends to subside and give way to a condition approximating physiological automatism, it is only a step to carry the inference forward that consciousness immanently considered is *per se* accommodation to the novel. Whether conscious processes have been the precursors of our present instinctive equipment depends on facts of heredity upon which a layman may hardly speak. But many of our leaders answer strongly in the affirmative, and such an answer evidently harmonizes with the general view now under discussion.

To be sure the further assertion that no real organic accommodation to the novel ever occurs, save in the form that involves consciousness, requires for its foundation a wide range of observation and a penetrating analysis of the various criteria of mentality. But this is certainly a common belief among biologists to-day. Selective variation of response to stimulation is the ordinary external sign indicative of conscious action. Stated otherwise, consciousness discloses the form taken on by primary accommodatory process.

<sup>1</sup> At this point there is obviously a possible ambiguity in the use of the term accommodatory. Any physiologically adequate process may be described as accommodatory. Respiration, for example, might be so designated. Clearly one needs a special term to designate accommodation to the novel, for this is the field of conscious activity. Of course if the contention be granted for which the view now under consideration stands, this could be called conscious accommodation and it would be understood forthwith that such accommodation was to the novel.

<sup>2</sup> Cf. MacDougal's striking papers in *Mind*, 1898, entitled 'Contribution toward an Improvement in Psychological Method.'

It is not unnatural perhaps that the frequent disposition of the functional psychologist to sigh after the flesh-pots of biology should kindle the fire of those consecrated to the cause of a pure psychology and philosophy freed from the contaminating influence of natural science. As a matter of fact, alarms have been repeatedly sounded and the faithful called to subdue mutiny. But the purpose of the functional psychologist has never been, so far as I am aware, to scuttle the psychological craft for the benefit of biology. Quite the contrary. Psychology is still for a time at least to steer her own untroubled course. She is at most borrowing a well-tested compass which biology is willing to lend and she hopes by its aid to make her ports more speedily and more surely. If in use it prove treacherous and unreliable, it will of course go overboard.

This broad biological ideal of functional psychology of which we have been speaking may be phrased with a slight shift of emphasis by connecting it with the problem of discovering the fundamental utilities of consciousness. If mental process is of real value to its possessor in the life and world which we know, it must perforce be by virtue of something which it does that otherwise is not accomplished. Now life and world are complex and it seems altogether improbable that consciousness should express its utility in one and only one way. As a matter of fact, every surface indication points in the other direction. It may be possible merely as a matter of expression to speak of mind as in general contributing to organic adjustment to environment. But the actual contributions will take place in many ways and by multitudinous varieties of conscious process. The functionalist's problem then is to determine if possible the great types of these processes in so far as the utilities which they present lend themselves to classification.

The search after the various utilitarian aspects of mental process is at once suggestive and disappointing. It is on the one hand illuminating by virtue of the strong relief into which it throws the fundamental resemblances of processes often unduly severed in psychological analysis. Memory and imagination, for example, are often treated in a way designed to emphasize their divergences almost to the exclusion of their functional

similarities. They are of course functionally but variants on a single and basal type of control. An austere structuralism in particular is inevitably disposed to magnify differences and in consequence under its hands mental life tends to fall apart; and when put together again it generally seems to have lost something of its verve and vivacity. It appears stiff and rigid and corpse-like. It lacks the vital spark. Functionalism tends just as inevitably to bring mental phenomena together, to show them focalized in actual vital service. The professional psychologist, calloused by long apprenticeship, may not feel this distinction to be scientifically important. But to the young student the functionalistic stress upon community of service is of immense value in clarifying the intricacies of mental organization. On the other hand the search of which we were speaking is disappointing perhaps in the paucity of the basic modes in which these conscious utilities are realized.

Ultimately all the utilities are possibly reducible to selective accommodation. In the execution of the accommodatory activity the instincts represent the racially hereditary utilities, many of which are under the extant conditions of life extremely anomalous in their value. The sensory-algedonic-motor phenomena represent the immediate short circuit unreflective forms of selective response. Whereas the ideational-algedonic-motor series at its several levels represents the long circuit response under the influence of the mediating effects of previous experience. This experience serves either to inhibit the propulsive power intrinsic to the stimulus, or to reinforce this power by adding to it its own dynamic tendencies. This last variety of action is the peculiarly human form of mediated control. On its lowest stages, genetically speaking, it merges with the purely immediate algedonic type of response. All the other familiar psychological processes are subordinate to one or more of these groups. Conception, judgment, reasoning, emotion, desire, aversion, volition, etc., simply designate special varieties in which these generic forms appear.

In facing the problem of classifying functions we may well turn for a moment to the experience of biologists for suggestions. It is to be remarked at once that the significance of function as

a basis for biological classification varies greatly in different parts of the biological field. Among the more complex animal organisms, for example, function, as compared with structure, affords a relatively precarious basis of classification, since very divergent structures may subserve identical functions. Moreover, the functions merely as such often fail to indicate with the definiteness characteristic of the anatomical structure the genetic relations involved in the maturing of a form. But in the study of the lower orders of life such as the bacteria, where structural variations are so largely to seek, the functional chemico-physiological reactions are of the utmost significance for classificatory purposes. In the botanical field generally there has of late been an increasing disposition to employ functional similarity and difference for the illumination of plant relationships. Indeed, this transition from a purely taxonomic and morphological point of view to a physiological and functional point of view is the striking feature of recent progress in botanical theory.

The ultimate value of a psychological classification based on functions, if interpreted in the light of these considerations, would apparently hinge on one's conception of the analogy between consciousness and undifferentiated protoplasm. In the measure in which consciousness is immanently unstable and variable, one might anticipate that a functional classification would be more significant and penetrating than one based upon any supposedly structural foundation. But the analogy on which this inference rests is perhaps too insecure to permit a serious conclusion to be drawn from it. In any event it is to be said that functions as such seem to be the most stable characters in the biological field. They extend in a practically unbroken front from the lowest to the highest levels of life—allowing for a possible protest in certain quarters against including consciousness in this list. That they are not everywhere so useful as structures for classificatory purposes reflects on the aims of classification, not on the fundamental and relatively fixed character of functions.

A survey of current usage discloses two general types of functional categories. Of these, the one is in spirit and purpose dominantly physiological. It groups all the forms of life func-

tions, whether animal or vegetable in manifestation, under the four headings of assimilation, reproduction, motion and sensibility. In such a schema assimilation is made to include digestion, circulation, respiration, secretion, and excretion, while motion in the sense here intended applies primarily to those forms of movement which enable the organism to migrate from place to place and thus accommodate itself to the exigencies of local conditions.

Another group of categories which concerns a deeper and more general level of biological interpretations is given by such terms as selection, adaptation, variation, accommodation, heredity, etc. These are categories of a primarily functional sort for they apply in a large sense to modes of behavior. Indeed, behavior may be said to be itself the most inclusive of these categories. But as compared with the members of the first group they have to do with the general trend of organic development and not with the specific physiological processes which may be concerned in any special case. This does not mean that a specific physiological setting cannot sometime be given these problems; but it does mean that at present the gaps in our knowledge of these matters are generally too large to be spanned with certainty.

Now it would appear that such general categories as selection and accommodation have a perfectly appropriate application to mental process. Indeed, as we have already remarked, not a few of our modern scientists regard the psychical as precisely synonymous with the selective — accommodatory activity as this appears in the life history of the individual; and we have, moreover, already pointed out certain limitations and certain merits of these categories when applied to the classification of mental phenomena. We have found them serving to magnify a certain community of organic service in the most various forms of psychical activity, but we have also found them rather too vague and general to afford a desirable scientific detail.

If on the other hand, we examine the familiar *physiological* functions with reference to their possible relations to mental functions, we are at once struck by certain similarities and certain disparities between the two. There are some mental

operations which have repeatedly been designated as assimilative. So familiar is this characterization and so commonly accepted that we may without undue hesitation assume its appropriateness and relevancy. Under the physiological aspects of assimilation are commonly ranged such processes as respiration, circulation, secretion, excretion etc. How far these processes find analogies in mental action is not altogether clear. Many of our psychologists are fond of describing 'the stream of consciousness' and in so far as the metaphor is justifiable one may naturally think of the physiological circulation as its counterpart. But there are perhaps as many differences as there are resemblances between the two. Certainly the cyclical character of the circulation of the blood finds no precise analogue in the flow of psychical phenomena. Similarly the periodicity of respiration may suggest the fluctuation of attention, the storing of mental dispositions may be connected with secretion, the casting off of mental irrelevancies may be likened to excretion, etc. But these relations are so largely metaphorical in character that one can hardly assign them a larger consequence than springs from such amusement as they may afford.

It would perhaps be difficult to disprove the theory that reproduction can be regarded as a mental category quite as truly as a physiological category, not only in the sense in which one mind can be conceived as the parent of other minds, but also in the familiar sense in which the mind is thought of as recreating its own ideas from time to time.

Yet granting all this, it may safely be said that however numerous the analogies connecting the mental functions with the physiological functions may be, we are not at present in a position to take advantage of them in any very serious way. Motion is by common consent applicable to the physiological alone and sensibility is in the intent of the classification appropriate to the psychical alone. The basal categories utilized by physiologists seem therefore to render us but little assistance. This view is vigorously maintained by many modern writers, but generally on *a priori* grounds.

If we examine the historically conspicuous classifications of mental process made by psychologists, we discover, as was

pointed out in an earlier paragraph, that they are frequently suggestive of definitely functional conceptions. The Aristotelian divisions, the so-called Kantian divisions, the divisions into higher and lower powers characteristic of the faculty psychologists (and many others not commonly ranked as such), and Brentano's and Stout's classifications, to mention no more, are all decidedly based on dynamic and functionalistic considerations. On the other hand, not a few of our contemporary authorities, notably Wundt, classify their material under the more statical and mechanical categories — 'elements and compounds.'

Professor Warren has recently suggested an interesting classification in which he proposes as the fundamental functional categories the following five: Sensibility, which gives us the sensory continuum; modification, which connotes our ability to become aware of intensive modifications in the continuum; differentiation, which covers our capacity to experience qualitative differences; association, which does not require interpretation, and discrimination, which refers to our ability to perform definite acts of rational apprehension and to articulate purposes.<sup>1</sup> These functions taken together will, he alleges, account for all forms of consciousness and they are not derivatives from phenomena of the material world which he regards as outside the pale. I do not propose at this time to offer any detailed criticism of Professor Warren's valuable paper. Indeed, until his views are more fully elaborated, extended criticism would be premature.

One distinction, however, to which he calls incidental attention as a biological distinction, is formulated in an admirable statement with which I fully agree. It presents a sort of functional analysis which seems to me at once pregnant and sound. He speaks of the three-fold division of cognition, affection and conative process as intrinsically biological in character and corresponding broadly to the differences among the external, the systemic and the kinæsthetic senses; the first reporting to us the outer world, the second our own general organic tone and the third supplying experiences of our motor activity by means of which voluntary control is developed.

<sup>1</sup> 'The Fundamental Functions of Consciousness,' *Psychological Bulletin*, 1906, p. 217.



Particularly significant is his remark that the 'fundamental functions of consciousness and the kinds of experience' are something quite distinct from one another. It is because he believes that the 'rise of any particular experience and its make-up as a datum of consciousness can be fully described in terms of certain mental functions' that he feels it possible to elaborate an independent natural science of psychology free from neurological, physiological and biological considerations. It is not clear that this conclusion flows from Professor Warren's premises any more exclusively than from the premises of the so-called structuralist's point of view. Nor is there any strictly logical impracticality in carrying out the program of such a pure psychology. But it is fair to emphasize the extremely pale, attenuated and abstract character of such a science as compared with one which should report upon conscious processes as they are really found amid the heat and battle of the actual mind-body life. It may be a pure science, but it is surely purity bought at a great price — *i. e.*, truth to life.

All pure science must abstract in a measure from the actual circumstances of life, but in the so-called exact sciences the abstraction is always away from the irrelevant and disturbing. The type of abstraction which Professor Warren champions, in common with many other distinguished scholars, is one which appeals to me as an abstracting away from the more significant, with the consequent fixation of attention upon the relatively less important.

It is a commonplace of logic that classification is intrinsically teleological and that the merits of any special classification, assuming that it does not distort or misrepresent the facts, is to be tested by the success with which it meets the necessities for which it was devised. If one desires to emphasize the taxonomic and morphological features of mentality, no doubt some such division as Wundt employs, using the rubrics elements and compounds, is preferable. If one wishes primarily to emphasize qualitative similarities and dissimilarities, the Kantian principle of irreducibility is judicious; and if one wishes to bring out the dynamic character of consciousness, such a principle as Brentano's, based on the mode in which conscious-

ness refers to its object, is effective. If functional psychology really possesses several distinct zones of interest, it is quite conceivable that different classifications may be necessary to fulfil most satisfactorily the demands in these several fields. In any case we must forego further discussion of the matter at this point and return to offer our description of the third of the main subdivisions of the functional problem.

### III.

The third conception which I distinguish is often in practice merged with the second, but it involves stress upon a problem logically prior perhaps to the problem raised there and so warrants separate mention. Functional psychology, it is often alleged, is in reality a form of psychophysics. To be sure, its aims and ideals are not explicitly quantitative in the manner characteristic of that science as commonly understood. But it finds its major interest in determining the relations to one another of the physical and mental portions of the organism.

It is undoubtedly true that many of those who write under functional prepossessions are wont to introduce frequent references to the physiological processes which accompany or condition mental life. Moreover, certain followers of this faith are prone to declare forthwith that psychology is simply a branch of biology and that we are in consequence entitled, if not indeed obliged, to make use where possible of biological materials. But without committing ourselves to so extreme a position as this, a mere glance at one familiar region of psychological procedure will disclose the leanings of psychology in this direction.

The psychology of volition affords an excellent illustration of the necessity with which descriptions of mental process eventuate in physiological or biological considerations. If one take the conventional analysis of a voluntary act drawn from some one or other of the experiences of adult life, the descriptions offered generally portray ideational activities of an anticipatory and deliberative character which serve to initiate immediately or remotely certain relevant expressive movements. Without the execution of the movements the ideational performances would be as futile as the tinkling cymbals of Scrip-

ture. To be sure, many of our psychologists protest themselves wholly unable to suggest why or how such muscular movements are brought to pass. But the fact of their occurrence or of their fundamental import for any theory of mental life in which consciousness is other than an epiphenomenon, is not questioned.

Moreover, if one considers the usual accounts of the ontogenesis of human volitional acts one is again confronted with intrinsically physiological data in which reflexes, automatic and instinctive acts are much in evidence. Whatever the possibilities, then, of an expurgated edition of the psychology of volition from which should be blotted out all reference to contaminating physiological factors, the actual practice of our representative psychologists is quite otherwise, and upon their showing volition cannot be understood either as regards its origin or its outcome without constant and overt reference to these factors. It would be a labor of supererogation to go on and make clear the same doctrine as it applies to the psychology of the more recondite of the cognitive processes; so intimate is the relation between cognition and volition in modern psychological theory that we may well stand excused from carrying out in detail the obvious inferences from the situation we have just described.

Now if someone could but devise a method for handling the mind-body relationships which would not when published immediately create cyclonic disturbances in the philosophical atmosphere, it seems improbable that this disposition of the functional psychologist to inject physiology into his cosmos would cause comment and much less criticism. But even parallelism, that most insipid, pale and passionless of all the inventions begotten by the mind of man to accomplish this end, has largely failed of its pacific purpose. It is no wonder, therefore, that the more rugged creeds with positive programs to offer and a stock of red corpuscles to invest in their propagation should also have failed of universal favor.

This disposition to go over into the physiological for certain portions of psychological doctrine is represented in an interesting way by the frequent tendency of structural psychologists to find explanation in psychology substantially equivalent to

physiological explanation.<sup>1</sup> Professor Titchener's recent work on *Quantitative Psychology* represents this position very frankly. It is cited here with no intent to comment disparagingly upon the consistency of the structuralist position, but simply to indicate the wide-spread feeling of necessity at certain stages of psychological development for resort to physiological considerations.

Such a functional psychology as I have been presenting would be entirely reconcilable with Miss Calkins' 'psychology of selves' (so ably set forth by her in her presidential address last year) were it not for her extreme scientific conservatism in refusing to allow the self to have a body, save as a kind of conventional biological ornament. The real psychological self, as I understand her, is pure disembodied spirit — an admirable thing of good religious and philosophic ancestry, but surely not the thing with which we actually get through this vale of tears and not a thing before which psychology is under any obligation to kotow.<sup>2</sup>

It is not clear that the functional psychologist because of his

<sup>1</sup>Cf. Münsterberg's striking pronunciamento to this effect in his paper entitled 'Psychological Atomism,' *PSYCHOLOGICAL REVIEW*, 1900, p. 1. The same doctrine is incorporated in his 'Grundzüge der Psychologie' and we await with interest the completion of that task in order to discover the characteristic features of a psychology consistently built on these foundations.

<sup>2</sup>Miss Calkins' views on this matter, which are shared by many of our leading psychologists, have been lucidly expounded on several papers [particularly 'Der doppelte Standpunkt in der Psychologie,' and a 'Reconciliation between Structural and Functional Psychology,' *PSYCHOLOGICAL REVIEW*, 1906, p. 61], to say nothing of their embodiment in her widely quoted *Introduction to Psychology*. She has done yeoman service in emphasizing the fundamental significance of the 'self' consciousness for all psychological doctrine and I am in entire sympathy with her insistence on this fact. But she seems to me unduly to circumscribe the legitimate scope of this 'self.' Possibly I misinterpret her meaning, but the following sentences together with the procedure in her *Introduction to Psychology* seem to justify me. "By self as fundamental fact of psychology is not meant . . . the psychophysical organism, . . . the objection is, very briefly, that the doctrine belongs not to psychology at all, but to biology," *PSYCHOLOGICAL REVIEW*, 1906, p. 66. After which reference is made to Professor Baldwin's *Development and Evolution* as a non-psychological treatise. Such a settlement of the issue is easy and logically consistent. But does it not leave us with a gulf set between the self as mind and the self as body, for the crossing of which we are forthwith obliged to expend much needless energy, as the gulf is of our own inventing?

disposition to magnify the significance in practice of the mind-body relationships is thereby committed to any special theory of the character of these relationships, save as was said a moment since, that negatively he must seemingly of necessity set his face against any epiphenomenalist view. He might conceivably be an interactionist, or a parallelist or even an advocate of some wholly outworn creed. As a matter of fact certain of our most ardent functionalists not only cherish highly definite articles of faith as regards this issue, they would even go so far as to test functional orthodoxy by the acceptance of these tenets. This is to them the most momentous part of their functionalism, their holy of holies. It would display needless temerity to attempt within the limitations of this occasion a formulation of doctrine wholly acceptable to all concerned. But I shall venture a brief reference to such doctrine in the effort to bring out certain of its essentials.

The position to which I refer regards the mind-body relation as capable of treatment in psychology as a methodological distinction rather than a metaphysically existential one. Certain of its expounders arrive at their view by means of an analysis of the genetic conditions under which the mind-body differentiation first makes itself felt in the experience of the individual.<sup>1</sup> This procedure clearly involves a direct frontal attack on the problem.

Others attain the position by flank movement, emphasizing to begin with the insoluble contradictions with which one is met when the distinction is treated as resting on existential differences in the primordial elements of the cosmos.<sup>2</sup> Both methods of approach lead to the same goal, however, *i. e.*, the conviction that the distinction has no existence on the genetically lower and more naive stages of experience. It only comes to light on a relatively reflective level and it must then be treated

<sup>1</sup> The most striking attempt of this kind with which I am acquainted is Professor Baldwin's paper entitled 'Mind and Body from the Genetic Point of View,' *PSYCHOLOGICAL REVIEW*, 1903, p. 225.

<sup>2</sup> Cf. on this general issue Bawden, 'Functional View of the Relation Between the Psychical and the Physical,' *Philosophical Review*, 1902, [XI.], p. 474, and 'Methodological Implications of the Mind-body Controversy,' *Psychological Bulletin*, 1906, p. 321.

as instrumental if one would avoid paralogisms, antinomies and a host of other metaphysical nightmares. Moreover, in dealing with psychological problems this view entitles one to reject as at least temporarily irrelevant the question whether mind *causes* changes in neural action and conversely. The previous question is raised by defenders of this type of doctrine if one insists on having such a query answered. They invite you to trace the lineage of your idea of causality, insisting that such a searching of one's intellectual reins will always disclose the inappropriateness of the inquiry as formulated above. They urge further that the profitable and significant thing is to seek for a more exact appreciation of the precise conditions under which consciousness is in evidence and the conditions under which it retires in favor of the more exclusively physiological. Such knowledge so far as it can be obtained is on a level with all scientific and practical information. It states the circumstances under which certain sorts of results will appear.

One's view of this functionalistic metaphysics is almost inevitably colored by current philosophical discussion as to the essential nature of consciousness. David Hume has been accused of destroying the reality of mind chiefly because he exorcised from it relationships of various kinds. If it be urged, as has so often been done, that Hume was guilty of pouring out the baby with the bath, the modern philosopher makes good the disaster not only by pouring in again both baby and bath, but by maintaining that baby and bath, mind and relations, are substantially one.<sup>1</sup> Nor is this unity secured after the manner

<sup>1</sup>To the simple-minded psychologist this saying, in which many authors indulge, that consciousness is merely a relation seems a trifle dark. The psychologist has no natural prejudice against relation, but in this special case he is as a rule given too little information concerning the terms between which this relation subsists. Possibly his vision has been darkened by a perverse logic, but relations imply termini in his usual modes of thought and before assenting too unreservedly to the 'relation' philosophy of consciousness, he urges a fuller illumination as to the character and status of these supporting end terms.

The following well-known papers will introduce the uninitiated, if any such there be, into the thick of the battle. A complete bibliography would probably monopolize this issue of the REVIEW. James, 'Does Consciousness Exist?' *Journal of Philosophy, Psychology and Scientific Methods*, I., p. 477. Woodbridge, 'Nature of Consciousness,' in the same *Journal*, II., p. 119. Also Gorman, 'Memorial Volume,' p. 137. Perry, 'Conceptions and Misconceptions of

prescribed by the good Bishop Berkeley. At all events the metaphysicians to whom I refer are not fond of being called idealists. But the psychological functionalist who emphasizes the instrumental nature of the mind-body distinction and the metaphysician who regards mind as a relation are following roads which are at least parallel to one another if not actually convergent.

Whether or not one sympathizes with the views of that wing of the functionalist party to which our attention has just been directed it certainly seems a trifle unfair to cast up the mind-body difficulty in the teeth of the functionalist as such when on logical grounds he is no more guilty than any of his psychological neighbors. No courageous psychology of volition is possible which does not squarely face the mind-body problem, and in point of fact every important description of mental life contains doctrine of one kind or another upon this matter. A literally pure psychology of volition would be a sort of hanging-garden of Babylon, marvelous but inaccessible to psychologists of terrestrial habit. The functionalist is a greater sinner than others only in so far as he finds necessary and profitable a more constant insistence upon the translation of mental process into physiological process and conversely.

#### IV.

If we now bring together the several conceptions of which mention has been made it will be easy to show them converging upon a common point. We have to consider (1) functionalism conceived as the psychology of mental operations in contrast to the psychology of mental elements; or, expressed otherwise, the psychology of the how and why of consciousness as distinguished from the psychology of the what of consciousness. We have (2) the functionalism which deals with the problem of mind conceived as primarily engaged in mediating between the environment and the needs of the organism. This is the psychology of the fundamental utilities of consciousness; (3) and

Consciousness,' *PSYCHOLOGICAL REVIEW*, 1904, XI., p. 282. Bush, 'An Empirical Definition of Consciousness,' *Journal of Philosophy, Psychology and Scientific Methods*, II., p. 561. Stratton, 'Difference Between Mental and Physical,' *Psychological Bulletin*, 1906, p. 1. 'Character of Consciousness,' *Ibid.*, p. 117.

lastly we have functionalism described as psychophysical psychology, that is the psychology which constantly recognizes and insists upon the essential significance of the mind-body relationship for any just and comprehensive appreciation of mental life itself.

The second and third delineations of functional psychology are rather obviously correlated with each other. No description of the actual circumstances attending the participation of mind in the accommodatory activities of the organism could be other than a mere empty schematism without making reference to the manner in which mental processes eventuate in motor phenomena of the physiological organism. The overt accommodatory act is, I take it, always sooner or later a muscular movement. But this fact being admitted, there is nothing for it, if one will describe accommodatory processes, but to recognize the mind-body relations and in some way give expression to their practical significance. It is only in this regard, as was indicated a few lines above, that the functionalist departs a trifle in his practice and a trifle more in his theory from the rank and file of his colleagues.

The effort to follow the lead of the natural sciences and delimit somewhat rigorously — albeit artificially — a field of inquiry, in this case consciousness conceived as an independent realm, has led in psychology to a deal of excellent work and to the uncovering of much hidden truth. So far as this procedure has resulted in a focusing of scientific attention and endeavor on a relatively narrow range of problems the result has more than justified the means. And the functionalist by no means holds that the limit of profitable research has been reached along these lines. But he is disposed to urge in season and out that we must not forget the arbitrary and self-imposed nature of the boundaries within which we toil when we try to eschew all explicit reference to the physical and physiological. To overlook this fact is to substitute a psychology under injunction for a psychology under free jurisdiction. He also urges with vigor and enthusiasm that a new illumination of this preëempted field can be gained by envisaging it more broadly, looking at it as it appears when taken in perspective with its neighboring territory.



And if it be objected that such an inquiry however interesting and advantageous is at least not psychology, he can only reply ; psychology is what we make it, and if the correct understanding of mental phenomena involves our delving in regions which are not at first glance properly mental, what reck's it, provided only that we are nowhere guilty of untrustworthy and unverifiable procedure, and that we return loaded with the booty for which we set out, and by means of which we can the better solve our problem?

In its more basal philosophy this last conception is of course intimately allied to those appraisals of mind which emphasize its dominantly social characteristics, its rise out of social circumstances and the pervasively social nature of its constitutive principles. In our previous intimations of this standpoint we have not distinguished sharply between the physical and the social aspect of environment. The adaptive activities of mind are very largely of the distinctly social type. But this does not in any way jeopardize the genuineness of the connection upon which we have been insisting between the psychophysical aspects of a functional psychology and its environmental adaptive aspects.

It remains then to point out in what manner the conception of functionalism as concerned with the basal operations of mind is to be correlated with the other two conceptions just under discussion. The simplest view to take of the relations involved would apparently be such as would regard the first as an essential propædeutic to the other two. Certainly if we are intent upon discerning the exact manner in which mental process contributes to accommodatory efficiency, it is natural to begin our undertaking by determining what are the primordial forms of expression peculiar to mind. However plausible in theory this conception of the intrinsic logical relations of these several forms of functional psychology, in practice it is extremely difficult wholly to sever them from one another.

Again like the biological accommodatory view the psychophysical view of functional psychology involves as a rational presupposition some acquaintance with mental processes as these appear to reflective consciousness. The intelligent corre-

lation in a practical way of physiological and mental operations evidently involves a preliminary knowledge of the conspicuous differentiations both on the side of conscious function and on the side of physiological function.

In view of the considerations of the last few paragraphs it does not seem fanciful nor forced to urge that these various theories of the problem of functional psychology really converge upon one another, however divergent may be the introductory investigations peculiar to each of the several ideals. Possibly the conception that the fundamental problem of the functionalist is one of determining just how mind participates in accommodatory reactions, is more nearly inclusive than either of the others, and so may be chosen to stand for the group. But if this vicarious duty is assigned to it, it must be on clear terms of remembrance that the other phases of the problem are equally real and equally necessary. Indeed the three things hang together as integral parts of a common program.

The functionalist's most intimate persuasion leads him to regard consciousness as primarily and intrinsically a control phenomenon. Just as behavior may be regarded as the most distinctly basic category of general biology in its functional phase so control would perhaps serve as the most fundamental category in functional psychology, the special forms and differentiations of consciousness simply constituting particular phases of the general process of control. At this point the omnipresent captious critic will perhaps arise to urge that the knowledge process is no more truly to be explained in terms of control than is control to be explained in terms of knowledge. Unquestionably there is from the point of view of the critic a measure of truth in this contention. The mechanism of control undoubtedly depends on the cognitive processes, to say nothing of other factors. But if one assumes the vitalistic point of view for one's more final interpretations, if one regards the furtherance of life in breadth and depth and permanence as an end in itself, and if one derives his scale of values from a contemplation of the several contributions toward this end represented by the great types of vital phenomena, with their apex in the moral, scientific and æsthetic realms, one must certainly find control a category more

fundamental than the others offered by psychology. Moreover, it may be urged against the critic's attitude that even knowledge itself is built up under the control mechanism represented by selective attention and apperception. The basic character of control seems therefore hardly open to challenge.

One incidental merit of the functionalist program deserves a passing mention. This is the one method of approach to the problem with which I am acquainted that offers a reasonable and cogent account of the rise of reflective consciousness and its significance as manifested in the various philosophical disciplines. From the vantage point of the functionalist position logic and ethics, for instance, are no longer mere disconnected items in the world of mind. They take their place with all the inevitableness of organic organization in the general system of control, which requires for the expression of its immanent meaning *as psychic* a theoretical vindication of its own inner principles, its modes of procedure and their results.<sup>1</sup> From any other point of view, so far as I am aware, the several divisions of philosophical inquiry sustain to one another relations which are almost purely external and accidental. To the functionalist on the other hand they are and must be in the nature of the case consanguineous and vitally connected. It is at the point, for example, where the good, the beautiful and the true have bearing on the efficacy of accommodatory activity that the issues of the normative philosophical sciences become relevant. If good action has no significance for the enriching and enlarging of life, the contention I urge is futile, and similarly as regards beauty and truth. But it is not at present usually maintained that such is the fact.

These and other similar tendencies of functionalism may serve to reassure those who fear that in lending itself to biological influences psychology may lose contact with philosophy

<sup>1</sup> An interesting example of the possible developments in this direction is afforded by Professor G. H. Mead's paper entitled 'Suggestions toward a Theory of the Philosophical Disciplines,' *Philosophical Review*, 1900, IX., p. 1. My own paper referred to elsewhere on 'Psychology and Philosophy,' *Philosophical Review*, 1903, XII., p. 243, contains further illustrative material.

Professor Baldwin's recent volume on genetic logic ['Thought and Things,' etc., N. Y., 1906] is a striking case of functional psychology evolving into logic.

and so sacrifice the poise and balance and sanity of outlook which philosophy undertakes to furnish. The particular brand of philosophy which is predestined to functionalist favor cannot of course be confidently predicted in advance. But anything approaching a complete and permanent divorce of psychology from philosophy is surely improbable so long as one cultivates the functionalist faith. Philosophy cannot dictate scientific method here any more than elsewhere, nor foreordain the special facts to be discovered. But as an interpreter of the psychologist's achievements she will always stand higher in the functionalist's favor than in that of his colleagues of other persuasions, for she is a more integral and significant part of his scheme of the cosmos. She may even outgrow under his tutelage that 'valiant inconclusiveness' of which the last of her long line of lay critics has just accused her.

A sketch of the kind we have offered is unhappily likely to leave on the mind an impression of functional psychology as a name for a group of genial but vaguer ambitions and good intentions. This, however, is a fault which must be charged to the artist and to the limitations of time and space under which he is here working. There is nothing vaguer in the program of the functionalist when he goes to his work than there is in the purposes of the psychologist wearing any other livery. He goes to his laboratory, for example, with just the same resolute interest to discover new facts and new relationships, with just the same determination to verify and confirm his previous observations, as does his colleague who calls himself perhaps a structuralist. But he looks out upon the surroundings of his science with a possibly greater sensitiveness to its continuity with other ranges of human interest and with certainly a more articulate purpose to see the mind which he analyzes as it actually is when engaged in the discharge of its vital functions. If his method tempts him now and then to sacrifice something of petty exactitude, he is under no obligation to yield, and in any case he has for his compensation the power which comes from breadth and sweep of outlook.

So far as he may be expected to develop methods peculiar to himself — so far, indeed, as in genetic and comparative psy-

chology, for example, he has already developed such — they will not necessarily be iconoclastic and revolutionary, nor such as flout the methods already devised and established on a slightly different foundation. They will be distinctly complementary to all that is solid in these. Nor is it in any way essential that the term functionalism should cling to this new-old movement. It seems at present a convenient term, but there is nothing sacrosanct about it, and the moment it takes unto itself the pretense of scientific finality its doom will be sealed. It means to-day a broad and flexible and organic point of view in psychology. The moment it becomes dogmatic and narrow its spirit will have passed and undoubtedly some worthier successor will fill its place.

## DEFINITION AND ANALYSIS OF THE CONSCIOUSNESS OF VALUE. (II.)

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### I.

The analyses of the preceding paper have led to a demarcation of that type or class of meanings which are described as worths or values. Beginning with the preliminary definition of worth as the affective-volitional meaning of the object for the subject, we advanced by successive stages of analysis to the more specific statement that the worth experience is always a feeling attitude which presupposes the actualization of some conative disposition by acts of presumption, judgment or assumption (implicit and explicit). This definition obviously involves a certain theory of the nature of feeling and of its relation to conation (desire and volition). For one thing, the broader use of the term feeling involves a relative distinction between feeling attitude and affective tone of sensation, a distinction which has in fact been insisted upon, and it also leads to the view that feeling, as worth feeling, has appreciative distinctions not found in passive affection. To this theory, of the nature of feeling, and the more abstract psychological analyses which it involves, we must turn our attention later; for the present (and indeed as a necessary preliminary of this later study) our problem is the further development of the appreciative distinctions of feeling.

Earlier in our study a distinction was made between the 'appreciative' and 'reality' (including existence-) meanings of worth predicates. Starting with the analysis of the latter, we developed the definition of value in terms of its functional presuppositions. But in the course of that very analysis we came upon certain appreciative distinctions in feeling (as for instance in the study of the criteria of Lipps and Kruger) such as feeling of the personality, breadth and depth of feeling in the

personality, which were taken as descriptive of feelings of value. Logically this analysis of appreciative descriptions of feeling should, perhaps, have come first in our own study,<sup>1</sup> but the order of presentation chosen has this advantage, that the critical studies of the preceding paper have, by their results both positive and negative, defined the sphere of worth experience, and have given us the clue to the interpretation of the different qualifications of feeling which are worth suggestive, that is give rise to those meanings of objects which we call worth predicates.

These qualifications of feeling are certain aspects of feeling attitude which are not only appreciable but which may be described in terms which convey their meaning. It has already been pointed out in another connection,<sup>2</sup> that the meanings of feeling attitudes, grouped under the general terms *transgredient* and *immanental* references, are susceptible of communication and description in their own special terms, no less than the content which acquires these meanings. In fact, feeling may itself become the object of both presentation and judgment, and when it does there arise, or rather become explicit, certain selective meanings which find their own type of description and their own media of communication. This description we have called appreciative description. Into the nature of this description — its relation to the normative sciences on the one hand and to psychological analysis on the other — we cannot here enter. It will be sufficient to recall that such description always conveys the meaning of attitudes and fixes the place of a feeling attitude in a system of possible attitudes toward reality presupposed. At the center of that system of meanings is the self to which all these meanings refer, either explicitly or implicitly.

<sup>1</sup> In my article: 'Appreciation and Description and the Psychology of Values,' *Philosophical Review*, November, 1905, two methodological principles were developed as guides in the analysis of the consciousness of value. Psychological analysis must take its start from appreciative description and, since appreciative description conveys functional meaning as well as the content, psychological description involves the development of the functional presuppositions of the feeling.

<sup>2</sup> In the article referred to above.

## II.

A. The worth predicates themselves, as tertiary qualities of objects, are, in their manifold modifications, appreciative distinctions arising from differences in the meaning of feelings. They are projections into the object of distinctions within feeling. The supposition presents itself immediately that these predicates, since they are funded meanings of feeling processes, correspond directly to fundamental differences in feeling itself, and that there are as many differences in feeling as there are worth predicates. Reflection, however, makes clear that appreciative description of objects, while the expression of worth feelings, is not necessarily the appreciative description of those feelings themselves. These predicates are *what* we feel about the object, not *how* we feel. We feel beauty, goodness, nobility, sublimity, obligation, but when we describe how we feel in such cases a transition has been made to the appreciative description of the feeling itself. The feeling has been made the object of presentation and description and it is quite possible that in this appreciative description of the feeling one of these general worth predicates may stand for different modifications of feeling or for several at the same time. Thus the predicate good may, when applied to an act, have as its equivalent a feeling described as the tension of obligation, at another the feeling of satisfied repose. In order to adequately describe the feeling I have when I call an object sublime it may be necessary to use the terms elevation, repose, and, if I wish to add to my description quantitative terms, to speak of the depth of the feeling. It will be apparent then that what is meant by the appreciative distinctions in primary worth feeling are those descriptions of his feelings which the subject seeks as equivalents for his worth predicates applied to objects. The ultimate terms in which such feelings of simple appreciation are described should give us the fundamental modifications of worth feeling.

B. It has been said that there are innumerable nuances of feeling and in the same breath it has been asserted that all these differences are reducible to differences in intensity and duration of a one-dimensional continuum, pleasantness-unpleasantness,



these differences being due to differences in the sensational, perceptual, ideal content with which the feeling is connected. With the first part of this statement we may agree but the second requires critical examination. The consciousness of the inadequacy of this conception of the dimensions of feeling has been growing recently and the demand for new analysis has arisen from two distinct quarters, — from the study of the psychology of worth experience, on the one hand, and from non-appreciative psycho-physical analysis, on the other hand, as illustrated in Wundt's three-dimensional theory.

In the case of the 'worth psychologists,' with whom we are in this connection primarily concerned, the logic of this analysis is clear enough. When they turn from the worth predicates of objects to a description of the experiences which determine these predicates, they find the old terminology, intensity and duration of pleasantness-unpleasantness inadequate for the reconstruction of this experience. In the analysis of Kruger which we have already considered, worth feeling (which is distinguished functionally from pleasure-causation by the fact that it presupposes conative constants) is distinguished appreciatively by a new dimension depth and breadth in the personality. Simmel,<sup>1</sup> who likewise makes feeling the worth fundamental, also finds it necessary to distinguish the aspects of depth and breadth of feeling from intensity. Another class of analysts, who hold a voluntaristic theory, find modifications of worth experience, which cannot be correlated with feeling if feeling be conceived merely as intensity of pleasantness-unpleasantness. Brentano<sup>2</sup> is compelled to assume quasi-logical dimensions of acts of preference, to which pleasantness and unpleasantness are related merely as redundant passive phenomena and more recently and definitely, Schwartz<sup>3</sup> has found it necessary to distinguish fundamentally between degrees of worth experience, satisfaction (*Sättigung des Gefallen*) and intensity of feeling, and, on the assumption that feeling is passive pleasantness-unpleasantness, to seek a voluntaristic basis for worth experi-

<sup>1</sup> Simmel, *Einleitung* in die *Moralwissenschaft*.

<sup>2</sup> Brentano, *Psychologie*. Also *Ursprung der sittlichen Erkenntnis*.

<sup>3</sup> Schwartz, *Psychologie des Willens*, Chapter II., also Appendix I.

ence. Despite the differences in theory of the nature of the worth fundamental, it is clear that these analyses all have in view the object of doing justice to appreciative distinctions in worth experience, whatever that may be found to be, in terms of psychological equivalents.

C. If then we hold to our view already developed, that worth experience is feeling with certain characteristic presuppositions, our task is naturally to seek some conception of feeling which lies between the two views propounded — both of them unworkable for worth analysis — the proposition that feeling has innumerable modifications, and the view that it is merely intensity of pleasantness and unpleasantness. Now the key to our procedure is to be found in the fact that ‘pleasantness-unpleasantness’ are but one class of terms which may be applied to the description of the concrete feeling attitude, that there are other class terms which are equally fundamental for the communication of the qualitative differences in feeling. In order to communicate the subjective experience corresponding to the worth predicate the qualitative differences, pleasantness-unpleasantness, are insufficient. And secondly, when this has become clear, it will also appear that in order to express quantitative differences in worth feeling it will be necessary to make use of other conceptions than that of intensity (in its narrower sense) which has been transferred from sensation to the pleasantness and unpleasantness which accompanies sensation.

The problem then is — what are the fundamental class terms for the nuances of feeling corresponding to the tertiary qualities, worth predicates attributed to objects? The answer to this question would naturally take the direction of a classification of the appreciative descriptions of feeling attitudes and, indeed, a desideratum of the greatest importance in the present situation of the psychology of feeling is precisely such a pre-scientific classification of the appreciative terms used in the first stages of introspection. As was pointed out in the article referred to, the psychology of religious, ethical and æsthetic feeling must build its generalizations almost entirely upon these appreciative introspections (as for instance in the questionnaire

method) and its possibility rests ultimately upon the existence of uniformities in such descriptions. Partial contributions to such a classification already exist—notably in the sphere of religious experience—but in default of any adequate view of the whole range of such descriptions, and in view of the impossibility of attempting such a classification here, we may resort to the more usual and more direct method of analysing our experience directly for the primary fundamental meanings of feeling, and then seeking to develop the secondary derived meanings by genetic progressions from the fundamental. This special application of the genetic method of analysis will have the advantage of presenting our results in such a form as to connect them immediately with the results of the preceding analysis of functional presuppositions, and the two will act as mutually supplementary and corrective.

### III.

A. What, then, are the primary, irreducible aspects of feeling without use of which as predicates the meaning of a feeling attitude, *i. e.*, its place in a system of meanings, cannot be fixed? As has been suggested, these aspects must be expressed in terms both of quality and degree. Our first concern is therefore with the quality meanings. Every concrete feeling attitude has two primary aspects or meanings, its *directions* and its *references*. Its direction is either positive or negative. Its reference is either transgredient or immanent. Of the first aspect little need be said. It is that fundamental duality of quality which, when feeling is viewed retrospectively as passive, as abstracted from conation, is described as pleasantness-unpleasantness. As direction or meaning of feeling attitude, however, it presupposes relation of the attitude to conation.

What have been described as the references of feeling specify more completely, on the other hand, this relation to conation: they are aspects of the feeling which refer to something presupposed, to a disposition already acquired and for which the object has a meaning. In the case of the transgredient reference it is the sense of a subjective control leading on to other states. In the case of the immanent, it is a sense of a control

more objective leading to continuance or repose in the same state. When it comes to describing these directions and references, their different nuances and suggestions, use is made of metaphorical and analogical terms the significance of which we must consider.

The most fundamental analogical differentiation of feeling in appreciative description is in connection with its directions and is brought about by application of contrast pairs from the different sense regions. Feelings are described as sweet or bitter, bright or dull, soft or hard, etc. They specify for finer discrimination and description the two fundamental directions of feeling, the positive and negative, pleasant and unpleasant, and the basis of this transference is the fact that the conative tendency connected with these feelings, as well as the actual organic attitude, even when the feelings are connected with perceptual and ideational activity, are the same as those associated with sensations in terms of which the feeling is described.

The second group of terms employed in differentiating the worth suggestions of feeling attitudes are those which may be described as *dynamic*. They describe the dynamic suggestions of the feeling, specify the transgradient reference. This transgradient reference is ordinarily described metaphorically in terms of movement forms from the external world. Of the large number of movement forms made use of in such descriptions a slight study of appreciative literature, or of those appreciative prescientific introspections, to which reference has already been made, makes us immediately aware. They are full of terms for different nuances of movements of the crescendo or diminuendo type — of soaring, of uplift, of sudden breaking in upon consciousness and of dying away, of height and depth, etc. They can probably all be included under the general terms tension, restlessness (and perhaps contraction), the nature of which dimensions, and the theory connected with this classification, we shall consider presently. From the point of view of content such movement forms are also probably complexes founded in intensity and duration relations of more ultimate elements.

However that may be, the characteristic of these symbolic dynamic descriptions is that they describe transitional aspects of experience, transitions from one aspect of content to another by which meaning is acquired. By this I mean that in the present feeling there is always a transgredient reference to a past or future attitude. The present experience is always the foreground of a background, past or future, which is still, or already, dimly felt. Of course in such a feeling there is always reference to conation, and it might be objected that we are here dealing with impulse and desire rather than with feeling if it were not, as we shall seek to show, that feeling cannot be completely abstracted from conation.

A third, and qualitatively opposite, class of terms is used to characterize appreciatively the nuances of immanental reference of feeling. They may all be grouped, I think, under the general terms, repose, relaxation, expansion. Feelings of expansion have an unusual wealth of descriptive terms at their service. Favorite descriptions are in terms of pervasion, possession. The subject of the emotion describes himself as pervaded—as by an ether, a fluid—as swallowed up by the emotion, and in the mystical amorous and religious literature of which such descriptions are typical, it is with love with the glory or the will of God that the subject is filled. These suggestions, meanings, of feelings are likewise probably aspects or qualities founded in more elementary content. The significance of the terms of their description is to be found in the fact that they specify, in their symbolic way, nuances of that fundamental meaning of feeling which we have called its immanental reference.

That immanental reference of repose, with its expansion of feeling, is a meaning which the feeling gets when the conative tendency or disposition, presupposed, has reached the stage of habit after accommodation. The object of the feeling occupies the whole consciousness but into the meaning of the object is taken up all the accumulated meaning of the processes of accommodation for which the disposition now stands. The reference of the feeling is not beyond the present state but to something more deeply involved in it.

In the case of the term expansion (and contraction its correlative transgredient term) it is obvious that such descriptions are metaphorical transferences from the spatial world of perception, but I think it can scarcely be denied that, as appreciative descriptions, they are as fundamental as the other descriptions transferred from the experiences of intensity and duration. It has been objected to the three-dimensional theory of feeling that if the analogical terms, tension-relaxation, restlessness-quiescence are introduced, there is no reason why the terms contraction-expansion should not be applied. There is none in fact—the only question is whether they are equally irreducible terms of appreciative introspection. With an introspection which is not appreciative we have in this connection no concern.

That contraction-expansion are in this sense fundamental aspects of feeling I think there can be no question. And in this connection it is interesting to note the fact that in a recent study of feeling by experimental methods without these appreciative distinctions it was found impossible to distinguish the feeling tone of simple sensation from a mood or disposition feeling. "The former attaches, so to speak, *to* the stimulus-complex (taste) while the latter spreads *over* the whole consciousness." It was further found that they have different pneumographic expressions. The former is attended by quickening, the latter by slowing of respiration.<sup>1</sup>

B. The relation of this analysis to the so-called three-dimensional theory of feeling developed by Wundt may be stated as follows. For us the terms of this theory are descriptive equivalents appreciative meanings of total feeling attitudes, for Wundt they are qualities of elementary content. The difference arises necessarily from the different points of view from which the description of the same experience is approached. The appreciative descriptions try to fixate the meaning of the conative references (transgredient and immanent) implicit in the feeling attitude, references to preceding and succeeding conation. The analysis of Wundt, on the other hand, seeks to fixate the same experience by terms from which the worth connotation is

<sup>1</sup> G. Störing, 'Experimentelle Beiträge zur Lehre von Gefühl,' *Archiv für die gesammte Psychologie*, Bd. I., Heft 3.

more completely abstracted, where the implicit reference to the self is ignored. Royce, it should however be noted in passing, finds the interest in the hypothesis in the 'statement it makes possible of the relation of feeling and conduct, not adequately conceived on the one-dimensional theory,' a clear recognition of the fact that he is concerned with appreciative description.

This theory, of which Royce's recent formulation is in principle the same, distinguishes three fundamental qualities, of feeling, pleasantness-unpleasantness, tension-relaxation, restlessness-quiescence (or excitement-tranquilization). Concrete feelings represent combinations of pleasantness-unpleasantness with some member of the other groups. There may be a pleasant or unpleasant feeling of tension, as hope or fear, a pleasant or unpleasant feeling of relaxation, as contentment or resignation. These illustrations, it will be observed, are all on the cognitive level of emotion or sentiment. The question is whether they are likewise aspects of simple hypothetical feeling elements, sensation feelings.

That the three dimensional theory constitutes a true description of total feeling attitudes is then scarcely open to dispute. The slightest appreciative introspection enables us to distinguish between the exciting pleasure of hope and the tranquil pleasure of peace, between the painful tension of dread and the equally painful relaxation of despair. The question at issue is not then whether these differences are appreciable among total feeling attitudes and constitute worth suggestions but rather whether they are equally characteristic of sensation feelings. On this question there is no conclusive answer to be made at the present time. Wundt has brought forward experimental evidence in favor of the view that these additional qualities belong also to simple sensation feelings (the feeling tone of colors and sounds, for instance). As to the value of the evidence there is of course still doubt. Some experimenters do not find the modifications of the curves corresponding to the three-dimensional analysis. But even if there were no question in regard to the facts themselves, the meaning of these facts would not be unequivocal. We cannot, for one thing, be sure that while the stimuli are so-called simple sensations the feeling reactions are simple feel-

ings. They may be—and indeed probably are—on the emotional level, the organic and muscular sensations due to the surplus excitation. It is certainly true that the results are most apparent, both in the graphic registration and in introspection, as reference to Wundt's studies will show, in those cases where the reactions are on the emotional level. Besides, as has already been pointed out, although the feeling tone of sensation is itself not worth suggestive, on the level of worth feeling, nevertheless, when the stimulus has reached a certain intensity (or duration) it gives rise to a feeling attitude which is worth suggestive. Until the experimental evidence is more unequivocal both introspection and logic would rather lead to the view that these dimensions of feeling which seem to belong to simple feeling tone of sensation are really qualities of a secondary feeling attitude following upon pleasure-causation. Storring's analyses, already referred to, would indicate the truth of this view.<sup>1</sup>

#### IV.

A. Be this as it may, I think it may nevertheless at least be said that these aspects of experience, whether that experience be a hypothetical feeling element or sensation content, become *worth suggestive*, acquire the transgredient and immanental references only on the emotional level, only when the feeling is a feeling attitude toward an object. And I think it may further be said that the criterion of such a feeling attitude, of emotion (the term emotion being used in its broadest sense to include passion, emotion, sentiment and mood), is the presence of the cognitive presuppositions already analyzed, presumption, judgment and

<sup>1</sup>Recent criticisms of the three dimensional theory have been entirely justified in saying, on the one hand (Calkins), that these qualifications of feeling are taken from the side of conative meaning, and on the other (Washburn), that when we look for content equivalents for them we find them only in sensations, kinæsthetic and organic. Both statements are true and at the same time thoroughly consistent with each other, as will appear in our studies of feeling. It is only in the appreciatively described total meaning of the attitude that these appear as primary qualities of experience. When we take the abstract point of view of function they break up into relations of affirmation and arrest of tendency. When we take the abstract point of view content or structure, they break up into complexes or series of sensations, the reconciliation of structural and functional points of view in psychology is to correlate them both with the appreciative description from which both take their origin.



assumption. What is meant by this, to state the point more fully, is that the differences in feeling attitude appreciatively distinguishable appear only in total feeling attitudes and are not qualities of the mere feeling tone of sensations. It may be that the content which acquires these meanings are certain simple affective or sensational elements but they acquire these meanings only on the cognitive level of emotion.

The view here developed involves the further conception that the criterion of an emotion, a feeling attitude, is to be found in the presence of a cognitive act (presumption, judgment, assumption) as the presupposition of the feeling. Can this view be maintained? I think it may not only be reasonably maintained, but is in fact inevitable if we approach the study of feeling psychoses (on the level of emotion) from the standpoint of their meaning. There is, to be sure, another point of view (the more abstract study of content and of emotional expression) from which this scarcely seems to be the necessary criterion, as for instance in the case of the inherited instinctive emotions, of which the instinctive fears of animals is a good illustration. But while this is true — and with this view of the facts our present analysis must, in its proper place, be brought into harmony, it is nevertheless also true that, as a meaning, an emotional attitude always presupposes such cognitive acts. Joy and sorrow, the two typical and fundamental emotional attitudes which have these worth suggestions or meanings, become meaningless, lose all internal meaning, when conceived apart from these presuppositions. They are usually judgment feelings, although not always such (as Meinong maintains), for they may follow upon simple presumption or assumption of reality. The joy in the presumed, assumed or judged reality of an object is *toto genere* different from the pleasantness of a sensation. And the same is true of those modes of emotional attitude, such as fear, dread, despair, hope, elation, in which the cognitive act is further modified in the direction of mere possibility or necessity. It is further to be observed that, from the point of view of appreciative analysis, these emotional attitudes are variously specified according as the fundamental positive or negative direction has transgredient reference with its tension or restlessness, or immanent refer-

ence with its relaxation and repose. Joy or sorrow, as we have seen, may be of either type. The inevitable conclusion seems to be that these meanings arise only when there is that *totalization* of attitude the condition of which is the actualization of conative dispositions through acts of the type described.<sup>1</sup>

There are, however, certain phenomena which constitute an apparent exception to this law, namely objectless feelings (emotions, sentiments and moods) which are clearly worth-suggestive in our sense and find expression in worth judgments. Practically all the concrete emotional attitudes, joy, sadness, anger, fear, may appear as worth feelings without concrete perceptual or ideal objects. A nameless sadness or fear, an objectless anger, may arise in consciousness with all the worth suggestions of enhanced or thwarted conation, but without any object upon which it is definitely directed. This does not mean that there are not adequate conditions (physiological) but merely that there are not sufficient presuppositions, judgmental reference to the existence or non-existence of objects. They would appear at first sight to be without such presuppositions. In reality, however, they are to be viewed as in the main analogous to the impersonal judgment in the sphere of cognition. As in the impersonal judgment there is no directly asserted subject of the predicate discoverable, so in objectless emotions and moods there is no directly asserted object of judgment to which the worth predicates implied in the feelings of joy, sorrow, etc.,

<sup>1</sup> Wundt (and, it may be added, Höffding before him) makes much of the principle of totalization, of total resultant, in his analysis and theory of feeling. Whatever be the nature of the simple feelings (the manifold elements of content) they all tend to merge in a total resultant a unitary feeling. This principle of 'Einheit der Gefühls-Lage' is referred to the principle of unity of apperception for its explanation, all feeling being viewed as the subjective aspect of apperception. The truth of this general proposition is beyond question but there are different grades of apperception and different degrees of totalization. Undoubtedly when attention is held by a sensation of sound or color, or by an organic sensation, its feeling tone tends to dominate consciousness and to fuse with it all other feeling tones. But it is not until there is explicit reference of the sensation, as object, to a conative disposition through judgment or assumption, that totalization of attitude takes place which gives rise to the worth suggestions of feeling. In such a totalization the feeling tone of sensations, as such, becomes irrelevant and subordinate to the worth feelings of the attitude as a whole.

are applied. Reality is implied—the feelings are real and earnest but there is no existential judgment about any definite object in reality. There is merely an undifferentiated presumption or assumption of reality as presupposition. But this is sufficient to make them worth feelings.

The psychology of the impersonal judgment scarcely leaves us room to doubt of its nature. There is for such judgment neither subject nor predicate, nor reference of the one to the other. It is, so to speak, the amorphous, protoplasmic germ of later reflective judgments which do involve a separation of subject and predicate. Whatever, in the interests of systematic logic, we may seek to supply as the subject of such judgment (in order to bring it within the classifications of logical judgment) — whether we may describe the subject as universal, undetermined, the whole of reality, or as a determined and particular sensation of the moment—the fact remains that psychologically, the ‘*it*’ of the impersonal judgment is contentless. Precisely similarly, in the objectless worth feeling the object is no presentation, with the added judgment of existence or non-existence, no presentation either universal or particular, no sensation either peripheral or organic. Subject and predicate, presentation and feeling are not discriminated. We have to do here with a protoplasmic worth attitude without judgmental presuppositions but which may become definite through inclusion among its presuppositions, which are now merely conative and dispositional, of some explicit act of judgment.

B. Can we then correlate these meanings of worth feelings, thus appreciatively described, with specific types of cognitive presuppositions? The necessary presupposition of worth feeling, as we have seen, is the actualization of a conative disposition through acts of presumption, assumption and judgment. Can we connect the specific type of reference of the feeling with a definite type of actual presupposition?

The two directions of worth feeling (positive and negative), as distinguished from mere pleasantness-unpleasantness, contain some presupposition of reality—witness our study of joy and sorrow, love and anger, hope and despair. And, as we shall see

later, positive and negative worth may vary independently of pleasantness-unpleasantness. But it is with the other qualifications of feeling, references to conation, that we are chiefly concerned. When we turn to the transgredient reference, with its tension, restlessness, contraction, and immanental reference with its relaxation repose and expansion, we find that they are closely connected with changes in the presupposition of reality, with modification of the cognitive presuppositions.

In general the transgredient reference appears in all those emotional attitudes where an habitual presupposition of reality meets with opposition or arrest, where for instance primitive presumption passes into assumption and judgment. In such a case it may be either the subjective control factor, the conative disposition which is felt in the background and gives rise to the assumption, or the more objective factor of control, the cognitive, determining and giving rise to judgment. In either case, however, the transgredient reference is to a disposition in the background, in the process of determining a new accommodation.

The immanental reference to reality, on the other hand, represents the emotional attitude which goes with accommodation realized. It is the feeling which attaches to judgment habit or to the assumption of the second type arising out of that habit. The fact that habit has its own feeling, its own worth suggestions, is a point which must be emphasized throughout.

## V.

A. With the analysis of these primary aspects or meanings which feelings disclose, we are led to the problem of derived or acquired feeling attitudes. There are two possible conceptions of the nature of these attitudes and of the process of their derivation. The first of these is the concept of fusion or mixture of feelings, purely analytical in character. On this view the aspects of feeling, the selective meanings of appreciative description, are hypostatized as elements and all acquired meanings are conceived as fusions or mixtures of these elements. The second concept, genetic and functional in character, looks upon the derived attitude, the acquired meaning, as a new

aspect, the product of a new 'totalization' of consciousness in which the old aspects are taken up into the new, but in which the new meaning is not exhausted by its analysis into the old elements. The new feeling attitude is a new accommodation, a 'progression' in meaning or, in terms of worth theory, a value movement.

The former of these views, of very limited applicability at the best in any region of psychological explanation, is wholly inapplicable to the explanation of the meanings of feeling attitudes. Wundt, unfortunately, despite his three-dimensional theory, is still too much under the influence of this conception, although in applying his fundamental law of psychical causality, the law of resultants, he explicitly asserts that there is an acquired meaning in the resultant complexes or fusions not found in the elements. It is better to abandon the concept of elements entirely in this connection and to make use wholly of the genetic concept of progression or acquirement of meaning through change in presuppositions.

The acquired qualifications, selective meanings of feelings may be divided into two groups: (1) the acquired meanings of simple appreciation and (2) those of characterization and participation. If we recall these distinctions, previously made, it will be remembered that simple appreciation of an object is an appreciation of its affective-volitional meaning or worth prior to explicit reference of the object to the Ego or the Alter or to other objects, prior, in other words, to secondary possessive or instrumental judgments. On the level of simple appreciation appear, then, certain qualifications of the general transgradient and immanent references of feeling.

B. The first of these acquired meanings to be considered is the feeling of *oughtness* or *obligation*. The feeling of oughtness that *a thing should be*, that an act should take place, is a specific form of the feeling of worth. As such, upon our view, it should be defined in terms of its presuppositions. Appreciatively described, it is an acquired modification of the general feeling of transgradient reference, of tension. Apart from appreciative description it is an experience of mere strain, per-

haps, from the point of view of content, a mere strain sensation. Its differentia is to be found in the precise character of the transgredient reference and therefore in the character of its cognitive presuppositions. Now the feeling of oughtness, in its simplest form, attaches to objects, to things. It is felt that if a thing does not exist it ought to. As thus applied (for instance by a child who as yet has practically no sense of personal, ethical obligation) it means little more than that the thing is desired. But just that little additional meaning is the important modification. Is it possible to define that additional meaning?

The point of difference is to be found, I think, in the fact that the presuppositions of the feeling of oughtness are not simple as in the case of a simple mode of feeling or desire. The feeling of oughtness is in fact a transition mode between two existential judgments, in which an existential feeling is qualified by an assumption feeling. The object does not exist, and we have the corresponding feeling or desire, but so strong is the conative disposition presupposed, that it gives rise to an assumption of existence. This assumption is felt to be not merely possible but necessary and thus, as Simmel has said, obligation is in one aspect a mode of thought lying midway between possibility and necessity.<sup>1</sup> The source of this assumption is the subject's conative disposition and the feeling of oughtness is the feeling of that subjective control, but, since the subjective control is not explicitly acknowledged in judgment, the oughtness is felt as a tertiary quality of the object.

The transgredient reference of the assumption is therefore to the disposition. To refer again to the figure of the foreground and background of consciousness, the judgment of existence or non-existence of the object is in the foreground, the modification of the feeling which we describe as oughtness has reference to an object in the background which at first is revealed merely in this modification of feeling, but which later, through the activities of ideal construction and judgment, becomes an explicit ideal object, the self or the social will, when de-

<sup>1</sup> Simmel's masterly study of the mode of oughtness, *das Sollen* ('Einleitung in die Moralwissenschaft') can be merely referred to in passing, fuller treatment being reserved for another connection. The important point is that it is a fundamental mode, at the same time cognitive and affective-volitional.

veloped ethical obligation is felt. In a sense the simple feeling of oughtness is objectless until this stage of ideal construction is reached.

C. Corresponding to the feeling mode of oughtness, the primary mode out of which ethical obligation develops, we find a second mode of simple appreciation which represents a special qualification of the immanent reference of feeling, the 'semblant' or æsthetic mode.<sup>1</sup> This mode, the æsthetic psychosis, is always appreciatively described in terms of repose and expansion and its worth, in so far as the experience is purely æsthetic, is immanent. Here again, we have, not a simple aspect of feeling with simple presuppositions, but an attitude implying transition and accommodation, characterized by typical changes in cognitive presuppositions.

The characteristics of this mode of feeling, its repose, relaxation and expansion, have their origin in the fact that the judgments of existence and non-existence, and with them explicit conation, desire, are inhibited, reduced to a minimum, remain in fact merely as a dispositional presupposition, while consciousness is largely absorbed in presentational content. With the laws governing the ordering of that content, which condition the arrest of desire and the inducing of repose, we are not at this point concerned; it is sufficient to note the general fact that formal principles of the æsthetic owe their significance psychologically to the fact that they are instrumental in producing this effect. But, as has already been pointed out, it is not an adequate view of the æsthetic to regard it as a purely presentational consciousness. While explicit judgment is reduced to a minimum, its place is taken by assumptions which relate the object to the desire which is now merely dispositional. These assumptions, we have seen, may be of two types, the assumption which takes the place of primitive presumption after arrest, and that which becomes the substitute for the disposition or habit created by judgment and desire. In the first case we have the

<sup>1</sup>For the use of the term 'semblant mode,' see Baldwin's *Thought and Things*, Vol. I., especially Chapter VI. As to the complete identification of *sembling* with *Einfühlung*, I think there is some doubt, since the latter, in at least some of its aspects, is earnest, and the feeling has presumption and judgment — not merely assumption — as its presupposition.

primitive semblant mode, in the latter the more developed mode of contemplation.

In general, then, the æsthetic mode of sembling or contemplation is a complex, derived, mode of feeling of value in which the presuppositions are presentational content and assumptions. To use again the figure of the foreground and background of consciousness, the foreground is taken up with presentational content, the psychical energies involved in judgment are occupied with the activities of mere apperception of content in its relations, with contemplation, while in the background remains the assumption of existence, with its reference to conative dispositions. While the object is detached from immediate desire, its relation to desire is not severed. The object has its own reality coefficient and the feeling is a feeling of value. The source of these assumptions and of the objectivity, reality, which the object has, differs in important respects from that of the assumption in the feeling of oughtness. While the control is still partly subjective, is determined by conative disposition, the objective factor, the presentational content has a much larger share in the determination of the assumption.

An illustration will show the situation with greater clearness. The æsthetic appreciation of feminine beauty is a psychosis grafted immediately upon desire and desire dispositions. The process by which the æsthetic psychosis supervenes upon that of crude desire is one of arrest, social and individual, and a rearrangement of the elements of the object presented either unconsciously, or consciously as in art, in such a manner as to fill the foreground of consciousness with presentational activity and to detach the object from immediacy of desire. An implicit assumption of the existence of the object for desire is, however, a necessary presupposition of the æsthetic appreciation. Should the conative disposition become explicit in actual desire, the æsthetic repose would cease and a new adaptation take place.

In both these appreciative modes, it should finally be observed, worth or affective volitional meaning has been acquired. The deepening of the transgredient or immanent reference, as the case may be, becomes part of the funded meaning of the object, or is imputed to the object. The recognition of this fact



is of far reaching importance for all the meanings acquired in these modes of appreciation enter in as determinants in later judgments of value.

D. Simple appreciation, with its two primary modifications described, is further differentiated into secondary acquired meanings, through certain value movements, progressions, the nature of which is to be considered more fully later, but which we may here ignore for the reason that our problem is merely appreciative description of feeling attitudes. These meanings are those which we describe as *personal* worths (of possession and merit), instrumental or utility meanings (values of *utilization*) and the common meanings, or feelings, of *participation* value. The characteristic of all these modifications of primary feeling of value is to be found in the fact that they arise through the establishment of *relational* judgments between the object and the disposition presupposed. Otherwise expressed, that which in simple appreciation was a merely *felt* transredient or immanent reference, now acquires its explicit object which is acknowledged in judgment.

An analysis of the personal feelings makes this point clear. The feeling of possession is more than the feeling of the worth of the object, as presumed, judged or assumed to exist. The object acquires an imputed value through the explicit acknowledgment of the subject for which it exists. So also in the case of the feeling of personal obligation or merit which arises on the basis of a reference of the valued disposition to the personality. In general we may say that the personal feelings have an additional presupposition of reality which the primary feelings have not. But the more developed modes of these primary feelings, the obligation and the semblant are germinal to these personal values. They are transition stages in which a new feeling mode is introduced, through the transredient or immanent reference arising upon assumptions. In the case of the personal value the assumption becomes an existential judgment of acknowledgment of the self. Of course such a transition requires ideal construction of the self, and this involves the 'feeling-in' of primary experiences into others — an extension of

simple appreciation through sympathetic *Einfühlung*, a process to be studied in another connection.

The impersonal feelings of the participation values or utility values of dispositions and objects involve a further extension of this acquirement of common meaning. In addition to the presupposition of the reality of the desired object there is an additional presupposition of similar desires and feelings in the minds of others which gives rise ultimately to judgments and assumptions of over-individual demands. How such presuppositions arise is again, of course, a genetic problem of psychology, more especially of the study of the laws of sympathetic imitation and *Einfühlung*; the main point here is that the appreciative differences in the meaning of the feelings arises through acknowledgment of references which were previously merely implicit.

And it should be noted finally that just as the transgredient and immanental references acquire depth of meaning through the obligation and æsthetic modes, so in these further processes primary feeling is deepened and broadened.

#### IV.

A. Worth predicates have been defined as funded meanings of the objects. These predicates or meanings correspond, we have seen, to certain qualitative aspects of feeling, primary and derived. But these meanings or values have also a quantitative aspect, of degree. To what aspects of feeling do these differences of degree correspond?

It has been already pointed out that many psychologists have found it necessary to distinguish between degree of feeling of value and degree of intensity of sensation-feeling and some have used such terms as depth and breadth of the feeling in the personality to characterize quantitatively the worth suggestion of the feeling. And when we follow more closely the appreciative distinctions made in the sphere of worth experience it becomes clear that some such distinction is necessary. For in the first place it is to be observed that, if we make use of those appreciative descriptions of feeling subsumed under the general terms transgredient and immanental references, we cannot

properly apply the quantitative term intensity. While, for instance, we may speak of the degree we cannot properly speak of intensity, of repose or expansion. Here we must use the terms depth and breadth. Thus we find Munsterberg<sup>1</sup> accepting the ordinary formula that intensity of feeling decreases with repetition and at the same time, in his desire to do justice to the concrete facts of worth experience, insisting that repetition may increase the *depth* of feeling tone. Clearly depth and intensity are definitely distinguished and admitted to be independently variable. It would appear, then that we must make a distinction between degree (or intensity in the broader Kantian sense) and intensity in the narrower sense of sensational intensity, between degree of feeling of value and intensity of pleasantness-unpleasantness as feeling tone of sensations. Intensity in this latter sense applies to all sensation feelings, 'pleasure-causation' as we have described it, and probably to all sensation feelings which enter into a total feeling complex, but properly speaking not to feeling attitudes, not to the worth aspect of feeling.

What then is the relation between the degree of acquired meaning, value, of a feeling attitude and intensity of pleasantness-unpleasantness? How are they related for appreciative introspection and analysis, and how shall this empirical relation, when determined, be connected with our analysis of the conditions, actual and dispositional, of these two aspects of feeling? This question is of the utmost importance not only because of the fact that it is a problem implied in our preceding distinctions between feeling of value and pleasantness-unpleasantness, between pleasantness-unpleasantness and the appreciative aspects of feeling attitude, its selective meanings, but also because in the solution of this problem is involved the whole question of the measurement of feelings of value to which we must presently turn.

B. We find, then, that not only is worth experience distinguishable, in the aspects both of quality and degree, from pleasure-causation, but also that the worth modifications or suggestions of feeling are to an extent variable independently of hedonic

<sup>1</sup> Münsterberg, *Grundzüge der Psychologie*, p. 39.

intensity. Two phenomena of our worth experience indicate this relation. (1) Positive worth feeling may exist side by side with unpleasant experiences and negative worth feeling with pleasant. (2) Degree of worth feeling may increase with decrease of hedonic intensity and there are numerous instances where worth feelings are practically intensitiless. These facts have led to the general conception of the irrelevance of the hedonic aspects of a total attitude for worth judgment and the formulation of Brentano's term 'hedonic redundancies' to describe them.

We shall examine the facts briefly and then turn to a consideration of the theories of the relation of the two distinguishable aspects. The first phenomenon is well illustrated in the classical description of Lessing. In a letter to Mendelssohn he writes: "Darinn sind wir wohl doch enig, lieber Freund, dass alle Leidenschaften entweder heftige Begierden oder heftige Verabscheuungen sind? Auch darinn: dass wir uns bei jeder heftigen Begierde oder Verabscheuung eines grösser Grads unserer Realität bewusst sind und dass dieses Bewusstsein nicht anders als angenehm sein kann? Folglich, sind alle Leidenschaften, auch die allerunangenehmsten, als Leidenschaften, angenehm." The paradox of calling that which is unpleasant pleasant, and the lack of adequate analysis in this description, should not blind us to its essential appreciative truth. While the same feeling cannot at the same time be both pleasant and unpleasant, it is quite possible that we are concerned here with two feelings in certain relations to each other.

Plausible explanations have been given from the point of view of the identification of worth feeling with pleasure-causation. It might be said that we have to do here with an illusion of judgment, that what was formerly unpleasant has really become pleasant through change in physiological disposition, and that the unpleasantness instead of being real is merely a memory of former unpleasantness. It seems hardly necessary, however, to deny, in the interests of theory, what is a fairly constant deliverance of appreciation, namely that positive worth feeling may be coexistent with actual unpleasantness. Or it has been

<sup>1</sup> Quoted from Hirn, *Origins of Art*, London, 1900, p. 60.

said that we have a simple case of mixed feeling. A pleasant and unpleasant sensation feeling may exist side by side in the same state of consciousness (as for instance the pleasant taste of sugar and the unpleasant sensations of satiety as they are just beginning to appear)—why should not two worth feelings or worth feeling and simple pleasantness or unpleasantness? To this we may answer that the two cases are not parallel. The inapplicability of the concept of mixture or fusion to feelings of value we have already pointed out and in this case the figure is especially misleading.

If we look at Lessing's description more closely we find that his paradox really arises from a failure to analyze—to distinguish between two aspects of the total psychosis, the feeling of value and the irrelevant hedonic accompaniments. The situation he describes admits of two interpretations. On the one hand the passion, of anger let us say, is really a feeling of negative worth, with certain cognitive presuppositions, unpleasant, as Lessing says. It is quite possible, however, that the organic disturbance may be pleasantly toned, especially after long continued arrest, with its accompanying strain sensations negatively toned. We have here then pleasant accompaniments of a feeling of negative worth. On the other hand, it is equally possible that what Lessing calls the pleasantness of the unpleasant passion may really cover a gradual transition from one feeling of value to another, and what he calls the pleasantness of the psychosis may be a feeling of value of the personal type. The object itself may have negative worth while the entire experience of having such a passion, or in fact the knowledge of the capacity for such reaction, may give rise to a feeling of satisfaction, of personal worth. This might even extend to such passions which have unpleasant hedonic accompaniments. Feelings of value might be accompanied by unpleasant sensation-feelings.

The second group of facts which lead to this appreciative differentiation of degree of intensity of pleasantness-unpleasantness from degree of worth or meaning of the feeling, are the so-called intensitiless attitudes or acts of valuation or preference. Here, it is maintained, quasi-logical modifications take the place

of intensity. If we begin with those two primary modifications of simple appreciation, the ethical and æsthetic, we find intensity giving place to other modifications. A quiet sense of obligation may reveal a degree of worth of an ideal object which the intensest passion or emotion does not suggest. Similarly in the æsthetic, semblant mode a degree of immanent worth may be suggested in the depth and breadth of the feeling when the element of intensity is reduced to a minimum. But still more evident do these facts become when we pass to the secondary, derived feelings, the personal and the impersonal over-individual references. In a case of preference between objects to which these feelings correspond, a relatively intensitiless feeling of personal worth may have an affective-volitional meaning which the intensest passion connected with a condition worth has not, and so with the over-individual feelings. If then by intensity we mean not the broader Kantian conception of any modification of degree of inner experience, but that particular degree which applies to sensation and feeling tone of sensation, there can be no question but that worth feelings, as determined by judgment and assumption, may be practically intensitiless. These acts are of course causally connected with sensation tendencies, both peripheral and organic, and every such act has as accompaniment secondary hedonic resonances of more or less intensity, but the point is that appreciatively we can distinguish the two factors and are aware that the latter do not determine the worth judgment.

The facts upon which this hypothesis of independent variability of the two factors in a total worth attitude is based are now before us, as well as some insight into the subordinate role which the hedonic resonance plays in worth judgments. We are, however, as yet wholly without any conception which will enable us to understand this relation functionally.

C. There are two general theories of this relation, which may be described as the dualistic and monistic, or genetic. The dualistic theory is represented by Brentano and Schwartz. In Brentano's view,<sup>1</sup> as we have seen, any concrete attitude of valu-

<sup>1</sup> Brentano, *Psychologie*, especially page 197. Also *Ursprung der sittlichen Erkenntniss*, especially page 86.

ation can be analyzed into two aspects, intensitiless acts of preference, acts of love and hate, and the hedonic redundancies which accompany them. To the latter, as sensation feelings, belong alone, properly speaking, degrees of intensity. To the primary reaction belong quasi-logical directions, worth suggestions, which give rise to worth predicates and judgments. In Schwartz's view<sup>1</sup> feeling intensity belongs to the passive side of consciousness while degrees of worth to the active, voluntaristic side. They appear in the form of acts of analytic and synthetic preference. The essential of both conceptions is the dualism between feeling and will, and the reference of worth distinctions to modifications of will.

The facts which have given rise to this theory are, as we have seen, true enough. So also is the conception of hedonic redundancies, in so far as it merely describes for appreciation the functional relation of these two aspects. But it is far from certain that it is necessary to draw their dualistic conclusion. That would follow only on condition that feeling and will are totally different elements and the distinction between them as active and passive is ultimate, and secondly, that the only modification of feeling which could be made the equivalent of degrees of worth is hedonic intensity.

Whether these assumptions are necessary must be determined ultimately by a consideration of the whole question of the psychology of feeling and will and their relations, which must be reserved for another connection. It will be sufficient here to deny the necessity of such assumptions, and in the meantime to suggest a second possible conception, monistic and genetic in character. Feeling, according to our analysis, has other modifications, other meanings than passive pleasantness unpleasantness, transredient and immanent references to conative dispositions. These references which arise only when the disposition is actualized by cognitive acts of presumption, judgment, assumption, are signs of the affective-volitional meaning of the object, its relation to conation. Feeling as passive is therefore not to be separated from will as active. But more than this — these references, these aspects may, con-

<sup>1</sup>Schwartz, *Psychologie des Willens*, Chapter II., also Appendix I.

ceivably,—with repeated actualization of the dispositions—become differentiated, as selective meanings, from the aspect of hedonic intensity, and increase in depth and breadth. If this view should prove tenable, we should have a relation analogous to that between the general concept and the particular presentation. As the meaning of the concept develops with actualization of the judgment disposition in successive cognitive acts, the particular presentation becomes less and less significant, until what is practically imageless apprehension may appear. So also with the development of the selective meanings of feeling attitude, the hedonic resonance may become less and less significant until relatively intensiless appreciation of the worth of the object appears. The substantiation of such a conception of affective generalization involves a more extended excursion into the psychology of feeling. Here we may merely note the fact that such feeling attitudes exist, in the case where the presuppositions are assumptions, either of the explicit or implicit type.

#### V.

A. In concluding this study we may with advantage return to a consideration of that preliminary definition of worth and worth predicates from which this entire analysis took its start. This analysis, it will be seen, has given content to that definition. It has also given us the ground work for further researches into the principles governing the concrete phenomena of valuation of different types, economic, ethical, æsthetic, etc. A more general view, both retrospective and prospective, will serve to give unity to the results attained.

In general, we found worth or value to be the funded affective-volitional meaning of the object for the subject. That funded meaning, expressed in terms of the worth predicates, goodness, utility, beauty, obligation, desert, etc., represents the desirability of the object (although not necessarily the fact of actual desire). The funded meaning is acquired through actualization of conative dispositions by acts of presumption, judgment and assumption, and this actualization results in feeling which undergoes certain modifications, with change in presuppositions, and with repetition. This feeling, with its modifica-



tions, reflects the funded meaning of the object. Worth predication, in the aspects both of quality and degree, is determined by appreciative modifications of feeling which in turn are determined by changes in presuppositions of the feeling.

To these funded meanings, roughly classified as simple appreciation of objects (with its obligation and semblant modes) personal worths of characterization, and common over-individual values of participation and utilization, correspond certain classes of objects, primary and founded, perceptual and ideal. All these derived objects, with their corresponding attitudes, are perceptual and ideal constructions which emerge, through certain value movements or progressions, from simple appreciation. The genesis of these objects, with their corresponding predicates, is one of the chief problems which present themselves. This differentiation and fixation of objects and predicates of valuation must be traced to fundamental laws of psychical process, of processes by which affective-volitional meaning is acquired. These laws we may describe as the Laws of Valuation.

B. But worth predication has a quantitative as well as qualitative side. Worth judgments express the degree of preferability of one object over another (as well as degrees of preferability of amounts of the same object). We are thus led to the problem of the measurement of the worth or funded meaning of objects. At this point several questions arise. Is worth or value, as we have conceived it, an object, a function, to which the concepts of quantity and measurement can be applied?

In answering this question we must first note the fact that such quantitative judgments do exist. Within the various regions of worth predication numerous empirical uniformities are discoverable connecting quantity of object with degree of worth predicated. Thus in the region of economic 'condition' worths, there are certain empirical laws connecting changes in the intrinsic desirability or in the utility (instrumental desirability) of an object with changes in its quantity. In the region of personal worth judgments the obligation or desert predicated varies in certain definite ways with changes in the

amount of the object (in this case in dispositions displayed). The same is true of those judgments upon dispositions according to their over-individual, participation value. It is clear then that merely empirical relations of a quantitative character may be established between objects and their worth predicates or funded meanings. But such empirical laws would constitute no explanation, nor would they enable us to establish relations of degree between objects of these different types. While we might formulate empirical statements of dependence of degree of value of the object upon changes in the object without formulating any theory of the psychological grounds for this dependence, this measurement must, if it is to lead to any insight into the nature of worth judgments, involve the reduction of these empirical uniformities to more ultimate psychological laws.<sup>1</sup>

The question whether worth, or funded meaning of an object as we have defined it, is susceptible of measurement is reduced, then, to the still more fundamental question whether the psychological determinants of that meaning are objects of measurement. Into the acquired, funded meaning of an object enter various elements presupposing various processes and attitudes. If these can be analyzed out and their contributions to the total worth of the object determined, such measurement is possible. On the view which we have rejected — that degree of worth is to be equated with degree of intensity of pleasantness-unpleasantness (or as sometimes formulated, with a function of intensity and duration)—the problem is, at least theoretically, simple. The laws of habit, satiety, contrast, etc., for sensation feelings might be applied directly to feelings of value. But such a procedure is impossible after our analysis. The

<sup>1</sup>Thus to take an illustration from another region of psychology, the significance of the empirical formulation of Weber's law for perception holds good irrespective of any theory of its psychological explanation. Or, to take another illustration from a more closely related region of investigation, from a special region of economic worth analysis, the law of marginal utility is an empirical law which holds, within limits, irrespective of its interpretation and is capable of explanation in terms which do not necessitate the hypothesis of continuous change in hedonic intensity. We must therefore distinguish between the merely empirical formulation of more and less and our theory of the psychological determinants of the change in worth or affective volitional meaning of the object.

psychological determinants are for us more complex. Having defined feelings of value as feelings presupposing dispositions actualized by presumption, judgment and assumption, our problem is the determination of the capacity of the object, as presumed, judged or assumed to exist, to call out feelings of value. Since the worth of the object is a function of the capacity of the subject for feeling, as determined by these preceding processes of accommodation in judgment and assumption, we must inquire into the effect of these processes upon the dispositions presupposed. The analysis and formulation of these factors constitute the laws of valuation. Such laws are capable of determination, and when determined they enable us to explain the empirical laws of 'more and less' already described.

## A STUDY OF AFTER-IMAGES ON THE PERIPHERAL RETINA.

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In a recent paper in this REVIEW<sup>1</sup> Miss Grace Fernald discussed the effect which the brightness of different backgrounds has upon the color tone of stimuli seen in indirect vision. Her work, performed in this laboratory, suggested to the writers a research in which peripheral after-images should be observed with special reference to the brightness of the backgrounds upon which they were cast. So far as the writers know this is the first systematic study of this particular point. For a general statement about peripheral after-images the reader is referred to Dr. Baird's work 'The Color Sensitivity of the Peripheral Retina,' pp. 63-65.

The following experiments were made in the laboratory of Mt. Holyoke College and extended through the academic years of 1904-1906. The subjects were Miss Lucia Bradley B, Miss Mabel Fernald F, students who had had laboratory training but who did not know the purpose of this research, and the writers T and G. T and G did not anticipate the results and avoided as far as possible any speculation during the progress of the investigation. All these subjects had normal color vision, except for the fact that B had color processes of unusual duration.

All observations were made upon the light-adapted eye and in daylight illumination. The walls and floor of the room were colorless; white curtains at the windows were lowered on bright sunny days and drawn aside at other times; nearly all work was done in the morning between the hours of nine and twelve, and on very dark days no experiments were made. As stimuli we used nine colors of the Hering tissue paper series; carmine, red, orange, yellow, green, blue-green, green-blue, blue and violet. These colors were shown upon back-grounds of differ-

<sup>1</sup> Vol. XII., p. 386 ff.

ing brightness made of papers taken from the Hering gray series. The five following backgrounds were used: paper no. 1 called white, no. 3 which matched the yellow tissue paper in brightness and was called the yellow background, no. 7 which matched the green in brightness, no. 38 which matched the blue and no. 50 which was called black. The greater number of readings was taken on the yellow, green and blue grounds (want of time prevented work on a background matching red). In matching the above colors in brightness two methods were followed; first, in indirect vision the point was found where yellow (resp. green or blue) looked gray, and the color was then exposed on a variety of the Hering grays until the best match was determined on; in the second place a small patch of gray was pasted on a disc of color and the disc rotated, and the gray selected which appeared to make least change in the brightness of the color. These tests were made on several subjects and at various times.

The apparatus and method of color-exposure were the same as those described by Miss Fernald.<sup>1</sup> The papers which served as backgrounds were mounted upon a campimeter, and along this campimeter fixation points were marked. The colors, however, were always shown from the same point, *i. e.*, directly below the eye. At the beginning of each test the subject stood with the head bent over the campimeter, the eye being steadied by a rest moulded to suit the brow and cheek-bone, and looked down through a small circular opening in the campimeter into a mirror below. The precise adjustment of the eye was accomplished by means of this image in the mirror; with one subject, for example, there was only one position in which the eye could see itself in the glass, and at the same time get the two corners of the eye in line with the row of fixation points on the campimeter. The subject's field of view is pictured in Fig. 1. She stands at *X* looking down with the right eye at *Y*. Starting then from this constant position the eye could be turned to any desired fixation point. As soon as a fixation had been taken, the color to be exposed, covered by a gray screen like the background, was laid over the mirror; the gray screen was then taken off and the color shone up through the opening at *Y*

<sup>1</sup> *Op. cit.*

and stimulated an eccentric part of the retina. When the stimulation had lasted the desired time the screen was again put over the color, thus making with the campimeter a uniform

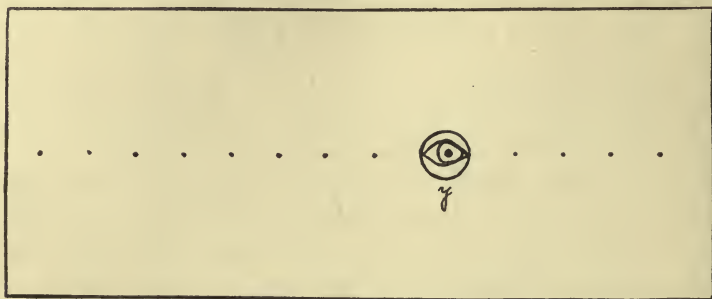


FIG. 1.

gray surface upon which the after-image could be observed.<sup>1</sup> The size of the retinal image is thus kept constant throughout the experiments, *i. e.*, its distance and relative position to the eye being constant, its absolute area in this case was that of a circle about 1.08 mm. in diameter.<sup>2</sup> Twenty fixation points were used, the retinal area explored extending from 0° — macular vision — to 93° of eccentricity. These points were all on the nasal meridian of the right eye. The location of the blind-spot was determined for all subjects and no stimulus allowed to come near enough to have its effect diminished.

Two plans were followed in regulating the time of exposure for the stimulus. In the first set of experiments the stimulus was allowed to remain until the color had completely faded, and at the spoken signal 'gone' from the subject the gray screen was replaced and the subject left to observe the after-image until it too had completely faded. On the periphery these times were not long enough to be fatiguing to the subject, but in the paracentral region the process of waiting for a complete fading was found somewhat exhausting. The time was, therefore, in this region limited to 45 seconds (in a few cases to 30 sec.), but the after-image as before was observed until its complete disap-

<sup>1</sup> For further description of apparatus cf. Miss Fernald, *loc. cit.*

<sup>2</sup> Distance from cornea to middle of circular opening in campimeter = 172 mm.; from anterior surface of cornea to nodal point of eye (after Foster) = 6.7236 mm.; from nodal point to retina = 16.0954 mm. Diameter of color shown = 12 mm.

pearance. In the second series the time of all exposures was limited to 3 seconds<sup>1</sup> and the after-image watched until completely faded. Between the complete fading of an after-image and giving a new stimulation an interval of 2 minutes was given. All times were kept by a stop-watch.<sup>2</sup> Colors were presented in constantly changing order, so that the subject could not anticipate them.

Judgments of color tone were made with reference to a mental standard, and color names were clearly understood before the tests began. A little practice showed that it would be convenient to distinguish about nine intermediate tones between neighboring colors, *i. e.*, nine tones between the colors under each bracket, carmine, red, orange, yellow, green, blue-green, green-blue, blue, violet, including only nine gradations between green and blue. The following abbreviations are used in tabulating results: for carmine, *car*, orange, *or*, yellow, *yl*, green, *gr*, blue, *bl* and for violet, *vi*; for the intermediate hues, *e. g.*, between *car* and *red* there is (1) a very slightly reddish carmine recorded as — *red-car*, (2) a slightly reddish carmine = *red-car*, (3) a reddish carmine = *red-car*, (4) a decidedly reddish carmine = *red-car*, (5) a color half way between red and carmine *car + red*, (6) a decidedly carmine red = *car-red* and so on to pure *red*, the complete series being

*car*/— *red-car*/= *red-car*/= *red-car*/= *red-car*/*car + red*/= *car-red*/= *car-red*/= *car-red*/— *car-red*/*red*.

<sup>1</sup> Subject B felt somewhat hurried and dissatisfied with so short a time, and the exposures were in her case lengthened to 4 seconds.

<sup>2</sup> Since the completion of our work Dr. Baird's monograph 'The Color Sensitivity of the Peripheral Retina' has appeared, and in this it is reported, p. 47, that an interval of 6 minutes was allowed between stimulations. We believe, however, that for daylight vision our interval of 2 minutes is satisfactory, and for the following reasons: (1) Our interval was not from the beginning of one stimulus to the beginning of another, but from the end of a completely faded after-image to the beginning of the next stimulus, (2) Since we worked in daylight illumination and with only reflected light from pigment colors it is probable that our stimuli were relatively less intensive, and (3) An additional series of tests was made in which an interval of 5 minutes was maintained and the results of these tests are in harmony with our previous results. These last tests are recorded in Tables XXIV.—XXXII. Subjects were G (Gordon) and F (Fernald).

If, now, a stimulus is given several times at the same fixation point, and a series of different judgments made, the mean judgment is found in this way; in the series — *car-red*, *car + red*, = *car-red*, the middle color is = *car-red*. The middle variation must depend upon the position of the three colors in the series between *car* and *red*. According to this the = *car-red* is two steps from *car + red* and two steps from — *car-red* and the middle variation is then 2.

In the tables on page 135 ff, the stimulus is given at the top of each table, the first column at the left gives the number of degrees of eccentricity of the retinal point stimulated, the columns headed nos. 1, 3, 7, 38 and 50 contain the results for the backgrounds whose brightnesses were those of white, yellow, green, blue and black respectively. In each of these columns is recorded (1) the number of experiments made, (2) the middle judgment as to what the stimulus color was, *i. e.*, 'color seen,' (3) the middle variation for such judgments, (4) the middle judgment on the color-tone of the after-image, and (5) the middle variation for these judgments. In the last ten tables only one test was made at each point, hence columns (1), (3) and (5) do not appear.

## RESULTS.

### I. *Extent of the Color Field.*

On the darker backgrounds the colors are seen farthest out in the periphery; for example, green, Table V., is visible as *gr* out to  $73.5^\circ$  on the *yl* ground, visible as *gr + yl* to  $76.5^\circ$  on *gr* ground, as = *gr-yl* to  $79^\circ$  on *bl* ground, and is seen as *yl* to  $87.5^\circ$  on the *gr* and *bl* grounds. No conclusion can be drawn about the relative extension of blue and yellow, red and green since we worked with pigment colors varying in their brightness, saturation and purity of color tone.

### II. *Color Tone of Stimuli as Perceived.*

1. *Affected by Retinal Location.* — At the extreme periphery all colors looked gray; next within this zone was a region where, at least on the dark backgrounds, all colors tended towards *bl* and *yl*, and within this zone was the region of full color vision. No indication appeared of the "gegenfarbige



Zone" of which Hellpach<sup>1</sup> writes, except in the case of one subject and here for one color only, *i. e.*, Table XXVI., F saw *gr* five times as an unquestioned *red*. However, this one instance does not occur in a region outside of the black-white zone as Hellpach's theory demands.

2. *Effect of Background upon Color Tone of Stimulus.*— A given background appears to enhance that color component in the stimulus which differs the more from itself (the background) in brightness. *Or*, for instance, looks = *red-or* on the light grounds but a = *or-yl* on the dark. This tendency of the background to alter the color tone of the stimulus frequently works against the tendency above referred to, namely, for all colors to approach at the periphery either *bl* or *yl*; for, as in Table II. on the light grounds *red* stays *red* as long as it is seen at all, and, Table V. on the light grounds *gr* stays *gr*. Up to this point our work merely repeats and confirms facts which Miss Fernald has already established.

### III. *Color Tone of After-images.*<sup>2</sup>

There are at least five factors which must be considered as coöperating to determine the color tone of the after-image.

1. First and most obvious is the color of the stimulus. If this alone were operative and if it were seen in its proper hue the after-image would probably be a perfect complementary.

2. A second factor in the color tone of the after-image is its retinal location. As an after-image approaches the periphery it tends to become either *bl* or *yl*. Thus in Table II. on the *yl* ground although the stimulus *red* is seen as pure *red* out to 73°, yet the after-image which from 0° to 49° is = *gr-bl* is from 49° to 73° a pure *bl*. In Table V. ground for *yl* the stimulus *gr* is seen as pure *gr* out to 73° but the after-image is from 0° to 55° — *red-car* or *car* and from 55° it takes on a distinctly more bluish color. Once more, Table VIII. ground for *yl*, *gr* and

<sup>1</sup> 'Die Farbenwahrnehmung im indirecten Sehen,' *Phil. Stud.*, XV.

<sup>2</sup> It was stated above that in one series of tests the stimulus was allowed to remain exposed until it had completely faded from sight, except that stimuli lasting as long as 45 seconds were stopped at that time, and that a second series had the stimuli limited to 3 and 4 seconds duration. This difference in the stimuli seemed not to affect the color tone of the after-images and the results of the two series are therefore not entered separately in our tables.

*bl*, the stimulus *bl* is seen almost without exception as pure *bl*, but the after-images, which vary considerably farther in, all approach pure *yl* in the periphery. This result agrees with the experiment recorded by Baird.<sup>1</sup>

3. *Effect of Background on the After-image.*—This is a somewhat complex effect and may be regarded as acting in three ways.

(a) As we saw above, the background is first operative upon the stimulus color which it surrounds. To trace, for example, the career of an after-image of *red* we must start with the complementary of *red* which is *gr + bl*. Now on a dark ground this stimulus looks not *red* but an *or-red*, so that we should expect to find for its after-image not *gr + bl* but a color shading more into the *bl*, a *gr-bl* then.

(b) But our *gr-bl* after-image must itself appear upon a dark ground. The same dark surface surrounds this image which surrounded the stimulus, and we must assume that its power of producing a simultaneous contrast effect is still present. This effect would tend however to bring out the lighter or *gr* component in our after-image thus shifting it back towards *gr + bl* or even *bl-gr*. Thus factor (a) and factor (b) tend to neutralize each other. Finally,

(c) The after-image is not merely surrounded by the dark surface but is being cast upon it and so mixed with the light which comes from it. Now since the effect of simultaneous contrast is probably cancelled, as shown above, we may assume that the two most important determinants of the after-image are its stimulus color and the amount of light with which the image is mixed when it is cast upon its background.

The effect of the background then seems to be this; that in a colored after-image, that color element is emphasized which in brightness approaches the brightness of the background, that is, on the lighter grounds the brighter element comes out and on the darker grounds the darker color element. The transition is nicely illustrated in Table V. at 11.5°. On the white ground the after-image for *gr* was  $\equiv$  *red-car*, on the *yl* ground  $\equiv$  *red-car*, on the *gr* ground  $\equiv$  *vi-car*, on the *bl* ground  $\equiv$  *car-vi*, and on the black ground  $\equiv$  *car-vi*. At 59.7° the change

<sup>1</sup> *Op. cit.*, pp. 64-65.

runs *car*, — *vi-car*, = *vi-car* = *vi-bl*, *vi*. Not every point exhibits so regular a transition, but the general distinction between light and dark grounds remains apparent. It is, perhaps, most striking in the after-images for *bl*, since here the stimulus is most often seen in its true color tone and the change made by the background is best isolated. The after-image for *bl* ranges from = *gr-yl* and pure *yl* on the light to = *yl-or* and even = *or-red* on the dark grounds. In Table XXVII. the after-image of *gr-bl* is pure *yl* on the *yl* ground and pure *red* on the *bl* ground, although the stimulus is seen as pure *bl* in both cases.

The following simple demonstration of this result was successful with the few persons upon whom it was tried and is feasible for a class exercise. The color to be observed was placed on a gray background which matched it in brightness, standing beside this were several other backgrounds of different degrees of brightness. The subject after fixating the color for about 15 seconds could then throw the after-image upon any ground desired. In this way the stimulus and the ground against which it was seen remained constant. A set of judgments taken in this way was as follows: (1) The after-image of *gr* was thrown upon white, *i. e.*, Hering gray no. 1, and the tone was = *red-car*, (2) Another after-image of *gr* was thrown upon no. 7, judgment = *red-car*, (3) Upon 38, = *bl-car* and (4) Upon 50, = *bl-car*.

#### IV. *Intensity and Distinctness of After-images.*

1. Relative vividness of after-image and stimulus. In general it may be said that the after-images on the light grounds were about equal in vividness to their stimuli, whereas on the dark grounds they were less vivid than the stimuli. Moreover almost all after-images were more difficult to see on the dark grounds. At the extreme periphery it sometimes happened:

(a) That a stimulus which was clearly seen produced no after-image. This was most frequently the case on the dark grounds: there were altogether 136 instances and of these 78 per cent. occurred on the *bl* and black grounds.

(b) On the other hand there were 118 cases in which a subliminal stimulus produced an after-image which was perfectly

distinct in color, and 83 per cent. of these instances occurred on the grounds for *white*, *yl* and *gr*. That this somewhat unusual result was not the outcome of imagination or suggestion seems proved by the fact that these invisible colors gave rise to their appropriate after-images: thus, Table X., ground *yl* and *gr*, the after-image of an unseen *car* is  $\equiv$  *yl-gr*, in Table XV. grounds *white*, *yl* and *gr* the after-image of unseen *bl-gr* is *car* and *red*, in Table XVI. the after-image of unseen *gr-bl* is *or* and *yl*.

It appears from these considerations as if the dark backgrounds which as we saw above tend to enhance the effect of the stimulus, and extend the color field, tend to do just the opposite with the after-image, to reduce and suppress it. On the other hand the light grounds which decrease the effect of the stimulus tend to enhance the effect of the after-image.

2. Intensity as dependent on retinal location. The after-images of the paracentral region were more intense than those in the periphery but not in a very striking degree. All of the subjects experienced surprise in the after-images of the yellow spot; the stimulus seen at  $0^\circ$  was at its maximal intensity, but the after-image was strikingly inferior not only to the intensity of the stimulus but to the after-images of the paracentral and even of the peripheral region. They were often faded and elusive in color tone, and on the *bl* and *black* grounds were sometimes wanting altogether.

#### V. Color Discrimination in After-images.

1. Color discrimination is sometimes finer in the stimulus than in the after-image. *Red*, *or* and *yl*, although clearly distinguished as stimuli may give rise to after-images of the same color tone, *e. g.*, in Tables II., III. and IV. ground for *yl* from  $63^\circ$  outward *red* is seen as *red*, *or* is seen as  $\equiv$  *red-or* and *yl* is seen as  $\equiv$  *or-yl* or pure *yl*, *i. e.*, the three though not seen in their pure tones are nevertheless different from one another, but all of them give for their after-images pure *bl*. Similarly on the *bl* ground *red* seen as  $\equiv$  *or-red* or  $\equiv$  *red-or*, *or* seen as *or* or  $\equiv$  *or-yl*, and *yl* seen as *yl* all give rise to *bl* after-images.

2. Again, color discrimination is sometimes finer in the after-images than in the stimulus. Thus, Tables XIV. and XV. *yl*

ground, from  $59^\circ$  outwards *gr* and *bl-gr* are both seen as pure *gr*, but the after-images are *car* or  $\equiv$  *vi-car* for the *gr* but  $\equiv$  *red-car* for the *bl-gr*. Again, the stimuli *gr-bl*, *bl* and *vi* are all seen in the periphery as pure *bl*, but their after-images are distinguished in Tables VII., VIII. and IX. on the *bl* ground where the peripheral after-image for *gr-bl* lies between *red* and *or*, for *bl* between *or* and *yl*, and for *vi* it is mostly  $\equiv$  *gr-yl*.

It seems from these facts that finer discriminations are made in the colors of the *red-yl* end of the spectrum whether those colors appear as stimuli or as after-images, whereas the colors of the *gr-bl* end tend towards uniformity whether in stimulus or after-image.

#### VI. Duration of After-images.

The duration of after-images proved to be so variable that the number of our tests is not sufficient to make a quantitative statement very reliable. The following points, however, are to be noted :

1. At the peripheral limits of color the stimulus and after-image both appear as momentary flashes.

2. The duration both of stimulus and after-image gradually increases as the center is approached. This is also true of the after-image independently of the duration of the stimulus; for in the tests where the length of exposure of the stimulus was limited the after-images increased in duration as they came nearer the center.

3. At the fovea the after-images were frequently briefer than in the paracentral region and occasionally were altogether wanting, as reported above.

4. There appears to be some correspondence between the duration of the stimulus and of the after-image, but this is not a simple ratio for though the longer stimulus often gives the longer after-image yet: (*a*) a brief stimulus, except at the extreme periphery, gives rise to an after-image longer than the stimulus, but (*b*) a long stimulus frequently occasions an after-image shorter than the stimulus. Thus a stimulus of 3 seconds produces an after-image of from about 4 to 10 seconds whereas

a stimulus lasting upwards of 20 seconds gives usually after-images ranging between about 10 and 25 seconds.<sup>1</sup>

5. Where the duration of the stimulus is constant the duration of the after-image is likely to be slightly longer on the light grounds than on the dark.

#### VII. *Alterations in the After-image During the Process of Fading.*

1. After-images decrease in saturation, while in brightness they seem gradually to approach the brightness of the background on which they are seen.

2. Changes in color tone occur sometimes though by no means always.<sup>2</sup> The commonest of these changes were *red* passing through *or* and *yl* to gray, and *or* and *gr* passing through *yl* to gray.

3. Fluctuations between same and other colored phases occurred with 24 of B's after-images, Table XXXIII. shows the distribution of this phenomenon. The colors which oscillated were usually *gr* and *car*. These fluctuations did not occur where there had been a long exposure of the stimulus, but were the result in every case of stimuli which had been limited to 3 or 4 seconds' duration.

#### VIII. *Minor Observations.*

1. An accidental interruption one day gave this result with subject B. An after-image had just faded out and B was saying 'gone' when a metronome was started in the adjoining room. Immediately the color flashed into the after-image again, and returned rhythmically with every stroke of the metronome for several seconds.

2. Subject B sometimes found that the after-image was not limited in area by the size of the stimulus, but in the case of *car* after-images the color would spread out and occasionally flood the whole field of vision.

3. Subjects T and G sometimes experienced a splitting up of the component colors in an after-image, *i. e.*, *yl* at about 70°

<sup>1</sup> These numbers hold for T, G and F, not for B whose color processes were uncommonly long.

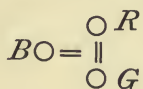
<sup>2</sup> In our tables we have entered always the first stage of such after-images.

frequently looked to be *or* and *gr* at the same time. The subjects did not at these times see pure *yl* at all but what appeared as *or* and *gr* occupying the same space at the same time.

### IX. *Theoretical.*

We have only the following two points to make :

1. It is possible with the light-adapted eye to arouse peripheral after-images. Our records show upwards of 4,500 tests ranging from  $0^\circ$  to  $93^\circ$  on the retina. Investigators who have worked in the dark room find that after-images are very difficult to observe and that they do not occur much beyond  $40^\circ$  eccentricity. In agreement with these two groups of facts are the relative results which we obtained on the light and dark backgrounds, where we found that the lighter were more favorable to the appearance of the after-images. Now these facts all indicate that the presence of white light is necessary to the production of the after-image on the peripheral part of the retina. The best explanation for this seems to us to be possible upon the Ladd-Franklin<sup>1</sup> theory of color vision. It is assumed by this theory that after-images are due to the successive phases of break-down in a color molecule. A ray of light, say blue, tears out the blue component of the molecule



leaving the remaining elements green and red in a state of such instability that they subsequently fall to pieces and thus give rise to the after-image sensation of yellow. May we not suppose that in the central and paracentral region, which all agree are more sensitive, the color molecules are more unstable than in the peripheral region, so that in the central zone the shattered molecules will sometimes fall to pieces without any further external stimulus, thus giving rise to the colored after-images which are sometimes seen in dark-adapted vision. The peripheral molecule, on the contrary, we may assume to be less easily decomposed, and after a stimulus has been given, to need

<sup>1</sup> *Mind*, N. S., Vol. 2 ; *PSY. REV.*, Vol. 6, etc.

the added excitation of white light to break down the residual portion and so give the after-image.

It is difficult to see what the explanation would be upon the Hering theory, for we should have to suppose that after-images caused by an assimilation process are enhanced by the addition of white light which stimulates a dissimilation process. Moreover one might fairly expect on the basis of either the Hering or Müller theory that the antagonistic color process, if it is initiated by the retina, could take place as well in the dark as in the light.

2. It was stated above, under II., that that component of a *stimulus* is emphasized which varies more from the brightness of the background; under III. it was stated that the component of an *after-image* was emphasized which approached the background in brightness. These two observations are simply two illustrations of the same phenomenon, *i. e.*, the tendency to interpret certain degrees of brightness in terms of certain color tones. A stimulus shown on a dark ground is being mixed with white by simultaneous contrast, whereas an after-image in order to be mixed with white light must be shown on a light background. The tables show that stimuli exposed on dark grounds and after-images cast on light grounds tend to have their lighter color components brought out, but that stimuli shown on light, and after-images on dark grounds tend to have the dark color element come out. These facts are of interest in connection with the case of pseudo-chromæsthesia reported by Professor Martin.<sup>1</sup> A black and white picture was shown to her subject but it appeared colored, the masses of shadow being purplish and the masses of light being yellowish.<sup>2</sup>

<sup>1</sup> PSYCH. REV., XIII., No. 3, Fechner number.

<sup>2</sup> The MS. of this article was received July 14, 1906. — ED.



TABLE I. SUBJECT T.—STIMULUS—CARMINE.

| Retinal Location | Background. 1 (White). |             |            |              | 3 (Yellow). |               |             |            | 7 (Green).   |            |               |             | 38 (Blue). |              |            |               | 50 (Black). |            |              |            |               |             |            |              |            |  |
|------------------|------------------------|-------------|------------|--------------|-------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|--|
|                  | No. of Tests.          | Color Seen. | Variation. | After-image. | Variation.  | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |  |
| 93°              |                        |             |            |              |             |               |             |            |              |            |               |             |            |              |            |               |             |            |              |            |               |             |            |              |            |  |
| 90.5             | 1                      | dark        |            | —gryl        |             | 1             | dark        |            | yl           |            | 1             | bl          |            | none         |            | 1             | bl          |            | none         |            | 2             | bl          |            | none         |            |  |
| 87.5             | 2                      | dark        |            | —gryl        |             | 3             | dark        |            | light        |            | 3             | none        |            | none         |            | 3             | bl          |            | none         |            | 1             | bl          |            | none         |            |  |
| 84.5             | 2                      | dark        |            | yl?          |             | 2             | dark        |            | yl?          |            | 1             | bl          |            | none         |            | 1             | bl          |            | none         |            | 1             | bl          |            | none         |            |  |
| 79               | 2                      | bl?         |            | gr?          |             | 3             | bl?         |            | gr?          |            | 1             | bl?         |            | none         |            | 1             | bl?         |            | none         |            | 1             | bl?         |            | or           |            |  |
| 76.5             | 4                      | car + vi    |            | light        |             | 4             | car + vi    |            | —gryl        | 1.5        | 3             | bl          |            | none         |            | 3             | bl          |            | none         |            | 1             | bl          |            | none         |            |  |
| 73.5             | 4                      | car + vi    |            | light        |             | 4             | car + vi    |            | —gryl        | 1.5        | 3             | vi bl       |            | none         |            | 3             | vi          | car        | vi           |            | 1             | vi          | car        | none         |            |  |
| 68.5             | 4                      | dark        |            | light        |             | 4             | dark        |            | light        |            | 3             | vi + bl     |            | none         |            | 3             | car         |            | car          |            | 1             | car         |            | none         |            |  |
| 66               | 3                      | bl vi       |            | —gryl        |             | 3             | bl vi       |            | —gryl        | 7          | 2             | vi + bl     |            | yl gr        |            | 3             | rd car      |            | rd car       |            | 1             | rd car      |            | —yl gr       |            |  |
| 63.2             | 3                      | bl + vi     |            | —gryl        |             | 3             | bl + vi     |            | —gryl        | 5          | 2             | bl vi       |            | yl gr        |            | 4             | car         |            | car          |            | 1             | rd car      |            | —yl gr       |            |  |
| 59.7             | 4                      | car vi      |            | gr           |             | 4             | car vi      |            | gr           | 3          | vi car        |             | vi car     |              | yl gr      |               | 3           | rd car     |              | gr         |               | 1           | rd car     |              | none       |  |
| 55               | 3                      | vi + car    |            | —bl gr       |             | 3             | vi car      |            | —bl gr       | 1          | 2             | vi car      |            | —bl gr       |            | 3             | —rd car     |            | rd car       |            | 1             | vi car      |            | gr           |            |  |
| 49               | 4                      | vi car      |            | gr           |             | 4             | vi car      |            | gr           | .5         | 2             | vi car      |            | gr           |            | 4             | rd car      |            | rd car       |            | 1             | rd car      |            | bl gr        |            |  |
| 41.2             | 4                      | car vi      |            | gr           |             | 4             | car vi      |            | gr           | 0          | 2             | car         |            | —bl gr       |            | 3             | car         |            | car          |            | 0             | rd car      |            | bl gr        |            |  |
| 31               | 3                      | car vi      |            | —bl gr       |             | 3             | vi car      |            | —bl gr       | 1          | 2             | —vi car     |            | —bl gr       |            | 3             | —rd car     |            | rd car       |            | 0             | rd car      |            | bl gr        |            |  |
| 20.5             | 3                      | vi car      |            | —bl gr       |             | 3             | rd car      |            | —bl gr       | 0          | 2             | car         |            | —bl gr       |            | 3             | rd car      |            | rd car       |            | 0             | rd car      |            | bl gr        |            |  |
| 11.5             | 3                      | vi car      |            | gr           |             | 3             | —rd car     |            | gr           | 0          | 2             | —rd car     |            | —bl gr       |            | 3             | rd car      |            | rd car       |            | 0             | rd car      |            | bl gr        |            |  |
| 0                | 3                      | vi car      |            | —yl gr       |             | 3             | car         |            | gr           | 0          | 2             | —vi car     |            | —bl gr       |            | 3             | rd car      |            | rd car       |            | 0             | rd car      |            | bl gr        |            |  |



TABLE III.

SUBJECT T.—STIMULUS—ORANGE.

| Retinal Location. | Background. 1 (White). |             |            | 3 (Yellow).  |            |               | 7 (Green).  |            |              | 38 (Blue). |               |             | 50 (Black). |              |            |
|-------------------|------------------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|-------------|--------------|------------|
|                   | No. of Tests.          | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation.  | After-Image. | Variation. |
| 93°               |                        |             |            | none         |            | 1             | red or      |            | none         |            | 1             | yl          |             | dark         |            |
| 90.5              | 1                      | dark        | none       | yl?          |            | 2             | or          | bl?        | bl?          |            | 1             | yl          |             | none         |            |
| 87.5              |                        |             |            | yl           |            | 2             | or yl       | bl         | bl           |            | 2             | or yl       | 3.5         | bl           |            |
| 84.5              | 3                      | dark        |            | none         |            | 3             | or yl       | bl         | bl           |            | 2             | or yl       | 0           | bl           |            |
| 82                | 4                      | yl?         | io         | light        |            | 1             | yl          | bl         | bl           |            | 2             | yl          | 0           | bl           |            |
| 79                | 3                      | red or      | 0          | bl           |            | 2             | yl or       | bl         | bl           |            | 2             | or yl       | 0           | bl           |            |
| 76.5              | 4                      | or red      | 3          | bl           |            | 2             | red or      | bl         | bl           |            | 2             | or yl       | 3.5         | bl           |            |
| 73.5              | 3                      | red or      | 0          | bl           |            | 3             | or          | bl         | bl           |            | 2             | or yl       | 5           | bl           |            |
| 71                | 3                      | red or      | 0          | bl           |            | 0             | or          | bl         | bl           |            | 3             | yl          | 0           | bl           |            |
| 68.5              | 1                      | none        |            | bl           |            | 2             | or          | bl         | bl           |            | 0             | or yl       | 0           | bl           |            |
| 66                | 1                      | or + red    |            | bl           |            | 0             | red or      | bl         | bl           |            | 3             | red or      | 0           | bl           |            |
| 63.2              | 1                      | or          |            | bl           |            | 2             | or          | bl         | bl           |            | 2             | or yl       | .5          | bl           |            |
| 59.7              | 1                      | red or      | 1.5        | bl           |            | 2             | red or      | bl         | bl           |            | 2             | or yl       | 0           | bl           |            |
| 55                | 3                      | red or      | 0          | bl           |            | 0             | or          | bl         | bl           |            | 0             | or          | 0           | bl           |            |
| 55                | 3                      | red or      | 0          | bl           |            | 2             | yl or       | bl         | bl           |            | 3             | or          | 0           | bl           |            |
| 49                | 1                      | yl          |            | —vi          |            | 1             | red or      | bl         | bl           |            | 0             | or          | 0           | bl           |            |
| 41.2              | 1                      | red or      | 2          | gr bl        |            | 2             | or          | gr bl      | gr bl        |            | 3             | yl or       | 0           | bl           |            |
| 31                | 1                      | red         | 0          | gr bl        |            | 2             | or          | gr bl      | gr bl        |            | 0             | or          | 0           | bl           |            |
| 20.5              | 1                      | red or      | 0          | gr bl        |            | 1             | red or      | gr bl      | gr bl        |            | 3             | or          | 0           | bl           |            |
| 11.5              | 1                      | red or      | 0          | gr bl        |            | 4             | red or      | gr bl      | gr bl        |            | 0             | or          | 0           | bl           |            |
| 0                 | 1                      | red or      | 0          | bl gr        |            | 2             | or          | gr bl      | gr bl        |            | 3             | or          | 0           | bl           |            |
|                   |                        |             |            | bl           |            | 2             | or          | —gr bl     | —gr bl       |            | 3             | or          | 0           | gr + br      |            |

TABLE IV.

SUBJECT T.—STIMULUS—YELLOW.

| Retinal Location. | Background. 1 (White). |             |            | 3 (Yellow).  |            |               | 7 (Green).  |            |              | 38 (Blue). |               |             | 50 (Black). |              |            |
|-------------------|------------------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|-------------|--------------|------------|
|                   | No. of Tests.          | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation.  | After-image. | Variation. |
| 93°               |                        |             |            |              |            |               |             |            |              |            |               |             |             |              |            |
| 90.5              |                        |             |            |              |            |               | light       |            | dark         |            |               | none        |             | none         |            |
| 87.5              | 1                      | dark        |            | light        |            | 8             | yl?         |            | dark         |            | 10            | yl?         |             | dark         |            |
| 84.5              |                        |             |            |              |            | 9             | yl          |            | bl           |            | 3             | yl          |             | bl           |            |
| 82                |                        |             |            |              |            | 3             | yl          |            | bl           |            | 3             | yl          |             | bl           |            |
| 79                |                        |             |            |              |            | 5             | —gr yl      |            | bl           |            | 2             | yl          |             | bl           |            |
| 76.5              |                        |             |            |              |            | 3             | ≡ or yl     |            | bl           |            | 2             | —gr yl      |             | bl           |            |
| 73.5              |                        |             |            |              |            | 2             | ≡ red or    |            | bl           |            | 3             | yl          |             | bl           |            |
| 71                | 2                      | yl          |            |              |            | 5             | yl          |            | bl           |            | 2             | —or yl      |             | bl           |            |
| 68.5              | 1                      | yl          |            |              |            | 4             | ≡ or yl     |            | bl           |            | 2             | yl          |             | bl           |            |
| 66                | 1                      | yl?         |            |              |            | 4             | ≡ or yl     |            | bl           |            | 2             | —or yl      |             | bl           |            |
| 63.2              | 1                      | yl + or     |            |              |            | 3             | yl          |            | ≡ vi bl      |            | 3             | yl          |             | bl           |            |
| 59.7              | 1                      | ≡ yl or     |            |              |            | 2             | ≡ or yl     |            | ≡ vi bl      |            | 3             | yl          |             | bl           |            |
| 55                | 1                      | or + red    |            |              |            | 4             | —yl or      |            | bl           |            | 3             | yl          |             | bl           |            |
| 49                | 1                      | ≡ or yl     |            |              |            | 3             | ≡ or yl     |            | —vi bl       |            | 3             | yl          |             | bl           |            |
| 41.2              | 1                      | yl          |            |              |            | 3             | ≡ or yl     |            | ≡ vi bl      |            | 3             | yl          |             | bl           |            |
| 31                | 1                      | yl          |            |              |            | 3             | ≡ or yl     |            | bl           |            | 3             | yl          |             | bl           |            |
| 20.5              | 1                      | —gr yl      |            |              |            | 3             | yl          |            | bl           |            | 3             | yl          |             | bl           |            |
| 11.5              | 1                      | —gr yl      |            |              |            | 3             | yl          |            | bl           |            | 3             | yl          |             | bl           |            |
| 0                 | 1                      | yl          |            |              |            | 3             | yl          |            | —vi bl       |            | 2             | yl          |             | —vi bl       |            |

TABLE V.  
SUBJECT T.—STIMULUS—GREEN.

| Retinal Location | Background. 1 (White). |             |            |              | 3 (Yellow). |              |            |             | 7 (Green).    |             |            |              | 38 (Blue). |              |               |             | 50 (Black). |              |               |             |            |              |
|------------------|------------------------|-------------|------------|--------------|-------------|--------------|------------|-------------|---------------|-------------|------------|--------------|------------|--------------|---------------|-------------|-------------|--------------|---------------|-------------|------------|--------------|
|                  | No. of Tests.          | Color Seen. | Variation. | After-image. | Variation.  | After-image. | Variation. | Color Seen. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | After-image. | No. of Tests. | Color Seen. | Variation.  | After-image. | No. of Tests. | Color Seen. | Variation. | After-image. |
| 93°              | 1                      | dark        | 0          | none         | 1           | none         | 0          | none        | 1             | yl?         | 0          | none         | 0          | none         | 1             | yl          | 0           | none         | 1             |             |            |              |
| 90.5             | 3                      | dark        | 1          | light        | 1           | yl           | 0          | none        | 4             | light       | 0          | dark         | 0          | dark         | 4             |             |             |              | 4             |             |            |              |
| 87.5             | 1                      | dark        | 1          | yl           | 4           | yl           | -5         | bl?         | 2             | yl          | 0          | bl           | 0          | bl?          | 2             |             |             |              | 2             |             |            |              |
| 84.5             | 2                      | dark        | 2          | light        | 2           | yl           | -5         | none        | 2             | yl          | 0          | dark         | 0          | dark         | 2             |             |             |              | 2             |             |            |              |
| 82               | 1                      | none        | 1          | none         | 2           | yl           | 0          | -vi bl      | 3             | gr yl       | 3          | dark         | 1.5        | dark         | 3             |             |             |              | 3             |             |            |              |
| 79               | 1                      | none        | 1          | none         | 2           | gr + yl      | 5          | -vi bl      | 2             | gr yl       | 2          | bl           | 1          | bl           | 2             |             |             |              | 2             |             |            |              |
| 76.5             | 3                      | gr          | 0          | bl           | 3           | gr yl        | 2          | bl          | 1             | yl          | 0          | bl           | 0          | bl           | 1             |             |             |              | 3             | gr yl       | 0          | bl           |
| 73.5             | 2                      | gr          | 0          | -cr vi       | 2           | gr           | -5         | -vi bl      | 2             | yl + gr     | 2          | none         | 0          | none         | 2             |             |             |              | 2             | gr yl       | 0          | bl           |
| 71               | 2                      | yl gr       | 1          | bl           | 2           | yl gr        | 0          | -vi bl      | 1             | yl          | 0          | bl           | 0          | bl           | 2             |             |             |              | 2             | gr yl       | 0          | bl           |
| 68.5             | 6                      | dark        | 0          | none         | 6           | yl gr        | 3          | bl          | 4             | yl          | 0          | bl           | 0          | bl           | 1             |             |             |              | 6             | gr yl       | 0          | bl           |
| 66               | 9                      | dark        | 0          | bl           | 5           | gr           | 3          | -vi bl      | 5             | gr yl       | 0          | bl           | 0          | bl           | 1             |             |             |              | 9             | gr yl       | 0          | bl           |
| 63.2             | 5                      | gr          | 0          | bl           | 3           | yl gr        | 4.5        | -vi bl      | 3             | yl + gr     | 0          | vi           | 0          | vi           | 1             |             |             |              | 5             | yl          | 0          | bl           |
| 59.7             | 4                      | gr          | 0          | -vi cr       | 3           | gr           | 0          | -vi cr      | 3             | gr          | 0          | gr           | 0          | gr           | 2             |             |             |              | 4             | gr yl       | 0          | bl           |
| 55               | 3                      | gr          | 0          | car          | 3           | gr           | -5         | car         | 3             | gr          | 0          | car          | 0          | car          | 3             |             |             |              | 3             | gr          | 0          | bl           |
| 49               | 4                      | gr          | 0          | car          | 2           | gr           | 0          | car         | 0             | gr          | 0          | car          | 0          | car          | 3             |             |             |              | 4             | gr          | 0          | bl           |
| 41.2             | 3                      | gr          | 0          | -rd cr       | 2           | gr           | 0          | car         | 0             | gr          | 0          | car          | 0          | car          | 3             |             |             |              | 3             | gr          | 0          | bl           |
| 31               | 3                      | gr          | 0          | -rd cr       | 1           | gr           | 0          | car         | 0             | gr          | 0          | car          | 0          | car          | 3             |             |             |              | 3             | gr          | 0          | bl           |
| 20.5             | 3                      | gr          | 0          | -rd cr       | 2           | gr           | 0          | -vi cr      | 0             | gr          | 0          | car          | 0          | car          | 3             |             |             |              | 3             | gr          | 0          | bl           |
| 11.5             | 2                      | gr          | 0          | rd cr        | 0           | yl gr        | 0          | -vi cr      | 1             | gr          | 0          | cr vi        | 0          | cr vi        | 3             |             |             |              | 2             | gr          | 0          | bl           |
| 0                | 2                      | gr          | 0          | car          | 0.5         | yl gr        | 1          | -vi cr      | 1             | gr          | 0          | cr vi        | 0          | cr vi        | 3             |             |             |              | 2             | gr          | 0          | bl           |



TABLE VII. SUBJECT T.—STIMULUS—GREEN-BLUE.

| Retinal Location. | Background. 1 (White). |             |            |              | 3 (Yellow). |             |            |              | 7 (Green).    |             |            |              | 38 (Blue). |             |               |             | 50 (Black). |              |               |             |            |              |            |
|-------------------|------------------------|-------------|------------|--------------|-------------|-------------|------------|--------------|---------------|-------------|------------|--------------|------------|-------------|---------------|-------------|-------------|--------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests           | Color Seen. | Variation. | After-image. | Variation.  | Color Seen. | Variation. | After-Image. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. | Color Seen. | No. of Tests. | Color Seen. | Variation.  | After-Image. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. |
| 93°               | 1                      | dark        | o          | light        | o           | none        | o          | none         | 1             | none        | o          | none         | o          | none        | 2             | bl          | o           | none         | 2             | bl          | o          | none         | o          |
| 90.5              | 2                      | bl          | o          | yl           | o           | bl          | o          | yl gr        | 1             | bl          | o          | yl gr        | o          | bl          | 2             | bl          | o           | rdor?        | 2             | bl          | o          | rdor?        | o          |
| 87.5              | 1                      | dark        | o          | yl           | o           | vi          | o          | gr yl        | 1             | vi          | o          | gr yl        | o          | red?        | 2             | red?        | o           | red?         | 2             | red?        | o          | red?         | o          |
| 84.5              | 5                      | bl          | o          | none         | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 2             | bl          | o          | rd           | o          |
| 82                | 3                      | bl          | o          | yl + gr      | o           | -vi bl      | o          | or yl        | 2             | -vi bl      | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 2             | bl          | o          | rd           | o          |
| 79                | 3                      | bl          | o          | yl           | o           | bl          | o          | or yl        | 1             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 1.5           | bl          | o          | rd           | o          |
| 76.5              | 3                      | bl          | o          | gr yl        | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 1.5           | bl          | o          | rd           | o          |
| 73.5              | 3                      | bl          | o          | yl           | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 3.5           | bl          | o          | rd           | o          |
| 71                | 3                      | bl          | o          | yl           | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 3.5           | bl          | o          | rd           | o          |
| 68.5              | 3                      | bl          | o          | gr yl        | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 3.5           | bl          | o          | rd           | o          |
| 66                | 3                      | bl          | o          | yl           | o           | bl + vi     | o          | or yl        | 2             | bl + vi     | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 3.5           | bl          | o          | rd           | o          |
| 63.2              | 5                      | bl          | o          | gr yl        | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 3.5           | bl          | o          | rd           | o          |
| 59.7              | 3                      | light       | o          | gr yl        | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 3.5           | bl          | o          | rd           | o          |
| 55                | 7                      | or?         | o          | yl           | o           | -vi bl      | o          | or yl        | 2             | -vi bl      | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 3             | bl          | o          | rd           | o          |
| 49                | 1                      | none        | o          | or yl        | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 3             | bl          | o          | rd           | o          |
| 41.2              | 4                      | gr yl       | o          | or yl        | o           | bl          | o          | or yl        | 2             | bl          | o          | or yl        | o          | bl          | 2             | bl          | o           | rd           | 2.5           | bl          | o          | rd           | o          |
| 31                | 3                      | rd          | o          | or           | o           | gr bl       | o          | or yl        | 3             | gr bl       | o          | or yl        | o          | gr bl       | 3             | gr bl       | o           | rd           | 2.5           | gr bl       | o          | rd           | o          |
| 20.5              | 4                      | red         | o          | or           | o           | gr bl       | o          | or yl        | 3             | gr bl       | o          | or yl        | o          | gr bl       | 3             | gr bl       | o           | rd           | 3             | gr bl       | o          | rd           | o          |
| 11.5              | 2                      | or + rd     | o          | rd           | o           | gr bl       | o          | or yl        | 2             | gr bl       | o          | or yl        | o          | gr bl       | 2             | gr bl       | o           | rd           | 2             | gr bl       | o          | rd           | o          |
| 0                 | 3                      | rd          | o          | rd           | o           | gr bl       | o          | or yl        | 2             | gr bl       | o          | or yl        | o          | gr bl       | 3             | gr bl       | o           | rd           | 3             | gr bl       | o          | rd           | o          |

TABLE VIII.

## SUBJECT T.—STIMULUS—BLUE.

| Retinal Location. | Background. 1 (White). |             |            |              | 3 (Yellow). |             |            |              | 7 (Green).    |             |            |              | 38 (Blue). |               |             |            | 50 (Black).  |            |               |             |            |              |            |    |   |
|-------------------|------------------------|-------------|------------|--------------|-------------|-------------|------------|--------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|----|---|
|                   | No. of Tests.          | Color Seen. | Variation. | After-image. | Variation.  | Color Seen. | Variation. | After-image. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |    |   |
| 93°               | 1                      | bl          |            | yl           | 0           | dark        | light      | yl           | 2             | dark        | 0          | none         | 0          | bl            | 0           | none       | none         | 2          | bl            | 0           | none       | 2            | bl         | 0  |   |
| 90.5              | 4                      |             |            | light        | 0           | dark        | light      | yl           | 4             | dark        | 0          | none         | 0          | bl            | 0           | none       | —lyro        | 4          | bl            | 0           | yl         | 2.5          | bl         | 0  |   |
| 87.5              | 8                      |             |            | yl           | 0           | dark        | yl         | yl           | 8             | dark        | 0          | bl           | 0          | bl            | 0           | bl         | yl + or      | 10         | bl            | 0           | yl         | 0            | bl         | 0  |   |
| 84.5              | 11                     |             |            | yl           | 0           | bl          | yl         | yl           | 11            | bl          | 0          | bl           | 0          | bl            | 0           | bl         | yl           | 5          | 1             | gr bl       | 1          | yl           | 3          | bl | 1 |
| 82                | 9                      |             |            | yl           | 0           | bl          | yl         | yl           | 9             | bl          | 0          | bl           | 0          | bl            | 0           | bl         | yl           | 5          | 2             | gr bl       | 1          | yl           | 3          | bl | 1 |
| 79                | 9                      |             |            | yl           | 0           | bl          | yl         | yl           | 9             | bl          | 0          | bl           | 0          | bl            | 0           | bl         | yl           | 5          | 2             | gr bl       | 1          | yl           | 3          | bl | 1 |
| 76.5              | 2                      |             |            | —gryl        | 1.5         | bl          | yl         | —gryl        | 2             | —vi bl      | 1          | bl           | 1          | bl            | 0           | bl         | yl           | 1.5        | 1             | car + vi    | 1          | yl           | 6.5        | bl | 1 |
| 73.5              | 3                      |             |            | yl           | 0           | bl          | yl         | yl           | 3             | bl          | 0          | bl           | 1          | bl            | 0           | bl         | or           | 0          | 1             | bl          | 0          | yl           | 1          | bl | 1 |
| 71                | 1                      |             |            | yl + gr      | 0           | bl          | yl         | yl           | 1             | bl          | 0          | bl           | 1          | bl            | 0           | bl         | or           | 0          | 1             | bl          | 0          | yl           | 1          | bl | 1 |
| 68.5              | 3                      |             |            | gryl         | 1.5         | bl          | yl         | —gryl        | 3             | bl          | 0          | bl           | 1.5        | bl            | 0           | bl         | or           | 3          | 1             | bl          | 0          | yl           | 5          | bl | 1 |
| 66                | 4                      |             |            | yl           | 0           | bl          | yl         | —gryl        | 4             | bl          | 0          | bl           | 2          | bl            | 0           | bl         | or           | 2          | 1             | bl          | 0          | or           | 1          | bl | 1 |
| 63.2              | 1                      |             |            | yl + gr      | 1           | bl          | yl         | yl           | 1             | bl          | 0          | bl           | 2          | bl            | 0           | bl         | or           | 1          | 1             | bl          | 0          | or           | 2          | bl | 1 |
| 59.7              | 3                      |             |            | gryl         | 1           | bl          | yl         | —gryl        | 3             | bl          | 0          | bl           | 1          | bl            | 0           | bl         | or           | 3          | 1             | bl          | 0          | or           | 2          | bl | 1 |
| 55                | 2                      |             |            | gryl         | 1           | bl          | yl         | gryl         | 2             | bl          | 0          | bl           | 0          | bl            | 0           | bl         | or           | 1          | 1             | bl          | 0          | or           | 1          | bl | 1 |
| 55                | 4                      |             |            | yl + gr      | 1.5         | bl          | yl + gr    | yl + gr      | 4             | —vi bl      | 1          | bl           | 0          | bl            | 0           | bl         | or           | 4          | 1             | bl          | 0          | or           | 1          | bl | 1 |
| 49                | 4                      |             |            | yl           | 0           | bl          | yl         | yl           | 4             | bl          | 0          | bl           | 0          | bl            | 0           | bl         | or           | 1          | 1             | bl          | 0          | or           | 1          | bl | 1 |
| 41.2              | 1                      |             |            | yl + gr      | 1           | bl          | yl + gr    | yl + gr      | 1             | —vi bl      | 1          | bl           | 1.5        | bl            | 0           | bl         | or           | 1          | 1             | bl          | 0          | or           | 1          | bl | 1 |
| 31                | 3                      |             |            | gryl         | 1           | bl          | yl         | —gryl        | 3             | bl          | 0          | bl           | 0          | bl            | 0           | bl         | or           | 3          | 1             | bl          | 0          | or           | 1          | bl | 1 |
| 20.5              | 3                      |             |            | gryl         | 0           | bl          | yl         | —gryl        | 3             | bl          | 0          | bl           | 0          | bl            | 0           | bl         | or           | 3          | 1             | bl          | 0          | or           | 1          | bl | 1 |
| 11.5              | 3                      |             |            | gryl         | 0           | bl          | yl         | —gryl        | 3             | bl          | 0          | bl           | 0          | bl            | 0           | bl         | or           | 3          | 1             | bl          | 0          | or           | 2          | bl | 1 |
| 0                 | 1                      |             |            | yl           | 0           | bl          | yl         | —gryl        | 1             | bl          | 0          | bl           | 1          | bl            | 0           | bl         | or           | 1          | 1             | bl          | 0          | or           | 1          | bl | 1 |



TABLE IX. SUBJECT T.—STIMULUS—VIOLET.

| Retinal Location. | 3 (Yellow).   |             |            |              | 7 (Green). |             |            |              | 38 (Blue). |               |             |            | 50 (Black).  |            |               |             |            |              |            |
|-------------------|---------------|-------------|------------|--------------|------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |
| 93°               | 1             | dark        |            | light        | 1          | bl          |            | yl           | 1          | none          |             | none       |              | 1          |               |             |            |              |            |
| 90.5              | 1             | dark        |            | yl           | 1          | bl?         |            | yl           | 3          | bl            |             | or         |              | 0          |               |             |            |              |            |
| 87.5              | 1             | dark        |            | yl           | 2          | bl          |            | yl           | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 84.5              | 1             | bl          |            | —gr yl       | 2          | bl          |            | yl           | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 82                | 1             | bl          |            | —or yl       | 2          | bl vi       |            | —gr yl       | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 79                | 1             | bl          |            | yl           | 2          | bl          |            | —gr yl       | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 76.5              | 2             | bl          |            | yl           | 2          | bl          |            | —gr yl       | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 73.5              | 3             | bl          |            | yl           | 0          | bl          |            | —gr yl       | 3          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 71                | 1             | bl          |            | yl           | 0          | bl          |            | yl           | 3          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 68.5              | 2             | bl          |            | yl + gr      | 0          | bl          |            | —gr yl       | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 66                | 4             | bl          |            | —gr yl       | 4          | bl          |            | —gr yl       | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 63.2              | 1             | bl          |            | yl + gr      | 0          | bl          |            | —gr yl       | 2          | bl            |             | yl + gr    |              | 0          |               |             |            |              |            |
| 59.7              | 1             | bl          |            | yl           | 0          | bl          |            | yl           | 2          | bl            |             | yl         |              | 0          |               |             |            |              |            |
| 55                | 1             | bl          |            | —gr yl       | 2          | bl          |            | yl + gr      | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 49                | 1             | bl          |            | yl + gr      | 0          | bl + vi     |            | —gr yl       | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 41.2              | 1             | —car vi     |            | —gr yl       | 0          | bl + vi     |            | —gr yl       | 2          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 31                | 1             | bl vi       |            | —gr yl       | 0          | bl + vi     |            | —gr yl       | 3          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 20.5              | 1             | bl vi       |            | —gr yl       | 0          | bl vi       |            | —gr yl       | 3          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 11.5              | 1             | vi          |            | —gr yl       | 0          | vi          |            | —gr yl       | 3          | bl            |             | —gr yl     |              | 0          |               |             |            |              |            |
| 0                 | 1             | vi          |            | yl + gr      | 1          | vi          |            | yl + gr      | 3          | vi            |             | yl + gr    |              | 0          |               |             |            |              |            |

TABLE X.  
SUBJECT G.—STIMULUS—CARMINE.

| Retinal Location. | Background. 1 (White). |             |            |              | 3 (Yellow) |             |            |              | 7 (Green). |              |             |            | 38 (Blue).   |            |              |             | 50 (Black). |              |            |              |             |            |              |            |
|-------------------|------------------------|-------------|------------|--------------|------------|-------------|------------|--------------|------------|--------------|-------------|------------|--------------|------------|--------------|-------------|-------------|--------------|------------|--------------|-------------|------------|--------------|------------|
|                   | No. of Tests           | Color Seen. | Variation. | After-image. | Variation. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests | Color Seen. | Variation. | After-image. | Variation. | No. of Tests | Color Seen. | Variation.  | After-image. | Variation. | No. of Tests | Color Seen. | Variation. | After-image. | Variation. |
| 93°               | 1                      | dark        |            | light        |            | dark        |            | light        |            | 1            | dark        |            | light        |            | 2            | light       |             | dark         |            | 1            | car         |            | yl           |            |
| 90.5              | 1                      | dark        |            | yl           |            | dark        |            | yl gr        |            | 3            | dark        |            | yl gr        |            | 2            | none        |             | none         |            | 1            | car         |            | gr           |            |
| 87.5              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | bl?         | 0           | dark         |            | 1            | car         |            | gr?          |            |
| 84.5              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | bl?         | 0           | dark         |            | 1            | car         |            | gr?          |            |
| 82                | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 5            | dark        |            | gr           |            | 3            | gr?         | 3.5         | dark         |            | 1            | car         |            | gr?          |            |
| 79                | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 3            | gr?         | 3           | dark         |            | 1            | car         |            | gr?          |            |
| 76.5              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 73.5              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 71                | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 68.5              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 66                | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 63.2              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 59.7              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 2            | dark        |            | gr           |            | 3            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 55                | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 2            | dark        |            | gr           |            | 3            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 49                | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 2            | dark        |            | gr           |            | 3            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 41.2              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 2            | dark        |            | gr           |            | 3            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 31                | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 2            | dark        |            | gr           |            | 3            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 20.5              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 2            | dark        |            | gr           |            | 3            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 11.5              | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 2            | dark        |            | gr           |            | 4            | car         | 0           | none         |            | 1            | car         |            | gr           |            |
| 0                 | 1                      | dark        |            | gr           |            | dark        |            | gr           |            | 3            | dark        |            | gr           |            | 2            | car         | .5          | dark         |            | 1            | car         |            | gr           |            |

TABLE XI.  
SUBJECT G.—STIMULUS—RED.

| Retinal Location. | Background. 1 (White). |             |            | 3 (Yellow).  |            |             | 7 (Green). |              |            | 38 (Blue).    |             |            | 50 (Black).  |            |               |             |            |              |            |
|-------------------|------------------------|-------------|------------|--------------|------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.          | Color Seen. | Variation. | After-Image. | Variation. | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. |
| 93°               | 1                      | none        | none       | none         | 1          | none        | none       | none         | 1          | gr yl         | bl          | bl         | bl           |            | 1             | red         |            |              |            |
| 90.5              | 4                      | or          | none       | light        | 1          | dark        | light      | bl           | 2          | yl            | none        | none       | none         |            | 1             | red         |            |              |            |
| 87.5              | 3                      | orred       | light      | bl           | 3          | orred       | bl         | bl           | 2          | yl or         | 6           | —grbl      | —grbl        | 1          | 3             | red         |            |              |            |
| 84.5              | 2                      | red         | bl?        | bl           | 1          | orred       | bl         | bl           | 3          | or yl         | 1           | bl         | bl           | 0          | 2             | red         |            |              |            |
| 82                | 2                      | red         | bl         | bl           | 0          | red         | bl         | bl           | 2          | red or        | 3           | —grbl      | —grbl        | 5          | 0             | red         |            |              |            |
| 79                | 2                      | orred       | grbl       | grbl         | 0          | red         | bl         | bl           | 3          | red or        | 0           | bl         | bl           | 0          | 0             | red         |            |              |            |
| 76.5              | 2                      | orred       | grbl       | grbl         | 1          | red         | —grbl      | —grbl        | 2          | red           | 1.5         | bl         | bl           | 0          | 0             | red         |            |              |            |
| 73.5              | 1                      | red         | —grbl      | —grbl        | 4          | orred       | bl         | bl           | 3          | red           | 0           | bl         | bl           | 0          | 1             | red         |            |              | bl         |
| 68.5              | 1                      | orred       | bl         | bl           | 5          | red         | grbl       | grbl         | 3          | orred         | 1           | bl         | bl           | 0          | 1             | red         |            |              | bl         |
| 66                | 1                      | red         | bl         | bl           | 3          | red         | bl         | bl           | 0          | red           | 0           | bl         | bl           | 0          | 1             | red         |            |              | bl         |
| 63.2              | 2                      | orred       | grbl       | grbl         | 5          | orred       | grbl       | grbl         | 3          | red           | 0           | —grbl      | —grbl        | 1          | 1             | red         |            |              | bl         |
| 59.7              | 3                      | red         | grbl       | grbl         | 1          | orred       | grbl       | grbl         | 2          | orred         | 1.5         | grbl       | grbl         | 1          | 1             | red         |            |              | grbl       |
| 55                | 3                      | orred       | grbl       | grbl         | 2          | orred       | grbl       | grbl         | 5          | red or        | 0           | —grbl      | —grbl        | 1          | 1             | red         |            |              | grbl       |
| 49                | 3                      | orred       | grbl       | grbl         | 0          | orred       | grbl       | grbl         | 3          | red           | 0           | —grbl      | —grbl        | 1          | 1             | red         |            |              | grbl       |
| 41.2              | 3                      | orred       | grbl       | grbl         | 1          | orred       | grbl       | grbl         | 0          | red           | 0           | grbl       | grbl         | 0          | 1             | red         |            |              | grbl       |
| 31                | 4                      | orred       | grbl       | grbl         | 0          | orred       | grbl       | grbl         | 3          | red           | 0           | grbl       | grbl         | 0          | 1             | red         |            |              | grbl       |
| 20.5              | 5                      | orred       | grbl       | grbl         | 2          | orred       | grbl       | grbl         | 5          | red           | 4           | bl + gr    | bl + gr      | 0          | 1             | red         |            |              | bl + gr    |
| 11.5              | 2                      | orred       | gr + bl    | gr + bl      | 1          | red         | bl + gr    | bl + gr      | 2          | red           | 1           | bl + gr    | bl + gr      | 5          | 1             | red         |            |              | bl + gr    |
| 0                 | 2                      | red         | grbl       | grbl         | 2          | red         | grbl       | grbl         | 0          | red           | .5          | grbl       | grbl         | 0          | 1             | red         |            |              | none       |

TABLE XII.

SUBJECT G.—STIMULUS—ORANGE.

| Retinal Location. | Background. 1 (White). |             |            |              | 3 (Yellow). |             |            |              | 7 (Green). |               |             |            | 38 (Blue).   |            |               |             | 50 (Black). |              |            |               |             |            |              |            |
|-------------------|------------------------|-------------|------------|--------------|-------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|-------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.          | Color Seen. | Variation. | After-image. | Variation.  | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation.  | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |
| 93°               | 1                      | dark        | 0          | none         | 0           | light       | 0          | dark         | 2          | yl            | 0           | bl?        | 0            | 2          | yl            | 0           | bl?         | 0            | 2          | yl            | 0           | bl?        | 0            | 2          |
| 90.5              | 2                      | red?        | 0          | bl           | 0           | light       | 0          | dark         | 3          | —or yl        | 1           | none       | 1            | 2          | —or yl        | 1           | none        | 1            | 2          | —or yl        | 1           | none       | 1            | 2          |
| 87.5              | 2                      | or + red    | 5          | bl           | 0           | yl + or     | 0          | bl           | 2          | yl            | 0           | bl         | 0            | 2          | yl            | 0           | bl          | 0            | 2          | yl            | 0           | bl         | 0            | 2          |
| 84.5              | 2                      | red or      | 10         | bl?          | 0           | or          | 0          | —grbl        | 2          | or            | 0           | bl?        | 0            | 2          | or            | 0           | bl          | 0            | 2          | or            | 0           | bl         | 0            | 2          |
| 82                | 2                      | red         | 3          | —grbl        | 1.5         | yl or       | 5          | bl           | 2          | yl or         | 5           | bl         | 0            | 2          | yl or         | 5           | bl          | 0            | 2          | yl or         | 5           | bl         | 0            | 2          |
| 79                | 2                      | —yl or      | 1.5        | —grbl        | 1           | red or      | 3.5        | bl           | 2          | red or        | 3.5         | bl         | 0            | 2          | red or        | 3.5         | bl          | 0            | 2          | red or        | 3.5         | bl         | 0            | 2          |
| 76.5              | 2                      | —or red     | .5         | —grbl        | .5          | or red      | 3.5        | bl           | 2          | or red        | 3.5         | bl         | .5           | 2          | or            | .5          | bl          | .5           | 2          | or            | .5          | bl         | .5           | 2          |
| 73.5              | 2                      | red or      | 2.5        | —grbl        | 1           | or          | .5         | bl           | 2          | or            | .5          | bl         | 0            | 2          | or            | .5          | bl          | 0            | 2          | or            | .5          | bl         | 0            | 2          |
| 71                | 2                      | red or      | 0          | bl           | 0           | or red      | 2.5        | —grbl        | 2          | or red        | 2.5         | —grbl      | 1            | 2          | or red        | 2.5         | —grbl       | 1            | 2          | or red        | 2.5         | —grbl      | 1            | 2          |
| 68.5              | 3                      | red or      | 2.5        | —grbl        | .5          | or          | .5         | bl           | 2          | or            | .5          | bl         | 0            | 2          | or            | .5          | bl          | 0            | 2          | or            | .5          | bl         | 0            | 2          |
| 66                | 2                      | red or      | .5         | grbl         | .5          | or red      | 3.5        | —grbl        | 2          | or red        | 3.5         | —grbl      | 1            | 2          | or red        | 3.5         | —grbl       | 1            | 2          | or red        | 3.5         | —grbl      | 1            | 2          |
| 63.2              | 2                      | red or      | 3          | grbl         | 0           | red or      | .5         | grbl         | 2          | red or        | .5          | grbl       | 1            | 2          | red or        | .5          | grbl        | 1            | 2          | red or        | .5          | grbl       | 1            | 2          |
| 59.7              | 2                      | red + or    | 3          | grbl         | 0           | red or      | .5         | grbl         | 2          | red or        | .5          | grbl       | 1            | 2          | red or        | .5          | grbl        | 1            | 2          | red or        | .5          | grbl       | 1            | 2          |
| 55                | 3                      | red or      | 0          | grbl         | 0           | or red      | 1          | —grbl        | 3          | or red        | 1           | —grbl      | 1.5          | 3          | or red        | 1           | —grbl       | 1.5          | 3          | or red        | 1           | —grbl      | 1.5          | 3          |
| 49                | 4                      | red or      | 1.5        | grbl         | 1           | or          | .5         | grbl         | 2          | or            | .5          | grbl       | 0            | 2          | or            | .5          | grbl        | 0            | 2          | or            | .5          | grbl       | 0            | 2          |
| 41.2              | 2                      | red or      | 1.5        | grbl         | 0           | red or      | 1.5        | grbl         | 2          | red or        | 1.5         | grbl       | 0            | 2          | red or        | 1.5         | grbl        | 0            | 2          | red or        | 1.5         | grbl       | 0            | 2          |
| 31                | 2                      | or          | 0          | grbl         | .5          | or          | 0          | —grbl        | 2          | or            | 0           | —grbl      | 0            | 2          | or            | 0           | —grbl       | 0            | 2          | or            | 0           | —grbl      | 0            | 2          |
| 20.5              | 2                      | or          | 0          | grbl         | 1           | or          | 0          | —grbl        | 2          | or            | 0           | —grbl      | 1            | 2          | or            | 0           | —grbl       | 1            | 2          | or            | 0           | —grbl      | 1            | 2          |
| 11.5              | 2                      | or          | 0          | grbl         | 1           | or          | 0          | —grbl        | 2          | or            | 0           | —grbl      | 1            | 2          | or            | 0           | —grbl       | 1            | 2          | or            | 0           | —grbl      | 1            | 2          |
| 0                 | 2                      | —red or     | 1.5        | —grbl        | 1           | or          | 0          | —grbl        | 2          | or            | 0           | —grbl      | 1.5          | 4          | or            | 0           | —grbl       | 1.5          | 4          | or            | 0           | —grbl      | 1.5          | 4          |

TABLE XIII.

SUBJECT G.—STIMULUS—YELLOW.

| Retinal Location. | Background x (White). |             |            |              | 3 (Yellow). |              |            |             | 7 (Green).    |             |            |              | 38 (Blue). |               |             |            | 50 (Black).  |            |               |             |            |              |            |
|-------------------|-----------------------|-------------|------------|--------------|-------------|--------------|------------|-------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.         | Color Seen. | Variation. | After-image. | Variation.  | After-image. | Variation. | Color Seen. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |
| 93°               | 2                     | none        |            | none         | 0           | bl           | dark       | light       | 3             | light       | 0          | dark         | 0          | 1             | yl          |            | none         | 0          | 1             | yl          |            | none         | 0          |
| 90.5              | 4                     | none        |            | bl           | 0           | bl           | bl         | yl          | 7             | yl          | 0          | bl           | 0          | 2             | yl          |            | bl?          | 0          | 2             | yl          |            | bl           | 0          |
| 87.5              | 6                     | —or yl      | 2.5        | bl           | 0           | bl           | bl         | —or yl      | 2             | —or yl      | 1.5        | bl           | 0          | 2             | yl          |            | bl           | 0          | 2             | yl          |            | bl           | 0          |
| 84.5              | 2                     | ≡yl or      | 4          | bl           | 0           | bl           | bl         | —or yl      | 2             | —           | 1.5        | bl           | 0          | 2             | yl          |            | bl           | 0          | 2             | yl          |            | bl           | 0          |
| 82                | 2                     | ≡or yl      | 3.5        | —gr bl       | 1.5         | bl           | bl         | yl          | 2             | —gr bl      | 0          | bl           | 0          | 2             | yl          |            | bl           | 0          | 2             | yl          |            | bl           | 0          |
| 79                | 2                     | ≡or yl      | 0          | bl           | 0           | bl           | bl         | —or yl      | 2             | —           | 0          | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 76.5              | 1                     | yl or       |            | ≡gr bl       | 0           | bl           | bl         | —or yl      | 1             | —           | 1.5        | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 73.5              | 1                     | yl          |            | ≡gr bl       | 0           | bl           | bl         | —or yl      | 1             | —           | 5          | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 71                | 2                     | ≡yl or      | 4          | —gr bl       | 1           | bl           | bl         | ≡yl or      | 2             | ≡yl or      | 5          | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 68.5              | 2                     | —yl or      | 1          | ≡gr bl       | 0           | bl           | bl         | —yl or      | 2             | —           | 4          | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 66                | 3                     | or          | 0          | bl           | 0           | bl           | bl         | or          | 2             | or          | 5          | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 63.2              | 3                     | ≡or yl      | 1          | —gr bl       | 0           | bl           | bl         | ≡or yl      | 2             | —           | 1.5        | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 59.7              | 4                     | or          | 0          | or           | 0           | bl           | bl         | or          | 2             | or          | 5          | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 55                | 3                     | or          | 0          | bl           | 0           | bl           | bl         | or          | 2             | ≡           | 2.5        | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 49                | 3                     | ≡or yl      | 0          | bl           | 0           | bl           | bl         | ≡or yl      | 2             | ≡           | 2.5        | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 41.2              | 3                     | ≡yl or      | 1          | bl           | 0           | bl           | bl         | —           | 2             | —           | 1          | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 31                | 1                     | yl          |            | —vi bl       | 0           | bl           | bl         | yl          | 2             | yl          | 0          | bl           | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
| 20.5              | 2                     | yl          |            | ≡vi bl       | 1           | bl           | bl         | yl          | 2             | yl          | 0          | bl           | 0          | 2             | yl          |            | bl           | 0          | 2             | yl          |            | bl           | 0          |
| 11.5              | 1                     | yl          |            | ≡vi bl       | 0           | bl           | bl         | yl          | 2             | yl          | 0          | bl           | 0          | 1             | yl          |            | bl           | 0          | 1             | yl          |            | bl           | 0          |
| 0                 | 1                     | yl          |            | ≡vi bl       | 0           | ≡vi bl       | ≡vi bl     | yl          | 2             | yl          | 0          | ≡vi bl       | 0          | 3             | yl          |            | bl           | 0          | 3             | yl          |            | bl           | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              | 0          | 1             |             |            |              | 0          |
|                   | 1                     |             |            |              | 0           |              |            |             | 2             |             | 0          |              | 0          | 1             |             |            |              |            |               |             |            |              |            |

TABLE XIV.

SUBJECT G.—STIMULUS—GREEN.

| Retinal Location. | Background. 1 (White). |             |            |              | 3 (Yellow). |             |            |              | 7 (Green). |               |             |            | 38 (Blue).   |            |               |             | 50 (Black). |              |            |               |             |            |              |            |
|-------------------|------------------------|-------------|------------|--------------|-------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|-------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.          | Color Seen. | Variation. | After-image. | Variation.  | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation.  | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |
| 93°               | 1                      | none        |            |              |             | light       |            | dark         |            | 3             | light       |            | dark         |            | 2             | light       |             | dark         |            | 1             |             |            |              |            |
| 90.5              | 3                      | red?        | 0          | none         | 0           | yl?         | 0          | bl           | 0          | 2             | yl          | 0          | bl           | 0          | 1             | yl          | 0           | none         | 0          | 1             |             |            |              |            |
| 87.5              | 1                      | red         | 10         | none         | 1           | gr yl       | 1          | bl?          | 0          | 3             | gr yl       | 1          | bl           | 0          | 2             | yl          | 0           | bl           | 0          | 2             |             |            |              |            |
| 84.5              | 3                      | red?        | 0          | none         | 1.5         | yl          | 1.5        | bl           | 0          | 4             | yl          | 0          | bl           | 0          | 3             | yl          | 0           | bl           | 0          | 3             |             |            |              |            |
| 79                | 2                      | yl gr       | 0          | bl           | 2           | gr yl       | 1.5        | bl           | 0          | 2             | gr yl       | 1.5        | bl           | 0          | 3             | gr yl       | 1           | none         | 5          | 1             |             |            |              |            |
| 76.5              | 2                      | gr          | 0          | bl + vi      | 5           | gr yl       | 1.5        | rd cr        | 6          | 2             | gr yl       | 1.5        | rd cr        | 6          | 3             | gr yl       | 0           | bl + vi      | 5          | 1             |             |            |              |            |
| 73.5              | 3                      | gr          | 0          | bl + vi      | 5           | yl gr       | 1          | car          | 0          | 3             | yl gr       | 1          | car          | 0          | 3             | yl gr       | 1           | rd cr        | 6.5        | 1             |             |            |              |            |
| 71                | 1                      | gr          | 0          | vi cr        | 1           | yl gr       | 0          | vi cr        | 1.5        | 2             | yl gr       | 0          | vi cr        | 1.5        | 3             | yl gr       | 1           | car          | 0          | 1             |             |            |              |            |
| 68.5              | 3                      | gr          | 0          | car          | 1           | yl gr       | 0          | car          | 1.5        | 3             | yl gr       | 0          | car          | 1.5        | 3             | yl gr       | 0           | vi cr        | 3          | 1             |             |            |              |            |
| 66                | 3                      | gr          | 0          | car          | 1           | yl gr       | 0          | car          | 1.5        | 2             | yl gr       | 0          | car          | 1.5        | 3             | yl gr       | 0           | vi cr        | 3          | 1             |             |            |              |            |
| 63.2              | 3                      | gr          | 0          | car          | 1           | yl gr       | 0          | car          | 1.5        | 2             | yl gr       | 0          | car          | 1.5        | 3             | yl gr       | 0           | vi cr        | 3          | 1             |             |            |              |            |
| 59.7              | 4                      | gr          | 0          | car          | 1           | yl gr       | 0          | car          | 1.5        | 2             | yl gr       | 0          | car          | 1.5        | 3             | yl gr       | 0           | vi cr        | 3          | 1             |             |            |              |            |
| 55                | 3                      | gr          | 0          | car          | 1           | yl gr       | 0          | car          | 1.5        | 2             | yl gr       | 0          | car          | 1.5        | 3             | yl gr       | 0           | vi cr        | 3          | 1             |             |            |              |            |
| 49                | 3                      | gr          | 0          | car          | 1           | yl gr       | 0          | car          | 1.5        | 2             | yl gr       | 0          | car          | 1.5        | 3             | yl gr       | 0           | vi cr        | 3          | 1             |             |            |              |            |
| 41.2              | 3                      | yl gr       | 1          | car          | 0           | yl gr       | 1.5        | vi cr        | 0          | 2             | yl gr       | 1.5        | vi cr        | 0          | 3             | yl gr       | 1           | vi cr        | 1          | 1             |             |            |              |            |
| 31                | 3                      | yl gr       | 1          | car          | 0           | yl gr       | 1.5        | vi cr        | 0          | 2             | yl gr       | 1.5        | vi cr        | 0          | 3             | yl gr       | 1           | vi cr        | 1          | 2             |             |            |              |            |
| 20.5              | 1                      | gr          | 1.5        | car          | 0           | yl gr       | 1.5        | vi cr        | 0          | 2             | yl gr       | 1.5        | vi cr        | 0          | 4             | gr          | 0           | vi cr        | 3          | 2             |             |            |              |            |
| 11.5              | 1                      | gr          | 1.5        | car          | 0           | yl gr       | 1.5        | vi cr        | 0          | 2             | yl gr       | 1.5        | vi cr        | 0          | 2             | gr          | 0           | vi cr        | 1          | 1             |             |            |              |            |
| 0                 | 1                      | gr          | 1          | car          | 0           | gr          | 0          | vi cr        | 1          | 3             | gr          | 0          | vi cr        | 1          | 4             | gr          | 0           | vi cr        | 2.5        | 1             |             |            |              |            |

TABLE XV.  
SUBJECT G.—STIMULUS—BLUE GREEN.

| Retinal Location | Background. 1 (White). |             |            |              | 3 (Yellow). |              |            |               | 7 (Green).  |            |              |            | 38 (Blue).    |             |            |              | 50 (Black). |               |             |            |              |            |   |
|------------------|------------------------|-------------|------------|--------------|-------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|-------------|---------------|-------------|------------|--------------|------------|---|
|                  | No. of Tests.          | Color Seen. | Variation. | After-image. | Variation.  | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation.  | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |   |
| 93°              | 1                      | none        |            |              | 1           | none         |            | 1             | none        |            |              |            | 1             | light       |            | dark         |             | 1             | —bl gr      |            |              |            |   |
| 90.5             | 2                      | none        |            | car          | 1           | ≡gr yl       |            | 1             | ≡gr yl      |            | car          |            | 2             | light       |            | dark         |             | 1             | ≡bl gr      |            |              |            |   |
| 87.5             | 2                      | none        |            | red          | 1           | gr           |            | 1             | gr          |            | none         |            | 2             | light       |            | car          |             | 1             | ≡bl gr      |            |              |            |   |
| 84.5             | 3                      | gr          | rd + cr    | 0            | 3           | gr           | 0          | 3             | gr          | 0          | car          | 0          | 3             | light       | 3          | red          |             | 1             | gr + bl     |            |              |            |   |
| 82               | 2                      | gr          | 0          | 0            | 3           | gr           | 0          | 3             | gr          | 0          | car          | 0          | 2             | light       | 3          | red?         |             | 1             | gr + bl     |            |              |            |   |
| 79               | 2                      | gr          | 0          | 0            | 2           | gr           | 0          | 2             | gr          | 0          | rd + cr      | 5          | 3             | light       | 3          | none         |             | 1             | —bl gr      |            | none         |            |   |
| 76.5             | 2                      | gr          | 0          | 0            | 2           | gr           | 0          | 2             | gr          | 0          | rd + cr      | 5          | 3             | light       | 3          | none         |             | 1             | ≡bl gr      |            | ≡ or rd      |            |   |
| 73.5             | 4                      | gr          | 0          | 0            | 4           | gr           | 0          | 2             | gr          | 0          | rd + cr      | 5          | 2             | light       | 3          | rd cr        | 2           | 1             | gr + bl     |            | red          |            |   |
| 71               | 2                      | ≡bl gr      | 0          | 0            | 2           | ≡bl gr       | 0          | 2             | ≡bl gr      | 0          | rd + cr      | 3.5        | 2             | gr          | 3          | rd cr        | 3           | 1             | gr + bl     |            | red          |            |   |
| 68.5             | 3                      | ≡bl gr      | 0          | 0            | 3           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4.5        | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | ≡ rd cr      |            |   |
| 66               | 3                      | ≡bl gr      | 0          | 0            | 3           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4          | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | ≡ rd cr      |            |   |
| 63.2             | 2                      | ≡bl gr      | 0          | 0            | 2           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 5          | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | rd           |            |   |
| 59.7             | 3                      | ≡bl gr      | 0          | 0            | 3           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 3.5        | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | ≡ rd cr      |            |   |
| 55               | 3                      | ≡bl gr      | 0          | 0            | 3           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4.5        | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | ≡ rd cr      |            |   |
| 49               | 2                      | ≡bl gr      | 0          | 0            | 2           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4          | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | rd + cr      |            |   |
| 41.2             | 2                      | ≡bl gr      | 0          | 0            | 2           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4          | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | rd + cr      |            |   |
| 31               | 3                      | ≡bl gr      | 0          | 0            | 3           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4          | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | car          |            |   |
| 20.5             | 3                      | ≡bl gr      | 0          | 0            | 3           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4          | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | car          |            |   |
| 11.5             | 2                      | ≡bl gr      | 0          | 0            | 2           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4          | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | car          |            |   |
| 0                | 2                      | ≡bl gr      | 0          | 0            | 2           | ≡bl gr       | 0          | 2             | gr          | 0          | rd + cr      | 4          | 2             | gr          | 3          | rd cr        | 4           | 1             | ≡bl gr      |            | car          |            | 0 |

TABLE XVI.  
SUBJECT G.—STIMULUS—GREEN-BLUE.

| Retinal Location. | Background. 1 (White). |             |            |              | 3 (Yellow). |               |             |            | 7 (Green).   |            |               |             | 38 (Blue). |              |            |               | 50 (Black). |            |              |            |  |
|-------------------|------------------------|-------------|------------|--------------|-------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|--|
|                   | No. of Tests.          | Color Seen. | Variation. | After-Image. | Variation.  | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. |  |
| 93°               |                        |             |            |              |             |               |             |            |              |            |               |             |            |              |            |               |             |            |              |            |  |
| 90.5              |                        |             |            |              |             | 2             | none        |            | —gryl        | 1.5        | 1             | none        |            | none         |            | 1             | light       |            | dark         |            |  |
| 87.5              |                        |             |            |              | 2           | none          | none        |            | yl?          |            | 1             | none        |            | yl?          |            | 1             | bl          |            | none         |            |  |
| 84.5              |                        |             |            |              | 2           | none          | none        |            | yl           | 0          | 2             | none        |            | yl           | 0          | 2             | bl          |            | ≡ vi cr      | 2.5        |  |
| 82                |                        |             |            |              | 2           | bl            | bl          | 0          | ≡ or yl      | 6          | 2             | bl          | 0          | or           | 9.5        | 2             | bl          | 0          | — or rd      | 1          |  |
| 79                |                        |             |            |              | 1           | dark          | dark        | 0          | or           |            | 1             | bl          | 0          | yl           | 0          | 3             | — gr bl     |            | red          |            |  |
| 76.5              |                        |             |            |              | 2           | bl            | bl          | 0          | ≡ or yl      | 0          | 2             | bl          | 0          | ≡ yl or      | 5.5        | 3             | bl          | 0          | red          |            |  |
| 73.5              |                        |             |            |              | 2           | bl            | bl          | 0          | yl           | 3.5        | 2             | bl          | 0          | ≡ gryl       | 2.5        | 3             | bl          | 0          | ≡ rd or      | 3          |  |
| 71                |                        |             |            |              | 2           | bl            | bl          | 0          | ≡ or yl      | 0          | 2             | bl          | 0          | yl + or      | 5          | 3             | bl          | 0          | ≡ or rd      | 2          |  |
| 68.5              | dar                    |             |            | or           | 3           | bl            | bl          | 0          | ≡ or yl      | 0          | 2             | bl          | 0          | ≡ or yl      | .5         | 3             | bl          | 0          | red          |            |  |
| 66                | d                      |             |            | or           | 7           | bl            | bl          | 0          | yl           | 3          | 2             | bl          | 0          | or           | .5         | 3             | bl          | 0          | ≡ or rd      | 0          |  |
| 63.2              |                        |             |            | ≡ gryl       | 1           | bl            | bl          | 0          | ≡ or yl      | 0          | 2             | bl          | 0          | or           | 0          | 3             | bl          | 0          | ≡ or rd      | 3          |  |
| 59.7              |                        |             |            | or           | 3           | bl            | bl          | 0          | ≡ yl or      | 0          | 2             | bl          | 0          | or           | 1.5        | 3             | bl          | 0          | ≡ or rd      | 2          |  |
| 55                |                        |             |            | or           | 3           | bl            | bl          | 0          | or           | 0          | 2             | bl          | 0          | or           | 0          | 3             | bl          | 0          | ≡ or rd      | 2          |  |
| 49                |                        |             |            | ≡ yl or      | 3           | bl            | bl          | 0          | or           | 1.5        | 2             | bl          | 0          | ≡ rd or      | 1.5        | 3             | bl          | 0          | ≡ or rd      | 3          |  |
| 41.2              |                        |             |            | — yl or      | 4           | ≡ gr bl       | ≡ gr bl     | 0          | or           | 0          | 3             | ≡ gr bl     | 0          | ≡ rd or      | 0          | 5             | ≡ gr bl     | 0          | red          |            |  |
| 31                |                        |             |            | or           | 3           | ≡ gr bl       | or          | 0          | or           | 0          | 3             | ≡ gr bl     | 0          | or           | 0          | 3             | ≡ gr bl     | 0          | red          |            |  |
| 20.5              |                        |             |            | or           | 3           | ≡ gr bl       | or          | 0          | or           | 0          | 1             | ≡ gr bl     | 0          | ≡ rd or      | 1.5        | 3             | ≡ gr bl     | 0          | — or rd      | 1          |  |
| 11.5              |                        |             |            | ≡ rd or      | 2           | ≡ gr bl       | or          | 0          | — rd or      | 1.5        | 2             | ≡ gr bl     | 0          | or           | 0          | 3             | ≡ gr bl     | 0          | ≡ or rd      | 3.5        |  |
| 0                 |                        |             |            | or           | 2           | ≡ gr bl       | or          | 0          | — rd or      | 1.5        | 2             | ≡ gr bl     | 0          | ≡ rd or      | 0          | 5             | ≡ gr bl     | 0          | red          |            |  |





TABLE XVIII.

SUBJECT G.—STIMULUS—VIOLET.

| Retinal Location. | Background. x (White). |             |            |              | 3 (Yellow). |              |            |               | 7 (Green).  |            |              |            | 38 (Blue).    |             |            |              | 50 (Black). |               |             |            |              |            |               |             |            |              |            |               |             |            |              |            |
|-------------------|------------------------|-------------|------------|--------------|-------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|-------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.          | Color Seen. | Variation. | After-image. | Variation.  | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation.  | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |
| 93°               | 2                      | none        |            | yl?          | yl?         | yl?          | 1          | bl            | 0           | 0          | yl           | 0          | 1             | bl          | 0          | ≡rd or       | 0           | 1             | bl          | 0          | ≡rd or       | 0          | 1             | bl          | 0          | ≡rd or       | 0          | 1             | bl          | 0          | ≡rd or       | 0          |
| 87.5              | 2                      | bl?         |            | -or yl       | -or yl      | or + yl      | 2          | bl?           | 0           | 0          | or + yl      | 5          | 2             | bl          | 0          | or           | 0           | 2             | bl          | 0          | or           | 0          | 2             | bl          | 0          | or           | 0          | 2             | bl          | 0          | or           | 0          |
| 84.5              | 1                      | bl          |            | gr yl        | gr yl       | yl           | 3          | bl            | 0           | 0          | yl           | 0          | 3             | bl          | 0          | -or rd       | 0           | 4             | bl          | 0          | -or rd       | 0          | 4             | bl          | 0          | -or rd       | 0          | 4             | bl          | 0          | -or rd       | 0          |
| 82                | 2                      | bl          |            | -or yl       | -or yl      | yl           | 2          | bl            | 0           | 0          | yl           | 0          | 2             | bl          | 0          | ≡rd or       | 0           | 3             | bl          | 0          | ≡rd or       | 0          | 3             | bl          | 0          | ≡rd or       | 0          | 3             | bl          | 0          | ≡rd or       | 0          |
| 79                | 2                      | bl          |            | gr yl        | gr yl       | ≡gr yl       | 2          | bl            | 0           | 0          | ≡gr yl       | 4          | 2             | bl          | 0          | ≡rd or       | 0           | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          |
| 76.5              | 2                      | bl          |            | -or yl       | -or yl      | ≡gr yl       | 2          | bl            | 0           | 0          | ≡gr yl       | 4          | 2             | bl          | 0          | ≡rd or       | 0           | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          |
| 73.5              | 2                      | bl          |            | gr yl        | gr yl       | ≡gr yl       | 3          | bl            | 0           | 0          | ≡gr yl       | 5          | 2             | bl          | 0          | ≡rd or       | 0           | 3             | bl          | 0          | ≡rd or       | 0          | 3             | bl          | 0          | ≡rd or       | 0          | 3             | bl          | 0          | ≡rd or       | 0          |
| 71                | 3                      | bl          |            | gr yl        | gr yl       | ≡gr yl       | 1          | bl            | 0           | 0          | ≡gr yl       | 5          | 2             | bl          | 0          | ≡rd or       | 0           | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          |
| 68.5              | 1                      | ≡bl vi      |            | gr yl        | gr yl       | ≡gr yl       | 2          | dark          | 0           | 0          | ≡gr yl       | 5          | 2             | bl          | 0          | ≡rd or       | 0           | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          |
| 66                | 3                      | dark        |            | gr yl        | gr yl       | ≡gr yl       | 3          | bl            | 0           | 0          | ≡gr yl       | 2.5        | 2             | bl          | 0          | ≡rd or       | 0           | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          | 2             | bl          | 0          | ≡rd or       | 0          |
| 63.2              | 1                      | bl          |            | gr yl        | gr yl       | ≡gr yl       | 2          | ≡bl vi        | 6.5         | yl + gr    | 0            | 0          | ≡yl + gr      | 0           | 2          | ≡yl + gr     | 0           | 2             | bl          | 0          | ≡yl + gr     | 0          | 2             | bl          | 0          | ≡yl + gr     | 0          | 2             | bl          | 0          | ≡yl + gr     | 0          |
| 59.7              | 1                      | vi          |            | yl + gr      | yl + gr     | yl + gr      | 4          | bl            | 0           | 0          | ≡yl + gr     | 1.5        | 2             | bl          | 0          | ≡yl + gr     | 1.5         | 3             | bl          | 0          | ≡yl + gr     | 1.5        | 3             | bl          | 0          | ≡yl + gr     | 1.5        | 3             | bl          | 0          | ≡yl + gr     | 1.5        |
| 55                | 1                      | bl          |            | yl + gr      | yl + gr     | yl + gr      | 6          | bl            | 0           | 0          | ≡yl + gr     | 1.5        | 2             | bl          | 0          | ≡yl + gr     | 2.5         | 5             | bl          | 0          | ≡yl + gr     | 2.5        | 5             | bl          | 0          | ≡yl + gr     | 2.5        | 5             | bl          | 0          | ≡yl + gr     | 2.5        |
| 49                | 1                      | bl          |            | yl + gr      | yl + gr     | yl + gr      | 5          | bl            | 0           | 0          | ≡yl + gr     | 1.5        | 2             | bl          | 0          | ≡yl + gr     | 1.5         | 4             | bl          | 0          | ≡yl + gr     | 1.5        | 4             | bl          | 0          | ≡yl + gr     | 1.5        | 4             | bl          | 0          | ≡yl + gr     | 1.5        |
| 41.2              | 1                      | ≡vi bl      |            | yl + gr      | yl + gr     | yl + gr      | 5          | bl            | 0           | 0          | ≡yl + gr     | 3          | 2             | vi          | 3          | gr           | 0           | 5             | bl          | 0          | ≡yl + gr     | 0          | 5             | bl          | 0          | ≡yl + gr     | 0          | 5             | bl          | 0          | ≡yl + gr     | 0          |
| 31                | 1                      | vi          |            | yl + gr      | yl + gr     | yl + gr      | 3          | vi            | 0           | 0          | ≡yl + gr     | 1.5        | 2             | ≡bl vi      | 1.5        | -yl + gr     | 1.5         | 4             | ≡bl vi      | 4.5        | ≡yl + gr     | 1.5        | 4             | ≡bl vi      | 4.5        | ≡yl + gr     | 1.5        | 4             | ≡bl vi      | 4.5        | ≡yl + gr     | 1.5        |
| 20.5              | 1                      | vi          |            | yl + gr      | yl + gr     | yl + gr      | 2          | vi            | 0           | 0          | ≡yl + gr     | 5          | 2             | vi          | 0          | ≡yl + gr     | 5           | 4             | vi          | 1.5        | ≡yl + gr     | 1.5        | 4             | vi          | 1.5        | ≡yl + gr     | 1.5        | 4             | vi          | 1.5        | ≡yl + gr     | 1.5        |
| 11.5              | 1                      | vi          |            | yl + gr      | yl + gr     | yl + gr      | 2          | vi            | 0           | 0          | ≡yl + gr     | 3          | 2             | vi          | 0          | ≡yl + gr     | 3           | 3             | vi          | 0          | ≡yl + gr     | 3          | 3             | vi          | 0          | ≡yl + gr     | 3          | 3             | vi          | 0          | ≡yl + gr     | 3          |
| 0                 | 1                      | vi          |            | yl + gr      | yl + gr     | yl + gr      | 2          | vi            | 0           | 0          | ≡yl + gr     | 0          | 3             | vi          | 0          | ≡yl + gr     | 0           | 3             | vi          | 0          | ≡yl + gr     | 0          | 3             | vi          | 0          | ≡yl + gr     | 0          | 3             | vi          | 0          | ≡yl + gr     | 0          |

TABLE XIX.

SUBJECT B.—STIMULUS—CARMINE.

| Retinal Location. | Background. 3 (Yellow). |             |            |              |            | 7 (Green).    |             |            |              |            | 38 (Blue).    |             |            |              |            |
|-------------------|-------------------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.           | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |
| 93°               |                         |             |            |              |            |               |             |            |              |            |               |             |            |              |            |
| 90.5              |                         |             |            |              |            |               |             |            |              | 1          | none          |             |            | none         |            |
| 87.5              |                         |             |            |              |            |               |             |            |              | 1          | none          |             |            | none         |            |
| 84.5              |                         |             |            |              |            | 1             | bl          |            | yl           |            | 1             | bl          |            | none         |            |
| 82                |                         |             |            |              |            | 1             | bl          |            | yl           |            | 1             | bl          |            | none         |            |
| 79                | 1                       | none        |            | none         |            | 2             | bl          | 0          | ≡gryl        | 4          | 1             | car         |            | bl?          |            |
| 76.5              | 1                       | none        |            | none         |            | 3             | bl          | 0          | yl           | 0          |               |             |            |              |            |
| 73.5              | 1                       | car         |            | ≡gryl        |            | 2             | car + vi    | 15         | yl + gr      | 5          | 1             | ≡vi car     |            | ≡gryl        |            |
| 71                |                         |             |            |              |            | 1             | ≡car vi     |            | gr           |            | 1             | car         |            | yl           |            |
| 68.5              | 2                       | car         | 0          | gr           | 10         | 1             | bl          |            | -gryl        |            | 2             | car         | 0          | gr           | 0          |
| 66                | 2                       | -rd cr      | 1.5        | ≡blgr        | 0          | 1             | vi          |            | ≡gryl        |            | 2             | -rd car     | 1.5        | gr           | 0          |
| 63.2              | 2                       | car + vi    |            | -gryl        | 0          | 1             | ≡car vi     |            | ≡gryl        |            | 4             | car         | 0          | gr           | 1          |
| 59.7              | 3                       | ≡vi car     | 3          | ≡gryl        | 0          | 1             | ≡vi car     |            | gr           |            | 1             | car         |            | gr           |            |
| 55                | 3                       | ≡vi car     | 1          | ≡ylgr        | 0          | 1             | ≡car vi     |            | gr           |            | 2             | -rd car     | 1          | gr           | 0          |
| 49                | 2                       | -vi car     | 1.5        | gr           | 0          | 1             | ≡car vi     |            | gr           |            | 2             | car         | 0          | gr           | 0          |
| 41.2              | 2                       | -vi car     | 1.5        | ≡ylgr        | .5         | 3             | ≡vi car     | 0          | ≡ylgr        | 0          | 2             | -rd car     | 1          | gr           | 0          |
| 31                | 2                       | ≡vi car     | .5         | gr           | 0          | 3             | ≡vi car     | 0          | ≡ylgr        | 0          | 2             | -rd car     | 1          | gr           | 0          |
| 20.5              | 2                       | car         | 3          | gr           | 2.5        | 1             | -rd car     |            | -ylgr        |            | 2             | -rd car     | 1.5        | gr           | 0          |
| 11.5              | 2                       | ≡vi car     | 1          | gr           | 0          | 1             | car         |            | ≡ylgr        |            | 1             | car         |            | gr           | 0          |
| 0                 | 2                       | car         | 0          | gr           | 0          | 1             | car         |            | gr           |            | 1             | -rd car     |            | gr           |            |

STIMULUS—RED.

|      |   |        |     |         |     |   |         |     |         |   |   |         |        |         |    |
|------|---|--------|-----|---------|-----|---|---------|-----|---------|---|---|---------|--------|---------|----|
| 93°  |   |        |     |         |     |   |         |     |         |   |   |         |        |         |    |
| 90.5 |   |        |     |         |     |   |         |     |         |   |   |         |        |         |    |
| 87.5 |   |        |     |         |     |   |         |     |         |   |   |         |        |         |    |
| 84.5 | 1 | none   |     | none    |     | 1 | ≡yl or  |     | bl      |   | 1 | light   |        | dark    |    |
| 82   | 1 | none   |     | none    |     | 1 | none    |     | none    |   | 1 | ≡yl or  |        | bl      |    |
| 79   | 1 | dark   |     | bl      |     | 3 | ≡orred  | 4   | bl      | 0 |   |         |        |         |    |
| 76.5 | 2 | ≡orred | 0   | bl      | 0   | 1 | red     |     | bl      |   |   |         |        |         |    |
| 73.5 | 1 | ≡orred |     | bl      |     | 1 | ≡orred  |     | bl      |   | 1 | ≡red or |        | bl      |    |
| 71   | 1 | ≡orred |     | bl      |     | 2 | -orred  | 1.5 | bl      | 0 | 1 | ≡orred  |        | bl      |    |
| 68.5 | 3 | ≡orred | 1   | bl      | 0   | 1 | ≡orred  |     | ≡gr bl  |   | 0 | 1       | -carrd | bl      |    |
| 66   | 2 | ≡orred |     | -gr bl  | 1.5 | 2 | ≡orred  | .5  | bl      | 0 | 2 | red     | 3      | -gr bl  | 1  |
| 63.2 | 2 | ≡orred | 2   | bl      | 0   | 1 | ≡orred  |     | bl      |   | 2 | ≡orred  | 2      | -gr bl  | 1  |
| 59.7 | 3 | ≡orred | 0   | bl      | 0   | 1 | ≡orred  |     | bl      |   | 2 | ≡orred  | 0      | -gr bl  | 1  |
| 55   | 3 | ≡orred | 0   | gr + bl | 2   | 1 | ≡orred  |     | bl      |   | 2 | ≡orred  | 0      | ≡gr bl  | 0  |
| 49.2 | 4 | ≡orred | .5  | ≡gr bl  | 1.5 | 1 | red     |     | gr + bl |   | 3 | ≡orred  | 0      | gr + bl | 2  |
| 41.2 | 2 | -orred | 1.5 | ≡blgr   | 1   | 1 | ≡orred  |     | ≡blgr   |   | 2 | ≡orred  | .5     | gr + bl | 2  |
| 31   | 2 | ≡orred | 0   | ≡blgr   | .5  | 1 | ≡orred  |     | ≡blgr   |   | 2 | ≡orred  | .5     | ≡blgr   | .5 |
| 20.5 | 2 | -orred | 1   | ≡blgr   | 0   | 1 | ≡orred  |     | ≡blgr   |   | 2 | -orred  | 1      | ≡blgr   | 0  |
| 11.5 | 1 | ≡orred |     | gr + bl |     | 1 | ≡red or |     | ≡blgr   |   | 3 | ≡orred  | 0      | ≡blgr   | 1  |
| 0    | 2 | red    | 0   | ≡blgr   | 1   | 1 | red     |     | ≡blgr   |   | 1 | red     |        | ≡gr bl  |    |

TABLE XX.

SUBJECT B.—STIMULUS—ORANGE.

| Retinal Location. | Background. 3 (Yellow). |             |            |              |            | 7 (Green).    |             |            |              |            | 38 (Blue).    |             |            |              |            |
|-------------------|-------------------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.           | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. |
| 93°               |                         |             |            |              |            |               |             |            |              |            | 1             | yl?         |            | none         |            |
| 90.5              | 1                       | none        |            | none         |            |               |             |            |              |            | 1             | yl          |            | bl           |            |
| 87.5              | 1                       | dark        |            | light        |            |               |             |            |              |            | 1             | yl          |            | none         |            |
| 84.5              | 1                       | dark        |            | light        |            |               |             |            |              |            | 1             | ≡ yl or     |            | bl           |            |
| 82                | 2                       | ≡ red or    | 4          | bl           | 0          | 1             | ≡ or red    |            | bl           |            | 1             | ≡ or yl     |            | bl           |            |
| 79                | 1                       | ≡ or red    |            | bl           |            | 1             | ≡ or yl     |            | bl           |            |               |             |            |              |            |
| 76.5              | 1                       | ≡ or red    |            | bl           |            | 1             | ≡ or red    |            | bl           |            |               |             |            |              |            |
| 73.5              | 1                       | ≡ or red    |            | bl           |            | 1             | ≡ red or    |            | bl           |            | 1             | ≡ or yl     |            | bl           |            |
| 71                | 1                       | ≡ or red    |            | bl           |            | 2             | — red or    | 1.5        | bl           | 0          | 1             | ≡ red or    |            | bl           |            |
| 68.5              | 2                       | or + red    |            | — gr bl      | 1          | 1             | ≡ red or    |            | bl           |            | 1             | ≡ red or    |            | bl           |            |
| 66                | 2                       | ≡ or red    | 0          | bl           | 0          | 1             | ≡ or red    |            | ≡ bl gr      |            | 1             | ≡ or red    |            | ≡ gr bl      |            |
| 63.2              | 2                       | ≡ or red    | 0          | bl           | 0          | 1             | ≡ or red    |            | ≡ gr bl      |            | 3             | ≡ or red    | 0          | ≡ gr bl      | 1          |
| 59.7              | 2                       | — or red    | 1.5        | — gr bl      | 1          | 1             | ≡ red or    |            | bl           |            | 2             | ≡ or red    | 0          | — gr bl      | 1          |
| 55                | 2                       | ≡ or red    | 2.5        | ≡ gr bl      | .5         | 1             | ≡ red or    |            | bl           |            | 2             | ≡ red or    | 1.5        | ≡ gr bl      | 1          |
| 49                | 3                       | ≡ red or    | 1          | gr + bl      | 1          | 1             | ≡ yl or     |            | bl           |            | 2             | ≡ red or    | 2.5        | ≡ gr bl      | 1          |
| 41.2              | 2                       | or + red    | 2          | ≡ gr bl      | 3.5        | 1             | ≡ or red    |            | gr + bl      |            | 2             | ≡ red or    | 2.5        | ≡ gr bl      | 0          |
| 31                | 2                       | ≡ red or    | 3.5        | gr + bl      | 2          | 1             | or          |            | gr + bl      |            | 2             | ≡ red or    | 4.5        | ≡ gr bl      | 0          |
| 20.5              | 1                       | ≡ red or    |            | ≡ gr bl      |            | 1             | ≡ yl or     |            | ≡ gr bl      |            | 3             | ≡ yl or     | 0          | ≡ gr bl      | 0          |
| 11.5              | 3                       | ≡ or red    | 0          | ≡ gr bl      | 3          | 1             | ≡ red or    |            | ≡ gr bl      |            | 1             | ≡ or red    | 0          | ≡ bl gr      |            |
| 0                 | 2                       | ≡ red or    | 0          | — gr bl      | 1.5        | 1             | or          |            | ≡ bl gr      |            | 2             | or          | 0          | ≡ gr bl      | .5         |

STIMULUS—YELLOW.

|      |   |          |     |         |     |   |         |   |         |   |   |         |     |         |     |
|------|---|----------|-----|---------|-----|---|---------|---|---------|---|---|---------|-----|---------|-----|
| 93°  |   |          |     |         |     |   |         |   |         |   | 1 | yl      |     | bl      |     |
| 90.5 | 1 | none     |     | none    |     |   |         |   |         |   | 1 | yl      |     | bl      |     |
| 87.5 | 1 | yl?      |     | none    |     |   |         |   |         |   | 1 | yl      |     | bl      |     |
| 84.5 | 3 | none     |     | bl      | 0   |   |         |   |         |   | 1 | ≡ or yl |     | bl      |     |
| 82   | 1 | ≡ or yl  |     | bl      |     |   |         |   |         |   | 1 | — gr yl |     | bl      |     |
| 79   | 1 | ≡ or red |     | bl      |     | 2 | ≡ yl or | 6 | bl      | 0 |   |         |     |         |     |
| 76.5 | 1 | ≡ red or |     | bl      |     | 1 | ≡ yl or |   | bl      |   | 1 | yl      |     | bl      |     |
| 73.5 | 1 | ≡ red or |     | bl      |     | 1 | ≡ yl or |   | ≡ gr bl |   | 1 | yl      |     | bl      |     |
| 71   | 1 |          |     | bl      |     | 1 | ≡ or yl |   | ≡ gr bl |   | 1 | yl      |     | bl      |     |
| 68.5 | 2 | or       | 3   | bl      | 0   | 1 | ≡ or yl |   | vi      |   | 1 | yl      |     | bl?     |     |
| 66   | 2 | or + red | 2   | bl      | 0   | 1 | ≡ yl or |   | ≡ gr bl |   | 2 | ≡ gr yl | 1   | bl      | 0   |
| 63.2 | 3 | or       | 2   | bl      | 0   | 1 | ≡ or yl |   | bl      |   | 2 | — gr yl | 1.5 | bl      | 0   |
| 59.7 | 3 | or       | 1   | bl      | 0   | 1 | ≡ yl or |   | ≡ gr bl |   | 2 | yl      | .5  | bl      | 0   |
| 55   | 3 | yl + or  | 2   | bl      | 0   | 1 | or      |   | bl      |   | 2 | yl      | 0   | — gr bl | 1   |
| 49   | 3 | ≡ yl or  | 0   | ≡ gr bl | 0   | 1 | ≡ yl or |   | ≡ gr bl |   | 2 | yl      | 0   | — gr bl | 1   |
| 41.2 | 2 | ≡ yl or  | 0   | — gr bl | 1.5 | 1 | ≡ or yl |   | bl      |   | 2 | yl      | 0   | — vi bl | 1.5 |
| 31   | 2 | ≡ or yl  | 0   | bl      | 0   | 1 | yl + or |   | bl      |   | 2 | yl      | 0   | — vi bl | 2   |
| 20.5 | 3 | ≡ gr yl  | 0   | ≡ vi bl | 1   | 1 | ≡ or yl |   | bl      |   | 3 | yl      | 0   | bl      | 0   |
| 11.5 | 2 | yl       | 2.5 | bl      | 0   | 1 | ≡ or yl |   | bl      |   | 2 | yl      | 0   | — vi bl | 1.5 |
| 0    | 2 | — gr yl  | 1.5 | — vi bl | 1   | 1 | yl      |   | bl      |   | 1 | yl      |     | ≡ vi bl |     |

TABLE XXI.

SUBJECT B.—STIMULUS—GREEN.

| Retinal Location. | Background. 3 (Yellow). |             |            |              |            | 7 (Green).    |             |            |              |            | 38 (Blue).    |             |            |              |            |
|-------------------|-------------------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.           | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. |
| 93°               |                         |             |            |              |            |               |             |            |              |            | 1             | light       |            | none         |            |
| 90.5              |                         |             |            |              |            |               |             |            |              |            | 1             | yl?         |            | dark         |            |
| 87.5              | 1                       | none        |            | none         |            |               |             |            |              |            | 1             | yl          |            | none         |            |
| 84.5              | 1                       | ≡ or yl     |            | none         |            | 1             | yl          |            | bl           |            | 1             | yl          |            | none         |            |
| 82                | 1                       | none        |            | none         |            | 1             | yl          |            | bl           |            | 1             | yl          |            | none         |            |
| 79                | 1                       | ≡ or yl     |            | bl           |            | 2             | -gr yl      | 1.5        | bl           | 0          |               |             |            |              |            |
| 76.5              | 1                       | dark        |            | bl           |            | 1             | ≡ yl gr     |            | bl           |            | 1             | -gr yl      |            | none         |            |
| 73.5              | 1                       | yl          |            | vi           |            | 1             | ≡ yl gr     |            | vi           |            | 1             | ≡ gr yl     |            | bl           |            |
| 71                | 1                       | -yl gr      |            | ≡ cr vi      |            | 1             | yl          |            | bl           |            | 1             | yl          |            | bl           |            |
| 68.5              | 3                       | ≡ bl gr     | 2          | car          | 0          | 1             | ≡ yl gr     |            | ≡ cr vi      |            | 2             | ≡ gr yl     | 0          | vi           | 0          |
| 66                | 2                       | -bl gr      | 1.5        | ≡ vi cr      | 0          | 1             | gr          |            | ≡ cr vi      |            | 2             | ≡ gr yl     | 1.5        | ≡ vi cr      | 0          |
| 63.2              | 2                       | -yl gr      | 1.5        | car          | 0          | 1             | ≡ yl gr     |            | vi           |            | 2             | ≡ gr yl     | 0          | -vi cr       | 1.5        |
| 59.7              | 3                       | -yl gr      | 2          | car          | 0          | 1             | yl+gr       |            | ≡ vi cr      |            | 2             | ≡ gr yl     | .5         | ≡ cr vi      | 1          |
| 55                | 3                       | gr          | 3          | car          | 0          | 1             | yl          |            | ≡ vi bl      |            | 2             | ≡ yl gr     | 0          | ≡ vi cr      | 1          |
| 49                | 4                       | -bl gr      | 2.5        | car          | 1          | 1             | gr          |            | ≡ vi cr      |            | 2             | ≡ gr yl     | 1          | cr+vi        | 5          |
| 41.2              | 3                       | gr          | 1          | car          | 1          | 1             | ≡ yl gr     |            | ≡ cr rd      |            | 3             | ≡ yl gr     | 0          | cr+vi        | 5          |
| 31                | 2                       | ≡ yl gr     | 2          | -rd cr       | 1.5        | 2             | ≡ yl gr     | .5         | -vi cr       | .5         | 2             | ≡ yl gr     | 1          | ≡ vi cr      | 3.5        |
| 20.5              | 2                       | -yl gr      | 0          | -rd cr       | 1.5        | 1             | ≡ yl gr     |            | ≡ vi cr      |            | 2             | ≡ yl gr     | 1.5        | car          | 0          |
| 11.5              | 2                       | -bl gr      | 1          | -rd cr       | 1.5        | 1             | ≡ yl gr     |            | ≡ vi cr      |            | 2             | -yl gr      | 1          | car          | 0          |
| 0                 | 2                       | ≡ bl gr     | 1          | car          | 0          | 2             | gr          | 0          | car          | .5         | 1             | ≡ yl gr     |            | cr+vi        |            |

STIMULUS — BLUE-GREEN.

|      |   |         |     |         |     |   |         |    |         |   |   |         |     |         |     |  |
|------|---|---------|-----|---------|-----|---|---------|----|---------|---|---|---------|-----|---------|-----|--|
| 93°  |   |         |     |         |     |   |         |    |         |   |   |         |     |         |     |  |
| 90.5 |   |         |     |         |     |   |         |    |         |   |   |         |     |         |     |  |
| 87.5 |   |         |     |         |     |   |         |    |         |   |   |         |     |         |     |  |
| 84.5 |   |         |     |         |     | 1 | bl      |    | none    |   | 1 | bl?     |     | none    |     |  |
| 82   |   |         |     |         |     | 1 | none    |    | none    |   | 1 | bl      |     | none    |     |  |
| 79   | 1 | none    |     | none    |     | 1 | none    |    | none    |   |   |         |     |         |     |  |
| 76.5 | 1 | dark    |     | bl?     |     | 1 | none    |    | none    |   | 1 | bl      |     | none    |     |  |
| 73.5 | 1 | dark    |     | bl?     |     | 1 | gr      |    | car     |   | 1 | bl?     |     | none    |     |  |
| 71   |   |         |     |         |     | 1 | ≡ yl gr |    | ≡ ylor  |   | 1 | bl      |     | car     |     |  |
| 68.5 | 1 | ≡ gr bl |     | vi      |     | 1 | ≡ bl gr |    | car     |   |   |         |     |         |     |  |
| 66   | 2 | gr      | 0   | -vi cr  | 1.5 | 1 | gr      |    | ≡ rd cr |   | 2 | -yl gr  | 8.5 | car     | 0   |  |
| 63.2 | 2 | gr      | 3   | -vi cr  | 1.5 | 1 | gr      |    | car     |   | 2 | ≡ yl gr | 6.5 | ≡ rd cr | 2.5 |  |
| 59.7 | 3 | ≡ bl gr | 2   | car     | 0   | 1 | none    |    | ≡ cr rd |   | 1 | ≡ yl gr |     | red     |     |  |
| 55   | 2 | ≡ bl gr | 1.5 | ≡ rd cr | .5  | 1 | gr      |    | ≡ cr vi |   | 2 | ≡ bl gr | 5   | car     | 0   |  |
| 49   | 3 | ≡ bl gr | 2   | ≡ cr rd | 3   | 1 | gr      |    | ≡ vi cr |   | 2 | ≡ bl gr | 4.5 | ≡ cr rd | 4.5 |  |
| 41.2 | 3 | -bl gr  | 1   | -rd cr  | 1   | 1 | gr      |    | car     |   | 2 | -yl gr  | 1   | car     | 0   |  |
| 31   | 2 | -bl gr  | .5  | -rd cr  | 1.5 | 1 | gr      |    | ≡ rd cr |   | 2 | gr      | 0   | ≡ cr rd | 5.5 |  |
| 20.5 | 2 | ≡ bl gr | .5  | ≡ rd cr | .5  | 2 | -yl gr  | .5 | -vi cr  | 1 | 2 | -bl gr  | 1.5 | ≡ rd cr | 5   |  |
| 11.5 | 2 | ≡ bl gr | .5  | ≡ rd cr | .5  | 1 | ≡ bl gr |    | ≡ rd cr |   | 1 | ≡ bl gr |     | ≡ cr rd |     |  |
| 0    | 2 | gr+bl   | 0   | ≡ cr rd | 4.5 | 1 | gr      |    | ≡ cr rd |   | 2 | -bl gr  | 1.5 | ≡ rd cr | 5.5 |  |

TABLE XXII.

SUBJECT B.—STIMULUS—GREEN-BLUE.

| Retinal Location. | Background. 3 (Yellow). |             |            |              | 7 (Green). |               |             |            | 38 (Blue).   |            |               |             |            |              |            |
|-------------------|-------------------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.           | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-image. | Variation. |
| 93°               |                         |             |            |              |            |               |             |            |              |            |               |             |            |              |            |
| 90.5              |                         |             |            |              |            |               |             |            |              |            |               |             |            |              |            |
| 87.5              |                         |             |            |              |            |               |             |            |              |            |               |             |            |              |            |
| 84.5              |                         |             |            |              |            |               |             |            |              |            |               |             |            |              |            |
| 82                | 1                       | bl          |            | — or yl      |            | 1             | = gr bl     |            | = or yl      |            | 1             | bl          |            | none         |            |
| 79                | 1                       | bl          |            | yl           |            | 2             | bl          | o          | yl           | o          | 1             | bl          |            | none         |            |
| 76.5              | 1                       | none        |            | = or yl      |            | 1             | bl          |            | = yl or      |            | 1             | bl          |            | = or rd      |            |
| 73.5              | 2                       | bl          | o          | — or yl      | 1          | 1             | bl          |            | = rd or      |            | 1             | bl          |            | = or rd      |            |
| 71                | 2                       | bl?         |            | — rd or      | 1.5        | 1             | bl          |            | or           |            | 1             | bl          |            | = or rd      |            |
| 68.5              | 3                       | bl          | o          | = yl or      | 4          | 1             | bl          |            | = or yl      |            | 1             | bl          |            | or           |            |
| 66                | 2                       | — gr bl     | 1          | = yl or      | o          | 1             | bl          |            | yl           |            | 2             | bl          | o          | or + rd      | 2          |
| 63.2              | 2                       | bl          | o          | yl + or      | 2          | 1             | bl          |            | = or yl      |            | 2             | bl          | o          | or           | o          |
| 59.7              | 2                       | bl          | o          | = rd or      | .5         | 1             | bl          |            | = or yl      |            | 2             | bl          | o          | = yl or      | 4          |
| 55                | 2                       | — gr bl     | 1          | = rd or      | .5         | 1             | bl          |            | = or yl      |            | 2             | bl          | o          | = yl or      | 4          |
| 49                | 4                       | = gr bl     | 1          | = rd or      | o          | 1             | bl          |            | or           |            | 2             | bl          | o          | or           | 3          |
| 41.2              | 4                       | = gr bl     | .5         | = rd or      | .5         | 1             | bl          |            | = or yl      |            | 2             | — gr bl     | 1          | = rd or      | o          |
| 31                | 2                       | = gr bl     | o          | = or rd      | 4          | 1             | = gr bl     |            | = yl or      |            | 3             | bl          | o          | = rd or      | o          |
| 20.5              | 2                       | = gr bl     | o          | — rd or      | 1          | 1             | gr + bl     |            | = rd or      |            | 1             | gr + bl     |            | = rd or      |            |
| 11.5              | 2                       | = gr bl     | .5         | = rd or      | .5         | 1             | gr + bl     |            | = rd or      |            | 1             | = gr bl     |            | = or rd      |            |
| o                 | 2                       | = gr bl     | .5         | = rd or      | 1          | 1             | = gr bl     |            | = rd or      |            | 3             | = gr bl     | o          | red          | o          |

STIMULUS—BLUE.

|      |   |         |     |         |     |   |         |   |         |     |         |     |         |         |   |
|------|---|---------|-----|---------|-----|---|---------|---|---------|-----|---------|-----|---------|---------|---|
| 93°  |   |         |     |         |     |   |         |   |         | 2   | none    |     | none    |         |   |
| 90.5 | 1 | none    |     | none    |     |   |         |   |         | 1   | bl      |     | none    |         |   |
| 87.5 | 1 | dark    |     | light   |     | 1 | dark    |   | = or yl | 1   | bl      |     | none    |         |   |
| 84.5 | 2 | bl      | o   | = yl    | o   | 1 | bl      |   | yl      | 1   | bl      |     | = or yl | 1       |   |
| 82   |   |         |     |         |     | 1 | bl      |   | = or yl | 1   | bl      |     | = yl or |         |   |
| 79   | 2 | bl      | o   | — or yl | 1   | 1 | bl      |   | — gryl  |     |         |     |         |         |   |
| 76.5 | 1 | bl      |     | = or yl |     | 1 | bl      |   | yl      |     |         |     |         |         |   |
| 73.5 | 1 | bl      |     | yl      |     | 1 | vi      |   | yl      | 1   | bl      |     | = rd or |         |   |
| 71   | 1 | bl      |     | yl      |     | 2 | bl      | o | yl      | o   |         |     |         |         |   |
| 68.5 | 2 | bl      | o   | yl      | o   | 2 | bl      | o | — gryl  | 1.5 | 2       | bl  | o       | — yl or | 1 |
| 66   | 2 | bl      | o   | — gryl  | o   | 1 | bl      |   | = or yl | 2   | bl      | o   | = rd or | o       |   |
| 63.2 | 2 | bl      | o   | yl      | 1.5 | 1 | bl      |   | = or yl | 2   | bl      | o   | yl + or | 5       |   |
| 59.7 | 3 | bl      | o   | = gryl  | o   | 1 | bl      |   | = or yl | 2   | bl      | o   | — or yl | 1       |   |
| 55   | 3 | bl      | o   | = gryl  | 1   | 1 | bl      |   | yl      | 2   | — gr bl | 1   | = or yl | 3.5     |   |
| 49   | 5 | bl      | o   | = gryl  | 1   | 1 | bl      |   | = or yl | 2   | — gr bl | 1.5 | = or yl | o       |   |
| 41.2 | 3 | bl      | o   | = gryl  | 1   | 1 | = bl vi |   | = gryl  | 1   | bl      |     | — or yl |         |   |
| 31   | 2 | = vi bl | 3.5 | = gryl  | 1.5 | 1 | bl      |   | yl      | 2   | — gr bl | 1.5 | = or yl | 3.5     |   |
| 20.5 | 2 | vi      | o   | = yl gr | o   | 1 | = bl vi |   | = gryl  | 2   | — gr bl | 1.5 | — or yl | 2       |   |
| 11.5 | 2 | bl      | o   | — gryl  | .5  | 1 | bl      |   | yl      | 2   | = gr bl | o   | = yl or | 1       |   |
| o    | 2 | bl      | o   | yl      | .5  | 2 | bl      | o | yl      | o   | 2       | bl  | o       | — or yl | 1 |

TABLE XXIII.

SUBJECT B. — STIMULUS — VIOLET.

| Retinal Location. | Background. 3 (Yellow). |             |            |              | 7 (Green). |               |             |            | 38 (Blue).   |            |               |             |            |              |            |
|-------------------|-------------------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|---------------|-------------|------------|--------------|------------|
|                   | No. of Tests.           | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. | No. of Tests. | Color Seen. | Variation. | After-Image. | Variation. |
| 93°               |                         |             |            |              |            |               |             |            |              |            |               |             |            |              |            |
| 90.5              |                         |             |            |              |            |               |             |            |              |            | 1             | bl          |            | ≡ or y?      |            |
| 87.5              |                         |             |            |              |            |               |             |            |              |            | 1             | bl          |            | none         |            |
| 84.5              | 1                       | dark        |            | yl?          |            | 1             | bl          |            | yl           |            | 1             | bl          |            | ≡ or yl      |            |
| 82                | 1                       | bl          |            | yl           |            | 1             | bl          |            | ≡ or yl      |            | 1             | bl          |            | ≡ or yl      |            |
| 79                | 1                       | bl          |            | yl           |            | 1             | bl          |            | yl           |            |               |             |            |              |            |
| 76.5              | 1                       | bl          |            | yl           |            | 1             | bl          |            | yl           |            | 1             | bl          |            | —rd or       |            |
| 73.5              | 1                       | bl          |            | yl           |            | 1             | bl          |            | yl           |            |               |             |            |              |            |
| 71                | 1                       | bl          |            | yl           |            | 1             | bl          |            | yl           |            | 1             | bl          |            | ≡ ylor       |            |
| 68.5              | 5                       | bl          | o          | yl           | o          | 1             | bl          |            | yl           |            | 2             | bl          | o          | ≡ or yl      | 2          |
| 66                | 2                       | bl          | o          | yl           | o          | 2             | bl          | o          | yl           | o          | 2             | ≡ vi bl     | 2.5        | yl           | .5         |
| 63.2              | 3                       | bl          | o          | yl           | o          | 1             | bl          |            | —gryl        |            | 1             | bl          |            | ≡ gryl       |            |
| 59.7              | 2                       | bl          | o          | —gryl        | .5         | 1             | bl          |            | yl           |            | 3             | bl          | o          | ≡ gryl       | o          |
| 55                | 3                       | bl          | o          | ≡ gryl       | o          | 1             | bl          |            | yl           |            | 2             | bl          | o          | ≡ gryl       | .5         |
| 49                | 5                       | bl          | o          | ≡ gryl       | o          | 2             | bl          | o          | yl           | o          | 2             | ≡ vi bl     | 1          | —gryl        | 1.5        |
| 41.2              | 3                       | vi          |            | ≡ gryl       | o          | 2             | —car vi     | 1          | ≡ gryl       | o          | 2             | ≡ bl vi     | 6.5        | yl           | .5         |
| 31                | 2                       | —car vi     | 1.5        | yl+gr        | 2          | 1             | vi          |            | ≡ gryl       | 2          | 2             | —bl vi      | 8.5        | —gryl        | 1          |
| 20.5              | 2                       | vi          | 3          | ≡ ylgr       | o          | 1             | vi          |            | ≡ ylgr       | 1          | 1             | vi          |            | —gryl        |            |
| 11.5              | 2                       | —car vi     | 1          | ≡ ylgr       | 3.5        | 1             | vi          |            | ≡ gryl       | 2          | 2             | vi          | o          | ≡ ylgr       | 1          |
| o                 | 2                       | vi          | o          | ≡ gryl       | .5         | 1             | ≡ car vi    |            | ≡ gryl       | 2          | 2             | vi          | o          | ≡ ylgr       | .5         |

TABLE XXIV.

## SUBJECT F.—STIMULUS—CARMINE.

| Retinal Location. | Background. 3 (Yellow). |              | 7 (Green).  |              | 38 (Blue).  |              |
|-------------------|-------------------------|--------------|-------------|--------------|-------------|--------------|
|                   | Color Seen.             | After-image. | Color Seen. | After-image. | Color Seen. | After-image. |
| 93°               |                         |              |             |              |             |              |
| 90.5              |                         |              |             |              |             |              |
| 87.5              |                         |              |             |              |             |              |
| 84.5              |                         |              |             |              |             |              |
| 82                | dark                    | light        |             |              |             |              |
| 79                |                         |              | red?        | yl           |             |              |
| 76.5              | dark                    | yl           |             |              |             |              |
| 73.5              | dark                    | yl           |             |              | car         | dark         |
| 71                | dark                    | none         |             |              | ≡ car vi    | dark         |
| 68.5              | red                     | light        | ≡ car red   | light        | ≡ car vi    | bl?          |
| 66                | red?                    | light        | car         | light        | car + vi    | dark         |
| 63.2              | red                     | light        | car         | =yl gr       | car         | =gr yl       |
| 59.7              | red                     | light        | dark        | light        | car         | gr           |
| 55                | vi                      | yl           | ≡ red car   | light        | car         | =yl gr       |
| 49                | car                     | =gr yl       | ≡ vi car    | =yl gr       | =red car    | -yl gr       |
| 41.2              | car                     | =yl gr       | =vi car     | =yl gr       | car         | gr           |
| 31                | car                     | gr           | car         | =yl gr       | car         | gr           |
| 20.5              | car                     | -yl gr       | car         | gr           | car         | gr           |
| 11.5              | ≡ red car               | gr           | =red car    | -yl gr       | car         | gr           |
| 0                 | car                     | =yl gr       | car         | gr           | car         | gr           |

## STIMULUS—RED.

|      |          |         |         |         |          |         |
|------|----------|---------|---------|---------|----------|---------|
| 93°  |          |         |         |         |          |         |
| 90.5 |          |         |         |         |          |         |
| 87.5 |          |         |         |         |          |         |
| 84.5 |          |         |         |         |          |         |
| 82   | dark     | light   |         |         |          |         |
| 79   | or + red | bl      |         |         |          |         |
| 76.5 | red      | bl      |         |         | red      | bl      |
| 73.5 | red      | bl      |         |         | =red or  | bl      |
| 71   | red      | bl      | red     | bl      | red      | bl      |
| 68.5 | =or red  | bl      | red     | bl      | red      | bl      |
| 66   | =or red  | bl      | red     | bl      | ≡ red or | bl      |
| 63.2 | red      | bl      | -or red | bl      | =or red  | bl      |
| 59.7 | red      | bl      | red     | bl?     | =or red  | bl      |
| 55   | =or red  | bl      | =or red | bl?     | ≡ or red | bl      |
| 49   | red      | light   | =or red | bl      | =or red  | bl      |
| 41.2 | =or red  | bl      | red     | bl      | or       | ≡ gr bl |
| 31   | red      | ≡ gr bl | red     | bl      | ≡ red or | ≡ gr bl |
| 20.5 | =or red  | ≡ gr bl | =or red | ≡ bl gr | =or red  | ≡ gr bl |
| 11.5 | red      | ≡ bl gr | red     | =bl gr  | or       | ≡ gr bl |
| 0    | red      | =gr bl  | =or red | none    | =or red  | gr + bl |



TABLE XXV.

SUBJECT F. — STIMULUS — ORANGE.

| Retinal Location. | Background. 3 (Yellow). |              | 7 (Green).  |              | 38 (Blue).  |              |
|-------------------|-------------------------|--------------|-------------|--------------|-------------|--------------|
|                   | Color Seen.             | After-image. | Color Seen. | After-image. | Color Seen. | After-image. |
| 93°               |                         |              |             |              |             |              |
| 90.5              |                         |              |             |              |             |              |
| 87.5              |                         |              |             |              |             |              |
| 84.5              |                         |              |             |              |             |              |
| 82                |                         |              |             |              |             |              |
| 79                | = red or                | bl           |             |              |             |              |
| 76.5              |                         |              |             |              |             |              |
| 73.5              | ≡ red or                | bl           |             |              | = yl or     | bl           |
| 71                | ≡ red or                | bl           | ≡ red or    | bl           | = red or    | bl           |
| 68.5              | = red or                | bl           | ≡ red or    | bl           | = red or    | bl           |
| 66                | or                      | bl           | or          | bl           | yl          | bl           |
| 63.2              | ≡ or red                | bl           | or          | bl           | ≡ red or    | bl           |
| 59.7              | or                      | bl           | ≡ or red    | bl           | or          | bl           |
| 55                | = red or                | bl           | or          | bl           | = yl or     | bl           |
| 49                | or                      | bl           | ≡ red or    | bl           | or          | bl           |
| 41.2              | ≡ red or                | bl           | = red or    | bl           | = yl or     | bl           |
| 31                | or                      | ≡ gr bl      | = red or    | - gr bl      | or          | = gr bl      |
| 20.5              | or                      | ≡ gr bl      | = red or    | ≡ gr bl      | or          | = gr bl      |
| 11.5              | ≡ red or                | gr + bl      | or          | gr + bl      | or          | ≡ gr bl      |
| 0                 | or                      | bl           | ≡ red or    | none         | or          | = gr bl      |

STIMULUS — YELLOW.

|      |          |       |         |    |         |      |
|------|----------|-------|---------|----|---------|------|
| 93°  |          |       |         |    |         |      |
| 90.5 |          |       |         |    |         |      |
| 87.5 |          |       |         |    |         |      |
| 84.5 | dark ?   | light |         |    |         |      |
| 82   | or       | bl    |         |    |         |      |
| 79   |          |       | = or yl | bl |         |      |
| 76.5 | yl + or  | bl    |         |    | yl      | bl   |
| 73.5 | = yl or  | bl    |         |    |         |      |
| 71   | ≡ yl or  | bl    | or      | bl | yl      | bl   |
| 68.5 | ≡ or yl  | bl    | or      | bl | yl      | bl   |
| 66   | ≡ or yl  | bl    | = or yl | bl | - or yl | bl   |
| 63.2 | ≡ yl or  | bl    | or      | bl | yl      | bl   |
| 59.7 | ≡ red or | bl    | or      | bl | yl      | bl   |
| 55   | or       | bl    | = or yl | bl | yl      | bl   |
| 49   | or       | bl    | - yl or | bl | yl      | bl   |
| 41.2 | or       | bl    | or      | bl | yl      | bl   |
| 31   | ≡ or yl  | bl    | or      | bl | - or yl | bl   |
| 20.5 | = or yl  | bl    | ≡ or yl | bl | - or yl | bl   |
| 11.5 | - or yl  | bl    | or      | bl | yl      | bl   |
| 0    | yl       | bl ?  | ≡ yl or | bl | yl      | none |

TABLE XXVI.

## SUBJECT F. — STIMULUS — GREEN.

| Retinal Location. | Background. 3 (Yellow). |              | 7 (Green).  |              | 38 (Blue).  |              |
|-------------------|-------------------------|--------------|-------------|--------------|-------------|--------------|
|                   | Color Seen.             | After-Image. | Color Seen. | After-Image. | Color Seen. | After-Image. |
| 93°               |                         |              |             |              |             |              |
| 90.5              |                         |              |             |              |             |              |
| 87.5              |                         |              |             |              |             |              |
| 84.5              |                         |              |             |              |             |              |
| 82                |                         |              |             |              |             |              |
| 79                | or ?                    | bl ?         |             |              |             |              |
| 76.5              | dark                    | bl           |             |              |             |              |
| 73.5              | red                     | bl           |             |              | yl          | bl           |
| 71                | red red                 | bl bl        |             |              | yl          | none         |
| 68.5              | red red                 | bl bl        | = or yl     | bl           | yl          | none         |
| 66                | = or red ?              | bl           | yl          | bl           | yl          | bl           |
| 63.2              | yl                      | bl           | or          | bl           | yl          | none         |
| 59.7              | = yl or                 | bl           | yl          | bl           | yl          | bl           |
| 55                | gr                      | none         | yl          | bl           | yl          | bl           |
| 49                | gr                      | vi ?         | = gr yl     | bl           | yl          | = vi car     |
| 41.2              | gr                      | car          | = yl gr     | = vi car     | yl          | car          |
| 31                | gr                      | car          | - yl gr     | car          | yl          | = vi bl      |
| 20.5              | gr                      | car          | = yl gr     | car          | - yl gr     | = vi car     |
| 11.5              | gr                      | car          | - yl gr     | car          | gr          | = vi car     |
| 0                 | gr                      | car          | gr          | car          | gr          | red          |

## STIMULUS — BLUE-GREEN.

|      |           |           |         |          |         |           |
|------|-----------|-----------|---------|----------|---------|-----------|
| 93°  |           |           |         |          |         |           |
| 90.5 |           |           |         |          |         |           |
| 87.5 |           |           |         |          |         |           |
| 84.5 |           |           |         |          |         |           |
| 82   |           |           |         |          |         |           |
| 79   |           |           | yl ?    | bl ?     |         |           |
| 76.5 |           |           |         |          |         |           |
| 73.5 | dark      | light     |         |          | light   | none      |
| 71   | dark      | light     |         |          | light   | dark      |
| 68.5 | dark      | light     | = bl gr | = or red | light   | dark      |
| 66   | dark      | light     | dark    | car      | light   | dark      |
| 63.2 | dark      | light     | dark    | none     | light   | red       |
| 59.7 | dark      | light     | dark    | none     |         |           |
| 55   | = bl gr   | car       | gr      | car      | gr ?    | dark      |
| 49   | gr        | car       | - yl gr | car      | gr + bl | red       |
| 41.2 | = bl gr   | car       | gr      | car      | = bl gr | red       |
| 31   | = bl gr   | car       | gr      | car      | = bl gr | car       |
| 20.5 | = bl gr   | = red car | - bl gr | car      | = bl gr | = red car |
| 11.5 | gr        | car       | gr      | car      | = bl gr | = car red |
| 0    | = bl gr ? | car       | gr      | car      | = bl gr | car       |

TABLE XXVII.

SUBJECT F. — STIMULUS — GREEN-BLUE.

| Retinal Location. | Background. 3 (Yellow). |              | 7 (Green).  |              | 38 (Blue).  |              |
|-------------------|-------------------------|--------------|-------------|--------------|-------------|--------------|
|                   | Color Seen.             | After-Image. | Color Seen. | After-Image. | Color Seen. | After-Image. |
| 93°               |                         |              |             |              |             |              |
| 90.5              |                         |              |             |              |             |              |
| 87.5              |                         |              |             |              |             |              |
| 84.5              |                         |              |             |              |             |              |
| 82                |                         |              |             |              |             |              |
| 79                | dark                    | yl           |             |              |             |              |
| 76.5              | bl                      | yl           |             |              |             |              |
| 73.5              | bl                      | yl           |             |              | bl          | red          |
| 71                | bl                      | yl           |             |              |             |              |
| 68.5              | bl                      | yl           | =gr bl      | yl           | bl          | red          |
| 66                | bl                      | yl           | bl          | yl           |             |              |
| 63.2              | bl                      | yl           | -gr bl      | =or yl       | bl          | red          |
| 59.7              | bl                      | yl           | bl          | yl           | bl          | red          |
| 55                | bl                      | yl           | bl          | =or yl       | bl          | red          |
| 49                | bl                      | yl           | bl          | =or yl       | bl          | =or red      |
| 41.2              | bl                      | = or yl      | -gr bl      | = or yl      | bl          | red          |
| 31                | =gr bl                  | =red car     | =gr bl      | =yl or       | =gr bl      | =or red      |
| 20.5              | =gr bl                  | =red car     | =gr bl      | =or red      | =gr bl      | or + red     |
| 11.5              | =gr bl                  | =or red      | =gr bl      | =or red      | =gr bl      | =or red      |
| o                 | =gr bl                  | car          | =gr bl      | car          |             |              |

STIMULUS — BLUE.

|      |      |         |        |        |    |         |
|------|------|---------|--------|--------|----|---------|
| 93°  |      |         |        |        |    |         |
| 90.5 |      |         |        |        |    |         |
| 87.5 |      |         |        |        |    |         |
| 84.5 | dark | light   |        |        |    |         |
| 82   | bl   | yl      |        |        |    |         |
| 79   |      |         | bl     | =or yl |    |         |
| 76.5 | bl   | yl      |        |        | bl | yl      |
| 73.5 | bl   | yl      |        |        | bl |         |
| 71   | bl   | yl      | bl     | yl     |    |         |
| 68.5 | bl   | yl      | bl     | yl     | bl | =red or |
| 66   | bl   | yl      | bl     | yl     | bl | =or red |
| 63.2 | bl   | yl      | bl     | yl     | bl | =yl or  |
| 59.7 | bl   | yl      | bl     | yl     | bl | yl      |
| 55   | bl   | yl      | bl     | yl     | bl | =red or |
| 49   | bl   | yl      | bl     | =gr yl | bl | red ?   |
| 41.2 | bl   | yl      | bl     | =gr yl | bl | =or yl  |
| 31   | bl   | yl      | bl     | =gr yl | bl | =gr yl  |
| 20.5 | bl   | yl      | bl     | yl     | bl | =gr yl  |
| 11.5 | bl   | yl      | bl     | yl     | bl | =yl or  |
| o    | vi   | yl + gr | =vi bl | yl     |    |         |

TABLE XXVIII.

## SUBJECT F. — STIMULUS — VIOLET.

| Retinal Location. | Background. 3 (Yellow). |             | 7 (Green).  |             | 38 (Blue).  |              |
|-------------------|-------------------------|-------------|-------------|-------------|-------------|--------------|
|                   | Color Seen.             | After-Image | Color Seen. | After-Image | Color Seen. | After-Image. |
| 93°               |                         |             |             |             |             |              |
| 90.5              |                         |             |             |             |             |              |
| 87.5              |                         |             |             |             |             |              |
| 84.5              |                         |             |             |             |             |              |
| 82                |                         |             |             |             |             |              |
| 79                |                         |             | bl          | yl          |             |              |
| 76.5              | bl                      | yl          |             |             |             |              |
| 73.5              | bl                      | yl          |             |             |             |              |
| 71                | bl                      | yl          | bl          | =or yl      | bl          | --or red     |
| 68.5              | bl                      | yl          | bl          | yl          | bl          | yl           |
| 66                | bl                      | yl          | bl          | yl          |             |              |
| 63.2              |                         |             | bl          | --or yl     | bl          | yl           |
| 59.7              | bl                      | =gr yl      | bl          | yl          | bl          | =gr yl       |
| 55                | bl                      | yl          | bl          | yl          | bl          | yl           |
| 49                | bl                      | yl          | bl          | =gr yl      | bl          | =yl gr       |
| 41.2              | bl                      | yl          | bl          | =gr yl      | bl          | =yl gr       |
| 31                | vi                      | yl+gr       | =vi bl      | yl+gr       | bl          | yl+gr        |
| 20.5              | vi                      | =gr yl      | bl          | =gr yl      | bl          | =yl gr       |
| 11.5              | vi                      | =yl gr      | vi          | =yl gr      | bl          | yl+gr        |
| 0                 | vi                      | =gr yl      | =vi bl      | gr          |             |              |

## SUBJECT G. — STIMULUS — CARMINE.

|      |         |         |  |  |          |      |
|------|---------|---------|--|--|----------|------|
| 93°  |         |         |  |  |          |      |
| 90.5 | dark    | light   |  |  | light    | dark |
| 87.5 | dark    | light   |  |  | light    | dark |
| 84.5 | dark    | light   |  |  | light    | dark |
| 82   | dark    | light   |  |  | car      | dark |
| 79   | dark    | light   |  |  | =red car | dark |
| 76.5 | dark    | =gr yl  |  |  | =red car | dark |
| 73.5 | dark    | --gr yl |  |  | car      | gr   |
| 71   | dark    | yl      |  |  | car      | gr   |
| 68.5 | dark    | =yl gr  |  |  | car      | gr   |
| 66   | car     | =yl gr  |  |  | car      | gr   |
| 63.2 | car     | =yl gr  |  |  | car      | gr   |
| 59.7 | car     | =yl gr  |  |  | car      | bl   |
| 55   | car     | --yl gr |  |  | car      | gr   |
| 49   | car     | gr      |  |  | car      | gr   |
| 41.2 | =vi car | --yl gr |  |  | car      | gr   |
| 31   |         |         |  |  | car      | gr   |
| 20.5 | car     | gr      |  |  | car      | gr   |
| 11.5 | car     | gr      |  |  | car      | gr   |
| 0    |         |         |  |  | car      | gr   |

TABLE XXIX.

SUBJECT G.—STIMULUS—RED.

| Background. 3 (Yellow). |             |              | 7 (Green).  |              | 38 (Blue).  |              |
|-------------------------|-------------|--------------|-------------|--------------|-------------|--------------|
| Retinal Location.       | Color Seen. | After-image. | Color Seen. | After-image. | Color Seen. | After-image. |
| 93°                     |             |              |             |              |             |              |
| 90.5                    | dark        | light        |             |              | light       | bl           |
| 87.5                    | dark        | light        |             |              | or          | ≡gr bl       |
| 84.5                    | gr?         | light        |             |              |             |              |
| 82                      | dark        | light        |             |              |             |              |
| 79                      | red         | bl           |             |              | = or yl     | gr           |
| 76.5                    | red         | bl           |             |              | yl + or     | gr           |
| 73.5                    | red         | bl           |             |              | or          | = gr bl      |
| 71                      | — or red    | — gr bl      |             |              | ≡ or red    | ≡ gr bl      |
| 68.5                    | red         | bi           |             |              | ≡ or red    | bl           |
| 66                      | red         | bl           |             |              | ≡ or red    | — gr bl      |
| 63.2                    | red         | bl           |             |              | ≡ or red    | — gr bl      |
| 59.7                    | red         | bl           |             |              | — or red    | = gr bl      |
| 55                      | = or red    | bl           |             |              | = or red    | = gr bl      |
| 49                      | red         | = gr bl      |             |              | ≡ car red   | ≡ gr bl      |
| 41.2                    | red         | ≡ gr bl      |             |              | ≡ or red    | gr + bl      |
| 31                      | red         | — gr bl      |             |              | = or red    | ≡ gr bl      |
| 20.5                    | red         | gr + bl      |             |              | red         | ≡ gr bl      |
| 11.5                    | = or red    | ≡ bl gr      |             |              | = or red    | gr + bl      |
| 0                       |             |              |             |              |             |              |

STIMULUS—ORANGE.

|      |          |         |  |  |          |         |
|------|----------|---------|--|--|----------|---------|
| 93°  |          |         |  |  |          |         |
| 90.5 | none     | none    |  |  | yl       | bl      |
| 87.5 |          |         |  |  | yl       | bl      |
| 84.5 | or       | bl      |  |  | yl       | bl      |
| 82   | or       | bl      |  |  | yl       | bl      |
| 79   | = red or | bl      |  |  | or       | bl      |
| 76.5 | = red or | bl      |  |  | or       | bl      |
| 73.5 | or       | bl      |  |  | or       | bl      |
| 71   | ≡ or red | bl      |  |  | = or yl  | bl      |
| 68.5 | = red or | — vi bl |  |  | = red or | bl      |
| 66   | or       | bl      |  |  | = or red | ≡ gr b- |
| 63.2 | or       | bl      |  |  | or       | bl      |
| 59.7 | or       | — gr bl |  |  | ≡ yl or  | = vi bl |
| 55   | or       | — gr bl |  |  | = red or | ≡ gr bl |
| 49   | or       | = gr bl |  |  | = or red | ≡ gr bl |
| 41.2 | or       | — gr bl |  |  | ≡ red or | ≡ gr bl |
| 31   | or       | bl      |  |  | or       | ≡ gr bl |
| 20.5 | or       | ≡ gr bl |  |  | or       | gr + bl |
| 11.5 | or       | ≡ bl gr |  |  | or       | ≡ gr bl |
| 0    |          |         |  |  |          |         |

TABLE XXX.

## SUBJECT G. — STIMULUS — YELLOW.

| Retinal Location. | Background. 3 (Yellow). |              | 7 (Green).  |              | 38 (Blue).  |              |
|-------------------|-------------------------|--------------|-------------|--------------|-------------|--------------|
|                   | Color Seen.             | After-Image. | Color Seen. | After-Image. | Color Seen. | After-Image. |
| 93°               |                         |              |             |              | light       | bl           |
| 90.5              |                         |              |             |              | yl          | bl           |
| 87.5              | or                      | bl           |             |              | yl          | bl           |
| 84.5              | ≡ yl or                 | bl           |             |              | yl          | bl           |
| 82                | or                      | bl           |             |              | yl          | bl           |
| 79                | yl                      | bl           |             |              | yl          | bl           |
| 76.5              | ≡ yl or                 | bl           |             |              | yl          | bl           |
| 73.5              | yl                      | bl           |             |              | yl          | bl           |
| 71                | yl + or                 | bl           |             |              | yl          | bl           |
| 68.5              | ≡ or yl                 | bl           |             |              | yl          | bl           |
| 66                | or                      | bl           |             |              | yl          | bl           |
| 63.2              | yl                      | bl           |             |              | yl          | ≡ vi bl      |
| 59.7              | ≡ or yl                 | bl           |             |              | yl          | bl           |
| 55                | yl                      | bl           |             |              | yl          | bl           |
| 49                | — yl or                 | bl           |             |              | yl          | bl + vi      |
| 41.2              | yl + or                 | ≡ vi bl      |             |              | yl          | none         |
| 31                | ≡ or yl                 | bl           |             |              | yl          | ≡ bl vi      |
| 20.5              | yl                      | ≡ vi bl      |             |              | yl          | bl           |
| 11.5              | yl                      | ≡ vi bl      |             |              | yl          | ≡ vi bl      |
| 0                 |                         |              |             |              |             |              |

## STIMULUS — GREEN.

|      |         |           |  |  |         |          |
|------|---------|-----------|--|--|---------|----------|
| 93°  |         |           |  |  | light   |          |
| 90.5 | none    | none      |  |  | light   | none     |
| 87.5 | dark    | light     |  |  | light   | dark     |
| 84.5 | dark    | light     |  |  | yl      | none     |
| 82   | gr      | ≡ vi car  |  |  | yl      | bl       |
| 79   | dark    | bl        |  |  | yl      | none     |
| 76.5 | yl ?    | bl        |  |  | yl      | none     |
| 73.5 | gr      | vi        |  |  | ≡ gr yl | none     |
| 71   | — gr yl | bl        |  |  | yl      | bl       |
| 68.5 | — yl or | car       |  |  | ≡ gr yl | ≡ car vi |
| 66   | gr      | vi        |  |  | — gr yl | ≡ bl vi  |
| 63.2 | gr      | ≡ red car |  |  | ≡ yl gr | ≡ vi car |
| 59.7 | — yl gr | ≡ vi car  |  |  | yl + gr | ≡ car vi |
| 55   | gr      | car       |  |  | ≡ yl gr | ≡ bl vi  |
| 49   | gr      | — red car |  |  | ≡ yl gr | ≡ vi car |
| 41.2 | gr      | — vi car  |  |  | yl + gr | car + vi |
| 31   | gr      | ≡ vi car  |  |  | gr      | ≡ car vi |
| 20.5 | gr      | car       |  |  | gr      | vi       |
| 11.5 | gr      | ≡ vi car  |  |  | gr      | ≡ car vi |
| 0    |         |           |  |  |         |          |

TABLE XXXI.

SUBJECT G. — STIMULUS — BLUE-GREEN.

| Retinal Location. | Background. 3 (Yellow). |              | 7 (Green).  |              | 38 (Blue).  |              |
|-------------------|-------------------------|--------------|-------------|--------------|-------------|--------------|
|                   | Color Seen.             | After-Image. | Color Seen. | After-Image. | Color Seen. | After-Image. |
| 93°               |                         |              |             |              |             |              |
| 90.5              |                         |              |             |              | light       | dark         |
| 87.5              | dark                    | none         |             |              | light       | dark         |
| 84.5              |                         |              |             |              | light       | dark         |
| 82                | dark                    | light        |             |              | light       | ?            |
| 79                | dark                    | light        |             |              | light       | car          |
| 76.5              | gr                      | red          |             |              | light       | = car red    |
| 73.5              | dark                    | car ?        |             |              | light       | dark         |
| 71                | gr                      | none         |             |              | light       | ≡ red car?   |
| 68.5              | none                    | red ?        |             |              | gr ?        | red          |
| 66                | gr                      | red          |             |              |             |              |
| 63.2              | — bl gr                 | or           |             |              | bl          | red          |
| 59.7              | gr                      | = car red    |             |              | light       | ≡ red car    |
| 55                | = bl gr                 | = car red    |             |              | ≡ bl gr     | car          |
| 49                | — bl gr                 | ≡ red car    |             |              | ≡ bl gr     | car          |
| 41.2              | gr                      | ≡ red car    |             |              | ≡ gr bl     | car          |
| 31                | — bl gr                 | red + car    |             |              | ≡ bl gr     | ≡ vi car     |
| 20.5              | — bl gr                 | car          |             |              | ≡ bl gr     | ≡ vi car     |
| 11.5              | = bl gr                 | ≡ red car    |             |              | ≡ bl gr     | ≡ vi car     |
| 0                 |                         |              |             |              |             |              |

STIMULUS — GREEN-BLUE.

|      |         |         |  |  |         |          |
|------|---------|---------|--|--|---------|----------|
| 93°  |         |         |  |  |         |          |
| 90.5 | dark    | light   |  |  | light   | none     |
| 87.5 |         |         |  |  | light   | dark     |
| 84.5 | dark    | none    |  |  | light   | ≡ red or |
| 82   | bl      | = or yl |  |  | — gr bl | ≡ or red |
| 79   | bl      | ≡ yl or |  |  | bl      | red ?    |
| 76.5 | dark    | yl      |  |  | light   | red      |
| 73.5 | bl      | = or yl |  |  | bl      | ≡ red or |
| 71   | dark    | = or yl |  |  | bl      | red      |
| 68.5 | bl      | yl + gr |  |  | bl      | = or red |
| 66   | ≡ gr bl | ≡ yl or |  |  | bl      | ≡ or red |
| 63.2 | bl      | or      |  |  | bl      | = or red |
| 59.7 | bl      | or      |  |  | bl      | = or red |
| 55   | — gr bl | or      |  |  | bl      | red      |
| 49   | — gr bl | ≡ or yl |  |  | — gr bl | ≡ or red |
| 41.2 | = gr bl | or      |  |  | ≡ bl gr | = or red |
| 31   | ≡ gr bl | or      |  |  | ≡ gr bl | ≡ or red |
| 20.5 | ≡ gr bl | or      |  |  | ≡ gr bl | ≡ or red |
| 11.5 | ≡ gr bl | or      |  |  | ≡ gr bl | = or red |
| 0    |         |         |  |  |         |          |

TABLE XXXII.

## SUBJECT G. — STIMULUS — BLUE.

| Retinal Location. | Background. 3 (Yellow). |              | 7 (Green).  |              | 38 (Blue).  |                     |
|-------------------|-------------------------|--------------|-------------|--------------|-------------|---------------------|
|                   | Color Seen.             | After-image. | Color Seen. | After-image. | Color Seen. | After-image.        |
| 93°               |                         |              |             |              |             |                     |
| 90.5              | gr?                     | light        |             |              | none        | none                |
| 87.5              | dark                    | yl           |             |              | bl          | = or yl             |
| 84.5              | dark                    | yl           |             |              | bl          | = red or            |
| 82                | dark                    | = or yl      |             |              | bl          | or                  |
| 79                | dark                    | = or yl      |             |              | bl          | = or red            |
| 76.5              | bl                      | - gr yl      |             |              | bl          | red                 |
| 73.5              | - vi bl                 | = gr yl      |             |              | bl          | = or red            |
| 71                | dark                    | yl           |             |              | bl          | = red or<br>= gr yl |
| 68.5              | bl                      | yl           |             |              | bl          | red                 |
| 66                | bl                      | = yl or      |             |              | bl          | = or red            |
| 63.2              | bl                      | = gr yl      |             |              | bl          | = or red            |
| 59.7              | bl                      | = gr yl      |             |              | bl          | yl                  |
| 55                | bl                      | yl           |             |              | bl          | = red or            |
| 49                | bl                      | = gr yl      |             |              | bl          | = or yl             |
| 41.2              | bl                      | - or yl      |             |              | bl          | = red or            |
| 31                | = bl vi                 | = yl gr      |             |              | bl          | yl + or             |
| 20.5              |                         |              |             |              | bl          | yl + or             |
| 11.5              | bl                      | yl           |             |              | = gr bl     | = or yl             |
| o                 |                         |              |             |              |             |                     |

## STIMULUS — VIOLET.

|      |         |         |  |  |         |          |
|------|---------|---------|--|--|---------|----------|
| 93°  |         |         |  |  |         |          |
| 90.5 |         |         |  |  | bl      | yl       |
| 87.5 |         |         |  |  | none    | = or yl  |
| 84.5 | dark    | light   |  |  | bl      | - yl or  |
| 82   | bl      | yl      |  |  | bl      | = red or |
| 79   | dark    | = yl or |  |  | bl      | or       |
| 76.5 | dark    | yl      |  |  | bl      | yl       |
| 73.5 | dark    | = or yl |  |  | bl      | yl       |
| 71   | dark    | = gr yl |  |  | bl      | = red or |
| 68.5 | bl      | yl      |  |  | bl      | yl       |
| 66   | bl?     | yl      |  |  | bl      | = gr yl  |
| 63.2 | bl      | = gr yl |  |  | bl      | yl       |
| 59.7 | bl      | = gr yl |  |  | bl      | = yl gr  |
| 55   | bl      | = gr yl |  |  | bl      | = yl or  |
| 49   | bl      | = gr yl |  |  | = vi bl | = gr yl  |
| 41.2 | - vi bl | - gr yl |  |  | = vi bl | = gr yl  |
| 31   | vi      | = yl gr |  |  | vi      | = gr yl  |
| 20.5 | vi      | = yl gr |  |  | = bl vi | = yl gr  |
| 11.5 | vi      | = yl gr |  |  | vi      | yl + gr  |
| o    |         |         |  |  |         |          |



TABLE XXXIII.

SUBJECT B.

| Background. 7 (Yellow).       |                      |   | Background. 38 (Blue). |             |                     |
|-------------------------------|----------------------|---|------------------------|-------------|---------------------|
| Fix. pt.                      | Color Seen.          | After-image.                                      | Fix. pt.               | Color Seen. | After-image.        |
| <b>STIMULUS — CARMINE.</b>    |                      |   |                        |             |                     |
| 55°                           | ≡ vi car             | ≡ yl gr   bl   car                                | 66°                    | ≡ red car   | gr   ≡ red car      |
| 41.2                          | car                  | { ≡ yl gr   gr  <br>= red car   gr                | 31                     | ≡ red car   | gr   car   ≡ yl gr  |
| 31                            | ≡ vi car             | gr   ≡ bl gr   car                                |                        |             |                     |
| <b>STIMULUS — ORANGE.</b>     |                      |   |                        |             |                     |
| 41.2                          | ≡ red or             | bl   ≡ gr bl   red                                |                        |             |                     |
| <b>STIMULUS — GREEN.</b>      |                      |   |                        |             |                     |
| 59.7                          | ≡ yl gr  <br>≡ bl gr | car   ≡ bl gr                                     | 41.5                   | ≡ gr yl     | vi + car   ≡ yl gr  |
| 49                            | ≡ bl gr              | { ≡ vi car  <br>= bl gr   car                     | 31                     | gr + yl     | car   ≡ yl gr       |
| 31                            | gr                   | ≡ red car   gr                                    | 20.5                   | ≡ yl gr     | car   gr            |
| <b>STIMULUS — BLUE-GREEN.</b> |                      |   |                        |             |                     |
| 55                            | ≡ bl gr              | = red car   ≡ bl gr                               | 31                     | gr          | car   gr            |
| 41.2                          | - bl gr              | car   ≡ bl gr                                     |                        |             |                     |
| 31                            | - bl gr              | car   - gr bl                                     |                        |             |                     |
| 20.5                          | ≡ bl gr              | = red car   ≡ vi<br>car   ≡ bl gr                 |                        |             |                     |
| <b>STIMULUS — GREEN-BLUE.</b> |                      |   |                        |             |                     |
| 41.2                          | = gr bl              | = or red  <br>= car red   ≡ gr bl                 | 55                     | bl          | - red or   ≡ bl gr? |
|                               |                      |   | 31                     | ≡ bl gr     | = or red   ≡ bl gr  |
| <b>STIMULUS — BLUE.</b>       |                      |   |                        |             |                     |
| 31                            | bl                   | ≡ yl gr   ≡ or yl  <br>≡ ylor   ≡ red or<br>  car | 66                     | bl          | ≡ red or   - bl gr  |
|                               |                      |   | 31                     | ≡ gr bl     | = yl or   = bl gr   |
| <b>STIMULUS — VIOLET.</b>     |                      |   |                        |             |                     |
| 55                            | bl                   | ≡ yl gr   = yl gr  <br>car   = yl gr              |                        |             |                     |

### EDITORS' ANNOUNCEMENT.

The editors of the REVIEW announce the completion of arrangements to issue a new series of Monographs, planned on the lines of the *Psychological Monograph Series* already established. This new series will be devoted to philosophical topics, and will bear the title *Philosophical Monographs*. The two series will proceed side by side, being devoted respectively to more extended papers on psychological and philosophical subjects. We are glad to offer to authors and University departments this wider channel of publication on the terms heretofore extended in connection with the old series. Correspondence with reference to the printing of Monographs and manuscripts should be addressed as follows:

For the series of *Psychological Monographs*,  
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New Haven, Conn.

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to Prof. J. MARK BALDWIN, Johns Hopkins University,  
Baltimore, Md.

# THE PSYCHOLOGICAL REVIEW.

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STUDIES FROM THE LABORATORY OF THE UNIVERSITY OF CHICAGO.

COMMUNICATED BY PROFESSOR JAMES ROWLAND ANGELL.

THE PENDULAR WHIPLASH ILLUSION OF MOTION.

BY HARVEY CARR, Ph.D.

I. In an article entitled 'The Participation of the Eye Movements in the Visual Perception of Motion,'<sup>1</sup> Mr. Dodge reviews the historical trend of opinion in assigning a less and less importance to the factor of eye movement in mediating the visual consciousness of motion; he further takes the extreme radical position in this trend of thought by denying to eye movements any function at all; he maintains the thesis that eye movements alone can not mediate any consciousness of visual motion. "Not only, however, is there no independent consciousness of the eye movements, adequate to the refinement of the visual perception of motion, but the character of the eye movements which occur when we view a moving object furnishes evidence that, if our consciousness of them were complete and exact, it would be either useless or misleading as a datum in the visual perception of motion" (p. 3). In speaking of the results of one of his tests, he maintains that it "serves at once to show the utter inability of the pursuit movement either to subserve the perception of motion of the fixated point or to correct the exaggerated data from the displacement of the retinal image of the nonfixated point" (p. 14).

A crucial test of the theory would involve the elimination of all other possible functioning factors, the perception of an

<sup>1</sup> PSYCH. REV., 1904, pp. 1-14.

isolated moving object whose stimulation remains stationary upon the retina. Professor Dodge contends that these ideal conditions are obtained in his pendulum test. Two lights of weak intensity are placed on the two arms of a counterbalanced pendulum. One of these swinging lights is followed by the eyes, while the other is perceived peripherally. Former photographic tests have demonstrated that the image of the fixated light is not displaced on the retina during the last quarter of its swing. According to the theory, the fixated light should appear motionless during these ideal conditions, while of course the second light would still be seen in motion during this period. As a matter of fact, the experiment gave the expected results; the peripherally perceived light was seen to move an appreciable time after the fixated light came to a full stop; this second light appeared to make 'a gratuitous whiplash excursion' of its own. "We have already called attention to the fact that the end of every pursuit sweep is freer from corrective movements than its beginning. This is conspicuously true of the pursuit sweeps by which the line of regard follows a swinging pendulum. Photographs of such sweeps give no indication of corrective movements either negative or positive within the last quarter of the swings studied." He further says that the conditions of the experiment are such that it 'constitutes a faultless experimental test of our conclusions' (p. 13).

There is no doubt as to the genuineness of the whiplash phenomenon. Mr. Dodge has well described it. Also, is it obvious that the theory will satisfactorily explain the illusion, nor, so far as I know, is there any reason for questioning the statement that ideal conditions obtain during this part of the swing.

Mr. Dodge further maintains that the illusion is 'capable of only one explanation,' *i. e.*, in terms of his theory. If this be true, it would logically follow that the phenomenon is proof positive of the truth of his theoretical position. The only escape from the inevitable logic of the situation is to question his proposition that no other explanatory theory is possible. In fact, one such *possible* explanation occurred to the writer upon reading the article in question.

Let us assume the truth of the doctrine generally accepted before Dodge advanced his extreme proposition, viz., that eye movements can mediate visual motion, but only for the greater magnitudes and velocities; that their limen of perceptibility is much greater than that of the factor of retinal displacement. The assumption is entirely probable, for surfaces differ in their sensitivity to movement. A stimulus of a definite magnitude and rapidity may be below the limen of perceptibility on one part of the skin, and still be distinctly perceived as movement on another area. The same is true for different parts of the retina. In fact this is the generally accepted view, which Dodge is trying to overthrow. As the pendulum approaches the end of its swing, the rate of movement gradually decreases to zero. Consequently, for some definite portion of the end of its swing, its rate would be below the eye movement limen, but still above the retinal limen of perceptibility. In other words, the retinally perceived light would be seen moving for an appreciable time after the fixated light had apparently stopped. Hence the gratuitous whiplash excursion is evident. Since the function of eye movement in the perception of motion is the point at issue, one has as much right to make a positive assumption as Dodge has to assume a lack of function. The theory further has the weight of historical opinion behind it.

A third *possible* theory developed during a repetition of the experiment. The fixated light when successfully followed has (during the last portion of its swing) no positive after-image. The peripherally perceived light, on the contrary, does leave a pronounced positive after-image streak. The eye moves in a direction opposite to this latter light and consequently the rapidity of its retinal displacement equals that of a light, perceived by a stationary eye, moving at a rate equal to the combined velocities of the two lights used in the pendulum test. Other things being equal, the length of the after-image streak varies directly with the rapidity of the retinal displacement. Thus a very pronounced length of the positive streak results in the test. This light, with its positive after-image, is viewed peripherally and hence is seen indistinctly and *en masse*; without conscious effort on the part of the observer, it appears as an elongated light with

no very decided contour, nor sharply discriminated parts; it appears as a conscious whole or unity. As the pendulum reaches the end of its swing, this elongated mass of light rapidly contracts in length at its rear end. This occurs for two reasons: (1) the velocity of the pendulum rapidly decreases toward zero, and the length of the positive after-image is a function of the rate of movement; (2) the light on its return swing back-tracks, as it were, and meets the receding end of the fading after-image, but now leaves another positive streak in its rear. If the positive streak is six inches long when the pendulum is one inch from the end of its swing, and this streak has time to disappear while the pendulum is moving and returning over this final inch of its arc, it is evident that the total mass of light will have contracted at its rear end from six inches to one inch in length. These values are of course merely illustrative. Movement, psychologically, is the consciousness of spatial changes, and these changes occur at the two ends of the elongated light, the shifting boundaries between the two discriminable visual contents. One of these cues of movement becomes abnormally exaggerated as the pendulum comes to a full stop, and still continues to be operative, without any contrary cue, while the pendulum is gathering headway on its return swing. Consequently, the whole mass of light will appear to be moving on, after the pendulum has really stopped. The observed extra movement is thus a purely illusory one. Such a conception involves no new doctrine, for the influence of the receding positive after-image streak in mediating the perception of motion is well known. At the very least, the theory possesses an *a priori* possibility.

We shall term these theories *A*, *B*, and *C* in the order of their exposition. It is to be noted that only *A* and *B* are mutually exclusive. The phenomenon may be due to the causes designated in *A*, or *B*, or *C*, or it may be the combined result of those mentioned in *A* and *C*, or *B* and *C*. We propose to recount some additional observations and tests throwing light upon the relative efficiency of these conceptions as explanatory principles.

Hereafter the fixated and the peripherally perceived lights

will be termed the upper and the lower lights respectively. Unless otherwise stated, the following conditions will obtain: The length of the upper arm of the pendulum is slightly shorter than that of the lower arm. The lower arm is 78 cm. in length, and swings through an arc of 100 cm. The pendulum moves at a velocity of two seconds for a complete swing, *i. e.*, for a forward and a return movement. The observer is stationed at a distance of 230 cm., and the eye moves through an angle of 23 degrees in following the upper light. The angular distance of the lower light from the fovea is approximately 30 degrees. Two miniature incandescent lights were used of such intensity that no other objects were visible. The tests were conducted at night in a dark room.

II. Mr. Dodge alleges that the apparent length of the upper light's movement is judged to be much shorter than that of the lower one. In order to secure an equality of apparent length of movement, he found it necessary to make the upper arc of movement three times the length of the lower. He calls attention to the similarity between this ratio and that obtained by Exner, Von Fleischl, *et al.*, between the apparent rates of movement when judged with stationary eyes on the one hand, and with the eyes following the movement on the other. If the experienced velocity and duration of movement of the lower light are greater than that of the upper light, apparently it should seem to move for the greater distance.

My observers did not confirm these results as to the apparent lengths of movement. In fact, they gave judgments of equality of movement only when the two arcs were practically equal in length.<sup>1</sup> Moreover, the argument is not valid that the apparent movement of the lower light must be greater than that of the upper light because it has the greater apparent velocity and duration. In certain illusions, as the Pürkinje dizziness phe-

<sup>1</sup> Probably this discrepancy is due to a difference in the method of judging, for there are present several cues upon which the observer may base his judgments of length. It is practically impossible to make a judgment as to *pure length*, uninfluenced by other motives. The apparent rate of movement may have a determining influence, or the observer may mentally superimpose the two lengths to be compared. My observers invariably found themselves using the latter method.

nomenon and especially under some conditions of 'autokinetic sensations,' I have often observed that the customary mathematical relation between rate and magnitude of motion does not obtain. The light may appear to be moving at the rate of two feet a second, and yet after some time one would not judge the distance traversed to be over a few feet in length. The illusion is so striking to the writer under some circumstances, that the felt discrepancy between rate of movement and distance traversed forces itself upon the attention. The light appears to be *moving rapidly*, but yet does not appear to be getting anywhere, to be *traversing space*. One receives to some extent the anomalous feeling that the light is both moving and not moving at the same time. On the other hand, in a test to be described later, I received the impression occasionally that the amount of movement was too great for the velocity, that the object *got to positions without moving there*. As another illustration of the truth that axioms of ideal space do not necessarily hold true for experienced space, I may cite the fact that in cutaneous space two lengths equal to a third length do not always equal each other. In fact, many spatial illusions exist simply because the spatial relations of our experiences do not tally with the relationships of ideal space.

According to the theory *A*, the upper light appears motionless, when the pendulum has completed three fourths of its swing. The lower light is still perceived to be moving during the last quarter. Consequently, this extra movement of the lower light after the upper one has ceased moving ought to be equal in length to one fourth of the arc; with our conditions this would be 25 cm. Judgments as to its apparent length gave values of but 7-10 cm. Such judgments are of course unreliable so far as any nice accuracy is concerned, but the discrepancy between these values and 25 cm. appears too great to be explained in this manner.

If the upper light appears motionless when the pendulum completes but three fourths of its swing, and a screen is interposed so as to intercept the subject's vision of the lower light at this point, *i. e.*, cut off from view [the last quarter (25 cm.)] of its movement, it follows that the lower light should



disappear at the same time that the upper light ceases moving. This test was made as follows: The position of the screen was adjustable so that the subject's vision of the lower light was intercepted for any desired portion of the end of the swing. The amount of arc intercepted was varied in an irregular manner, nor was it known to the observer. The subject was asked to judge whether the lower light disappeared before, after, or coincidentally with the cessation of movement on the part of the upper light. As many trials were allowed as the subject desired before giving each judgment. For judgments of simultaneity, two observers gave an average result of 5 cm., with an average variation of 2 cm. Within these limits (3-7 cm.), hesitancy of judgment was the rule. For the greater values of 10-25 cm., the observers were never in doubt; the upper light was distinctly perceived in motion after the disappearance of the lower light, *i. e.*, during at least nine tenths of its swing.

This experiment was varied by so placing the screen as to wholly intercept the sight of the lower light. This screen contained a small opening, 2 cm. square. This opening could be placed at any position along the arc of movement. Consequently, the lower light would be momentarily visible only at a certain desired time during its swing. The observer was now asked to judge whether this light was seen before, after or coincidentally with the cessation of movement on the part of the upper light. An average value of 2 cm. was obtained for judgments of simultaneity. For larger values there was no hesitancy of judgment. For all points above 5 cm. from the end of the swing, the upper light was perceived in distinct motion after the lower one became visible. The theory demands that the upper light be seen moving *only* during 75 hundredths of its swing. These results show that it is *distinctly perceived in motion* throughout 90 to 95 hundredths of its arc.

This extra duration of movement, or the whiplash excursion, can be seen under conditions of observation other than those taken into account by theory *A*. It can be seen with *stationary* eyes where both movements are perceived *entirely by retinal criteria*. The subject fixates the point in space where the

upper light comes to a full stop and observes the two movements under these conditions. When the the two arms of the pendulum are equal in length, the whiplash effect is absent. However, if the lower arm of the pendulum is much the longer, the whiplash phenomenon is again in evidence. Obviously, this result can not be explained on the basis of theory *A*.

III. The results of the above test can be explained by theory *C*. This conception of the whiplash effect assumes that the lower light appears to move for a greater duration of time but not necessarily through a greater amount of space. This apparent greater duration of movement is due to the stimulation of the receding end of the positive after-image streak. The duration of this extra movement would thus depend upon the length of this streak, and this length would depend, other conditions being similar, upon the actual velocity of the light. When the two lights are viewed with stationary eyes, positive streaks follow both lights. When the two arms of the pendulum are equal in length, the linear velocities of the lights and the lengths of their streaks are equal. Both lights would thus appear to move *after* the pendulum actually stopped, but for an *equal* duration of time. When the lower arm is much the longer, the lower streak is also the longer. Both lights would appear to move *after* the pendulum stopped, but for *unequal* durations of time. The lower light would appear moving after the upper one came to a full stop. In other words, the whiplash effect would be absent in the first case, but present in the second, in accordance with my observations.

In the above judgments of simultaneity where the lower light disappeared behind the screen on the one hand, and appeared through the opening on the other, a larger value was obtained in the first case. Granted that this difference of value is a valid result under the two conditions, the fact can be explained by theory *C*. In the first case the positive streak is present, but is absent in the second case because the light is hid behind the screen. Simultaneity was secured at 5 and 2 cm. from the end of the swing respectively for the two conditions. When the positive streak is present, the lower light will be visible, in indirect vision, after its actual disappearance behind the

screen. In order to make its apparent disappearance coincident with the cessation of the upper light's movement, it would need to be intercepted earlier in its swing by an amount of time equal to the functional persistence of the positive streak. As a matter of fact when the positive streak was present, the light was intercepted 3 cm. earlier in its swing. According to the conception, the time taken for the pendulum to move these 3 cm. should equal the functional duration of the positive streak. Since the pendulum moves 100 cm. per second, this time would be .03 second, provided that the rate of movement were uniform. Since the pendular movement decreases in velocity at the end of the swing, the actual time must be greater than this value, probably at least .05 second.

The whiplash illusion is conditioned by the direction of the attention. If the positive streak be consciously neglected by focussing the peripheral attention upon the forward part of the moving light, the whiplash effect is practically eliminated. By voluntarily attending to the streak, *i. e.*, to the receding end of the elongated light, the illusion of extra movement at once becomes evident. It was this observation which led to the formulation of the after-image theory. A second observer who knew nothing at all of the theories involved, voluntarily offered the same explanation after some observation of the phenomenon.

A contrary illusion may sometimes be obtained by sharply discriminating the light from its positive streak. Instead of perceiving the lower light moving forward, it may be seen moving *backwards* a couple of centimeters on its return swing while the upper light still appears motionless.

Since the length of the positive streak varies directly with the pendular velocity, it would follow, according to theory C, that the illusory effect will vary in direct proportion to the pendular rate of movement. By a system of weights, the velocity was varied without any other alteration of conditions. The rates secured were 5, 3, and 2 seconds for a complete swing. Judgments of the illusory movement were then given in linear terms. Values of 1, 3, and 6 cm. respectively were obtained for the three rates in the order given above.

A sufficient portion of the end of the swing for each of these

rates of movement was intercepted so as to obtain a judgment of equality in the duration of movement for the two lights. According to the theory the amount of arc intercepted should vary in proportion to the three rates. The values of 15, 30 and 45 mm. respectively were secured. These results correspond rather closely to the above values for the apparent lengths for this extra movement. The actual numerical values are in themselves unimportant; they bring out the fact, however, that the apparent extra movement does vary directly with the velocity of the pendulum.

A weak diffused light,  $10 \times 15$  cm. in dimensions, was so placed that the lower light would swing past and just emerge from it at the end of the movement. This background of diffused light was so varied in intensity that the positive streak could not be differentiated from it by direct observation. The experiment was then repeated as usual. At the end of the swing, the lower light would flash out sharply against its black background, while the positive streak could not be seen. The functional efficiency of the receding after-image was thus eliminated. Under these conditions the illusory movement was not apparent, while the lower light would flash out into distinct view practically at the same time that the upper light came to a full stop.

IV. But little positive evidence can be given in favor of theory *B*. The contrary illusion can be interpreted on this basis. The velocity of the pendulum is so small for the end and beginning of each swing that eye movements can not mediate a sense of motion. The upper light is thus not perceived in motion for a couple of centimeters at the end and beginning of its movement. Since the retina is more sensitive to movement than the eyes, the lower light is seen moving during this time; it not only moves *forward* a centimeter after the upper light stops, but also may be seen moving *backward* on its return swing before the upper light gathers a sufficient velocity to arouse a movement consciousness. The phenomenon might be explained legitimately in other terms, however.

In so far as the after-image theory does not entirely account for the illusory effect, it is legitimate to assume the influence of

factor *B*. In several of the tests, a slight illusory effect appeared to be present, although the after-image was eliminated. When the light appeared through the opening in the screen, the after-image was not present, yet the upper light was judged to be motionless when the pendulum lacked two centimeters of completing its swing. When the after-image was suppressed by the background of diffused light, a slight suggestion of the illusory movement was occasionally noticed. These cases are explicable in terms of theory *B*, though, of course, they may be explained by other means. No conclusive proof of this theory can be offered.

V. On the whole the evidence seems sufficient, to the writer, to warrant the conclusions that the phenomenon is not to be explained in any measure by theory *A*; that the upper light is perceived in motion during the major part of the last quarter of its swing; that the phenomenon is due mainly to the receding positive after-image; and that possibly factor *B* may have a small determining influence.

If Dodge's contention be true that ideal conditions obtain during the last quarter of the arc of movement, and if our tests prove that the upper light is seen in motion during the major portion of this time, it would logically follow that the experiment is proof positive against Dodge's theory as to the lack of function on the part of eye movements; that they, on the contrary, do function in the perception of movement. However, the writer does not presume to advance such a dogmatic conclusion on the basis of a single experiment, in view of the fact that the results of several other experiments advanced by Dodge and others remain to be controverted.

VI. A rather interesting phenomenon developed during a modification of the pendular experiment. Both lights were attached to the lower arm, but at different distances from the axis of rotation. If the upper light be followed by the eyes, the same results are obtained as formerly, though the whiplash effect is not so pronounced. The motion of the lower light is retinally perceived, because the eyes do not move to the same extent as does this light. When the lower light is followed, the eyes move faster than does the upper light, and consequently

retinal cues of movement are present. Moreover, the upper light is now *preceded* by a positive streak. Since the pendular velocity decreases at the end of the swing, the elongated light must now contract in length on its *forward* end. The forward end of the positive streak travels backward in relation to the light. Two opposing retinal criteria of movement are now present. The receding streak tends to *oppose*, or *neutralize*, instead of *emphasizing*, the upper light's motion. As a matter of fact, one's consciousness of this motion is strikingly peculiar and difficult of description. The movement seems weak and attenuated in character; it lacks body, force and vitality. It sometimes appears to be markedly shorter than its actual length, while at other times it appears to approximate its normal length, but in this case its length seems to be *too great* for its velocity; it strikes one at times as being in certain positions without having *moved* there. This illusory appearance becomes striking, if the observer suddenly stops the eyes and holds them stationary; the movement at once flashes out in vigor and vitality. Whatever the proper explanation may be, the illusion is certainly unique and seems worthy of further study.<sup>1</sup>

<sup>1</sup> The MS. of this article was received December 25, '06. — ED.

## THOUGHT AND LANGUAGE.<sup>1</sup>

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### § I. THE DETERMINATION OF THOUGHT IN A SYSTEM.

The description of logical meaning from the point of view of the belief embodied in the various forms of judgment, leads naturally on to the inquiry as to its development. We have seen, in our broad survey of the genesis of the logical mode, certain motive principles at work for the establishing of logical content or subject matter. It is, of course the continued action of these motives that carries on the movement, in the logical mode itself, by which its meanings are added to and extended. We may therefore, in taking up the problem of the development that logical meanings normally undergo, recall to mind the essential movements already recognized.

1. In the first place, it may be pointed out that logical meanings constitute a context of thoughts. The prelogical meanings of all sorts, the individuated contents established by processes earlier than explicit judgment, are taken up in the organized system of experience which is the objective thought-world of the thinker. It is first of all the thinker's experience, controlled in the inner processes of judgment and acknowledgment, whatever further reference or confirmation it may have as being true to or cognizant of 'reality.'

2. In the second place, we may recall the outcome of the discussion of 'common' meanings in the logical mode, to the effect that all judgments and hence all thought-contexts are common in the sense of being 'synnomic' or 'appropriate' for the acceptance of all competent judgment everywhere. The belief of the individual as determined in an act of judgment, is for him the expression of the belief of the larger world of personal selves. Apart from the question as to whether other individual

<sup>1</sup>From the material of chapter VI. of the writer's work, *Thought and Things or Genetic Logic*, Vol. II., 'Experimental Logic.'

thinkers do or do not at the time agree with him, still, in giving his belief, he is constituting a subject matter to which, by the essential movement involved, others are expected to give their assent.

3. Furthermore and third, this common character and meaning of the subject matter of thought was found to rest genetically or prelogically upon a process that is both social and experimental: the process described in our earlier discussions under the term 'secondary conversion.' We found that the context of knowledge, considered as a confirmed and established body of data, was in very essential ways due to the recognition and use of the contents of the minds of one's social fellows. Before it is judged, knowledge, as so far common, is 'syn-doxic.' All but the original substantive parts of experience — the parts found directly convertible into the hard coin of persisting and recurring fact — was actually set off from the fugitive and private images of fancy, through such secondary and essentially social conversion process. It was in the further development of this motive, it will be remembered also, that the marks of knowledge as general, universal, and even singular were derived. The conclusion that knowledge — in any mode that is not subpersonal and so subsocial<sup>1</sup> — is a 'social outcome rather than a private possession,' summed up our results in the matter.

We should expect, as has been said above, that the development of the context of thinking would be by a process continuous with that of its origin; that is, that accretions to the body of experience would be effected in the same way that earlier acquisitions were made. And this appears necessary when we remember that no material is available at all except that which has passed through these simpler modes. The new thoughts are always also sensations, memories, images or other such meanings that are found available in the development of the selective motives by which they are constituted as thoughts. There is, therefore, no extension of the context of thought ex-

<sup>1</sup>Even the low-grade knowledge of the perceptual mode is shot through with the quasi-social meaning that we have called 'commonness of common function.'



cept so far as the judgment is determined upon meanings by its one characteristic process. This process is, as has been said, both social and experimental.

4. Finally we may point out, in addition to the foregoing, a character of thought which has not as yet been adverted to; one that fixes genetically both the social motive and the experimental motive as now put in evidence. It is the *linguistic character* of thought. Thought is a system of predications or assertions that *may be* embodied in a more or less explicit system of symbols for purposes of inter-personal communication. The genetic relation of speech and language to judgment will be found to give striking confirmation of the point of view developed in the consideration of logical meaning, to the effect that judgment is in all cases common or synnomic.

#### § 2. THE LINGUISTIC DETERMINATION OF THOUGHT.

The old problem put in the question, 'Is thought possible without speech,' has no real significance except so far as it is set genetically or from the point of view of the comparative origin and development of these two great functions. But from such a point of view it takes on great significance inasmuch as even a superficial examination suggests a profound correlation. The current theories which deal with the topic from the side of language make out, each from its own class of data, certain plausible positions; these may be suggested as introductory to our own treatment of the problem.

1. *The Personal or Dynamic Theory.* This theory is based on the interpretation of 'expression.' It finds some sort of symbolic representation necessary as soon as the meaning to be expressed *becomes general or abstract*. The symbolism of gesture language, pictographic writing, etc., precedes that of vocal utterance and conventional phonetic written signs. It would seem, indeed, that if expression is to develop from a purely ejaculatory, demonstrative, or other mainly concrete stage to one of general or abstract meaning or import — that is, if it is to express something *imported*, something additional to the bare concrete common content of present experience — there would have to be a vehicle of a sort intentionally symbolizing this as-

pect of meaning. For example, a savage could not respond to express the meaning 'man,' *as suggested by but not limited to* 'this man,' except as a sign of this further intent attached to his response. Theoretically, of course, any sort of conventionalized indication — act, posture, sound — might have been selected for this function in the processes of development; but we find the function in which it has been embodied to be speech. Speech issues in a system of articulate vocal symbols, together with that special development of the same symbolism embodied in writing. So much may be said on the personal side; the side of personal expression as such.

For the purposes of linguistic theory, this may be called the 'personal' or 'dynamic' point of view. It recognizes the fact that the person is the source of new accretions of social meaning, and the dynamic movement of such meaning is made possible only as the results of personal thought find adequate and appropriate expression. It considers language as a live thing, flexible in its growth with the development of thought, divergent and varying in its comparative systems of symbolism. It gives a comparative philology, and aims at the genetic solution of linguistic problems in terms of psychological meanings. Evidently, therefore, this point of view is in its own province most important.

But the further question as to the conservation, the conventionalizing — in the large sense, the socializing — of meanings, whereby they show themselves more than personal, and in an important sense also less than personal, is equally urgent. This question may be put sharply thus: how can a system of symbols serving as expression of a dynamic movement of personal thought, also serve as the embodiment of established and conventionalized social meaning?

This inquiry has direct enforcement from the side of the psychology of what is called 'intercourse.' There is no purely 'personal' intercourse; all intercourse is in its constitution inter-personal. Its intent is to be understood as well as to be expressed. It becomes necessary to enlarge the theory of expression to make its unit one of *common meaning*. The lowest functional term of expression is in some crude sense 'inter-

course'—the development of common meaning. Turning, therefore, to the theories of language reached from the social side, we find a second type.

2. *The Social or Static Theory.* The theory of common symbolic meaning would seem not to find its problem in the first instance in personal expression. Its problem is not how personal meaning could become common in its expression, but how a conventionally common meaning could be the vehicle of genuine personal experience. Would not any system of symbolic meanings become, just by the rigidity and static character that its social fixity would impart, unavailable for personal purposes?

Indeed, the function of language, we are told by the static theorists, does not extend to the expression of what is personal as such. It comes to reflect personal interest only by being first of all conventional and common. The demand of intercourse is for a symbolism to express meanings already understood and accepted. It is only by social generalization that a meaning can become eligible for linguistic embodiment at all. Witness the fact that feeling and impulse, so far as they are not thrown into descriptive form as knowledge, cannot be given common linguistic rendering. Music may be cited: what does music really express? It is only so far as a meaning has taken on a form that gives it currency in society that it is made a matter of intelligible speech.

Upon this type of theory a view is based which makes language a static, stereotyped system of forms. The classics, being no longer living and growing but dead, offer the models of literary form. Any current modes of speech and language that do not fit into these models, so far fall short of the instrumental adequacy that facile social intercourse demands.

While stating these two types of theory in this extreme contrasted way, I do not mean that advocates of them in just this form are to be found; but the antithesis presents a fair contrast of attitude and spirit. Especially does it appear in the method of research that the schools respectively adopt. The men who look upon language statically are critical rather than genetic in their method; they study types rather than comparative forms.

Given the perfect models in which the human thought movements have once embodied themselves — say in Greek — and philology becomes the criticism and application of these models. Essential variations in model, reflecting racial and temperamental character and essential differences in intent and spirit in the actual development of cultural meaning — resulting in a variety of comparative modes maturing in common — all this they find it difficult to take interest in. The other school, on the contrary, having in view just the final point of origin and departure of all social meaning, the thoughts of the individual, make the comparative variations all important.

The line of solution would seem to lie in the distinction already made in the remarks on expression: the distinction between meaning on the one hand that is singular and in some sense private, and meaning on the other hand that is general and universal. Just as there is a sphere of personal experience that is ineligible to common and symbolic expression, so there is a sphere of common and public experience that is ineligible to strictly personal and private uses. In their range, in short, personal meanings and social meanings overlap but do not coincide. Consequently, there is the requirement all the way along that the symbols of conventional expression be so far as possible flexible in order to embody the accretions to personal experience; and on the other hand, that they be fixed enough to embody the habitual and conventionalized meanings of historical and common experience. This requirement is embodied in the view, now fast gaining ground, that language is a growing organic thing, relatively satisfactory for the epoch and the group; but by no means containing or requiring a system of fixed and stereotyped meanings.

Moreover the development of the appreciative or æsthetic consciousness is, all the while, working out new systems of symbolism for the more recondite meanings of personal intent and ideal fulfilment. The arts are such semi-socialized and in turn socializing systems of symbolic meaning. Their rôle is seen, in connection with the more conventional symbolism of language, in the various forms of conscious literary art. These, just *by being acceptable as art*, become more adequate as embodiments of individual meaning.

These two points of view may serve to guide our further thought. On the one hand, we must find the process whereby personal experience may be rendered in the symbolism of common intercourse; and on the other hand the process whereby the same symbolism, although of necessity fed by the progress of personal experience, may nevertheless preserve and embody the fruits of social and historical tradition.

If we assume, as a matter of fact, that the requirements of such a system of symbolic meanings are normally met in their linguistic embodiment we have then to analyze further the situation in which such meanings are in vital and effective use; and the modes of intercourse that embody such developing meanings will also interest us from the point of view of the genetic progress of thought.

### § 3. THOUGHT AS LINGUISTIC MODE.

We should expect to find, if our earlier positions are well taken, that thought, logical meaning of whatever grade, would take on a linguistic or other social form. Both of the great characters of logical meaning *actually require it*.

One of them has already been seen to be effective in the sketch just given of the two great points of view current in the theory of language—*i. e.*, that while speech expresses personal meaning, it must still be socially organized. This hits upon just the relation of the personal or private to the common strain in all logical meaning. The character of logical meaning as being at once personally judged true, and also acknowledged as appropriate for common acceptance — this is just the character we have found. It is denominated ‘synnomic.’ The transition from pre-judgmental to judgmental meaning is just that from knowledge that has social confirmation to that which gets along without it. The meanings utilized for judgment are those already in their presuppositions and implications developed through the confirmations of social intercourse. Thus the personal judgment, trained in the methods of social rendering, and disciplined by the interaction of its social world, projects its content into the world again. In other words, the platform for all individual movement of judgment to its assertion — the

level from which it utilizes new experience — is *already and always socialized*; and it is just this moment that we find reflected in the actual result as the sense of the ‘appropriateness’ or the ‘synnomic’ character of the meaning.

This requirement, signalized as the common or synnomic character of the linguistic embodiment of thought, may be called the ‘habit’ aspect — the funded, conserving, retrospective, general side of meaning in the logical mode. Evidently it is this that the static theorists of language have in mind. Language must embody meanings that are established and common. They are personally available only so far as the individual can use this kind of meaning, that is so far as his meaning *is already synnomic*. If our theory, however, discovers *that all personal judgment already embodies such meanings*, then we may simply say that this function, language, *is the normal and appropriate embodiment of individual judgment no less than of social meaning*.

The other aspect, however, is equally real. It may in contrast be called the ‘accommodation’ side — the side of growth, accretion, development of personal meaning through the resort to language as instrument and means. Of course, it is evident that both the general and the schematic, the retrospective and the prospective, the belief and the doubt, the assertion and the assumption, must be capable of characteristic linguistic embodiment.

It is upon this requirement that we find the dynamic theories of language dwelling in turn. They recognize the fact that thought would be killed, both personally and also as representing any social values, if its vehicle were stereotyped and unchanging. The symbolism of language must reflect the mode of development and growth peculiar to the progress of thought.

Now the development of thought, as we are to see in great detail,<sup>1</sup> is by a method of trial and error, of essential experimentation, through *the use of meanings as worth more than they are as yet recognized to be worth*. The individual must use his old thoughts, his established knowledges, his grounded judgments, for the embodiment of his new inventive constructions;

<sup>1</sup> In later chapters of the volume ‘Experimental Logic.’

he erects his thought as we say 'schematically' — in logical terms, problematically, conditionally, disjunctively — projecting into society an opinion still personal to himself, as if it were true. *Thus all discovery proceeds.* But this is, from the linguistic point of view, still to use the current language; still to work by meanings already embodied in social and conventional usage. And the result, what of that?

The result is now the essential thing. By this experimentation both thought and language are together advanced. The new meaning is, let us say, not confirmed in the way suggested; the old terms do not fully define and limit the connotation that actual trial justifies. Language then grows to fulfil the demand of the developing thought. It is accomplished, it is plain, by no situation that compels language to be private *or* public and *not both*. As tentatively suggested the meaning is rendered *as if common*, in common speech; the new form it takes on, while now become common as meaning, is still the individual's personal thought as well. Language grows, therefore, just as thought does, *by never losing its synnomic or dual reference; its meaning is both personal and social from start to finish.*

As soon as we recognize these two essential motives in the development of thought, a profound interest attaches to the question of the relation of language to thought. There are certain statements whose truth now appears, and which bring direct confirmation from the side of language of our view of the origin and nature of synnomic or judgmental meanings.

1. It would appear that language is the instrument of social habit, in the sense that it conserves and stores up as a social heritage the gains of common meaning. And this appears not simply as a fact, but by reason of the principle that *only in language* are the available elements of personal experience and meaning socially stored and rendered continuously available. It is the register of tradition, the record of racial conquest, the deposit of all the gains made by the genius of individuals. The social 'copy-system,' thus established, reflects the judgmental processes of the race; and in turn becomes the training school of the judgment of new generations. Not indeed would I say that linguistic models and linguistic study as such have any

such pedagogical importance; that is just the fallacy of our present-day instruction, that makes a fetish of language as such. But every day linguistic intercourse, *language performing its vital rôle*, is thus important. Linguistic study is instrumental, a means to an end; the end being admission to the storehouse of meanings and models of racial judgment, which literature in all its forms serves to mediate. When language is made an end — except of course in that department of research in which language is itself the content — it becomes a form that is eviscerated of its filling and meaning; much as we eviscerate thought of its content and so lose its meaning also, when we leave out of account the essential movements of belief.

2. In speech, the function by which the content of language is actively rendered and interpreted, the accommodation side of thinking is given its chance. Most of the training of the self, whereby the vagaries of personal reaction to fact and image are reduced to the funded basis of sound judgment, comes through the use of speech. When the child speaks he lays before the world his suggestion of a general and common meaning; the reception it gets confirms or refutes him. In either case he is instructed. His next venture is now from a platform of knowledge on which the newer item is more nearly that which is convertible into the common coin of effective intercourse. The point to notice here is not so much the mechanism of the exchange — the sort of conversion — by which this gain is made, as the training in judgment that the constant use of it affords. In each case, effective judgment is the common judgment; and there grows up the ability to make such judgment effective without the actual appeal. This is secured by the development of a function *whose rise is directly ad hoc* — directly for the social experimentation by which growth in personal competence is advanced — the function of speech.<sup>1</sup>

<sup>1</sup>The first and more superficial criticism of the reader is here, as elsewhere in these genetic discussions, that which raises the question as to whether speech is the only function by which this is secured. We are asked whether a child who is deaf and dumb does not become a competent thinker. Certainly he does, in this measure or that, according to the case, which is only to say that the rôle normally played by speech may on occasion be taken up in a less effective way by some other function having a content capable of the symbolic reading that usually attaches to language.



In language, therefore, to sum up the foregoing, we have the tangible — the actual and historical — instrument of the development and conservation of psychic meaning. It is the material evidence and proof of *the concurrence of social and personal judgment*. In its synnomic meaning, judged as 'appropriate,' becomes 'social' meaning, held as socially generalized and acknowledged. The dictionary is the register of private judgment become social. Written language, literature, is its institutional and traditional side; speech is the schematic and personal rendering of its intent, its accommodative side.<sup>1</sup>

#### § 4. THE DEVELOPMENT OF THOUGHT THROUGH INTERCOURSE.

The view of thought now briefly indicated justifies certain positions regarding the form in which the import of an item of knowledge may be expressed when embodied in such a vehicle as language. On the surface it appears that the entire import of such an item varies with the setting in which it is developing.

<sup>1</sup> There is here a confirmation of the position taken in my work *Social and Ethical Interpretations*, in which the method of social organization is found to be imitation; for not only is language the embodiment of generalized cognitive content, it is also, as functional in speech, through and through imitative in its method of learning and propagation.

We now see how it is that language is instrumental to the development of both personal and social meanings. What linguistic theory needs, in fact, is better psychology: a psychology that shows the artificiality of the dualism of private and social meaning, that the opposed theories assume. If it were true that there were no concurrence — no identity — between the movement of individual thought and that of conventional language, then not only would a theory of language be impossible — language itself would be impossible as well. This is one of the topics, therefore, in which a view of judgment that justifies the essentially common character of its meaning renders service in a field of more remote interest. If the demonstration of the social genesis of the individual's judgment be sound, philology will have for the first time a solution of one of its great problems.

Another fact known to psychologists and philologists alike has an interesting value in the light of our discussion: the fact of 'internal speech.' Recent investigation shows that it is not a mere by-phenomenon — our having words 'in our minds' and 'on our lips' when engaged in silent thought, reading, etc. (see my *Mental Development*, chap. XIV.). It is rather the incipient stirring up of those social and symbolic equivalents of thought, that vocal rendering employs. Since the normal development of thought and speech goes on together, the functional processes are not separable. The intended psychic meaning can come up only when its symbolic vehicle is incipiently stirred up with it.

The interest at work may be of this or that sort according as this or that group of meanings ordinarily called a 'topic' is being pursued. This in turn varies with all the dispositional or other tendencies or motives coming to consciousness in the individual. The content itself, so considered as a subject-matter of thought, has relations, discovered or not discovered, in a larger whole of meaning. For example, the item 'horse' may have very different lines of import developed according as I am conversing with a horseman, a naturalist, a dealer, or a veterinary surgeon. In each case only those ramifications of meaning that are relevant to the common interest of the parties to the situation are elucidated and further advanced. If we consider that phase of the situation that concerns the party for whom a set of relationships is already established as a whole of subject matter, then the form of linguistic expression he employs is motivated by the interest of what we may call 'elucidation.' You 'elucidate' to me the fuller import of what you understand. The motive to intercourse on his part is in this case not discovery, not the extension of his system of meanings, but the imparting of it to another—literally its *elucidation* to one who has not yet, it may be, fully thought it out under the same set of relevant interests.

On the other hand, supposing the interests to remain the same, the attitude embodied in the use of the term, sentence, or other linguistic unit, may be not elucidation but 'discovery,' not teaching but learning. And, of course, on the surface this may seem to require no active resort to speech at all. But such a statement, as being in any sense a final account of the matter, would be very superficial. The process of development of a system of logical meanings is never one of passive reception or even of relative inactivity. The growth of logical meaning in the hearer is by a series of judgments. The process is one of individuation of more or less familiar meanings in a new construction or context, in which the self receives a new impulse to its assertion of inner control. The understanding of a statement, or a series of statements, in detailed discourse, may be seemingly complete for each step; but the elucidation of the speaker may vary in effectiveness for the hearer all the way

from a mere glamour of familiarity or formal correctness, through varied stages of piece-meal, fragmentary, and semi-detached judgmental wholes, to that complete response of the hearer's logical interest that unifies the entire set of relevant items. How the more superficial sorts of comprehension of a subject are possible might be made subject of further remark; here it may suffice to say that when they are thus of the superficial sort, it is pseudo-thinking; it gives meanings that remain in large part either in a mode not yet judgmental, or so habitual as to be under mere reality-feeling, or again they are mere material for schematic use in this way or that when judgment upon their further relevancies is actually achieved.

If genuinely receptive, indeed, the attitude of the hearer is one of continuous thinking. His selective interests are not severely taxed, since the relevant information is directly supplied to him. But the meanings suggested to him are, in the first instance, merely proposed, assumptive, experimental. Each item added to the whole requires assimilation by some process complementary to that whereby, in the contrasted case, he tests in the social environment the meanings of his own suggestion. There must be a means, personal to the hearer, of testing the content of a thought proposed to him as valid, just as there must be a means, social in its nature, of testing the personal hypotheses put forth by the individual. Both of these processes are made effective through the medium of the common function, speech. The one sort of testing is the appeal to the socially established context of common meanings, as represented by authority; the other is that whereby the socially<sup>1</sup> problematical or assumptive meaning is confirmed by appeal to individual judgment. The unit in which such items of meaning are cast for either of these modes of confirmation or for both is now to be inquired into; it may be called the *unit of linguistic expression*. It is what is ordinarily called a *Predication*, or a *Predicative Meaning*.

<sup>1</sup> 'Social' in the sense of *made to a hearer* by whom it is to be ratified. Of course all social acceptance is constituted by an aggregate of such individual ratifications.

## § 5. MODES OF PREDICATION: ELUCIDATION AND PROPOSAL.

As soon as we take into account the entire situation in a case of intercourse of any kind, we find certain points of view from which the same meaning may be considered. There are always at least two persons to the situation, and if we distinguish these persons as 'speaker' and 'hearer,' we have the two personal elements marked off. Each of the persons is either already in possession of the judgmental meaning or he is not. If he is, then he is in rôle, if not in fact, 'speaker'; that is to say, the meaning is that which he might utter in place of the actual speaker; and whatever term we apply to the function of expressing this meaning, it may be put down as applying to his *act of participation in the situation*. On the other hand, there is the point of view of the one to whom the intelligence imparted by the meaning is in some sense not already his meaning, but an addition to it, or a modification of it. He is the 'hearer'—no matter how many of him there may be! The shadings of meaning involved may be distributed under this two fold division — *the speaker's meaning and the hearer's meaning*.

The next thing that occurs to us to note is that each of these persons, speaker and hearer, may have in his mind either a meaning which he believes or a meaning which he questions: either a 'logical' or a 'schematic' meaning; a 'presupposition' or an 'assumption' may underlie the relational subject-matter that constitutes the predication. And there must also be supposed a form of correlation between these two types of meaning, considered as being in a situation in which the speaker and hearer get the same subject-matter at the same time — as indeed they must lest intercourse lose its commonness and so be futile.

This analysis when pursued exhaustively gives the following cases:

1. Belief in the subject-matter on the part of the speaker, and predication that serves to elucidate the subject-matter: this we may call *predication as elucidation*. If this is accompanied by belief before the predication, in the mind of any actual hearer, the meaning to him is also one of elucidation, for he might have been the speaker.

2. Question in the mind of the speaker and predication that

in some form proposes something ; this we may call *predication as proposal*. If it be met by belief in the mind of the hearer — belief already formed — it is to the hearer not proposal but elucidation ; and he in turn may proceed to elucidate the proposal of the questioner. If, on the contrary, the hearer joins the speaker in erecting the subject-matter into a schema of problematical meaning, his meaning is then also one of proposal.

There are therefore four possible cases : (1) *Proposal* — (with) *Proposal*, (2) *Proposal* — *Elucidation*, (3) *Elucidation* — *Elucidation*, and (4) *Elucidation* — *Proposal*, in each case the meaning in the mind of the speaker standing first. Suppose, for example, a teacher teaching his class. The pupil says ‘A continent is really an island, isn’t it?’ (proposal), and the teacher replies either ‘yes’ (elucidation) — case (2) — or ‘let us look in the dictionary and see’ (proposal) — case (1). After looking up the dictionary, both pupil and teacher may say, ‘it is an island, as we thought’ (elucidation with elucidation) — case (3) — or the teacher may say, ‘I still question what you read’ (elucidation with proposal) — case (4). It must not be supposed that ‘elucidation — proposal’ and ‘proposal — elucidation’ give the same situation ; they do not. The former is the situation in which there is exposition with reference to which the hearer has not arrived at an assenting judgment ; the latter, on the other hand, is the case of a question met by an elucidating response. The latter is the more fruitful situation, genetically, since it results in actual development of meaning in the mind of the questioner, giving a third term of elucidation ; and if this be also stated, the progression becomes proposal — elucidation — elucidation. The other case, that of elucidation — proposal, is not of this fruitful issue, unless it be followed by a further elucidation by the first speaker, and then an elucidation also in the mind of the hearer ; but this latter pair of terms brings in one of the other situations mentioned above, that of elucidation — elucidation.

Putting it in general terms, we may say first that a statement may be met by acceptance or by question, and second, that a statement of question may be met by a belief or by a joint question. The instrumental utility, and with it the genetic justifica-

tion, of these four cases of predicative meaning should be examined. In each of them we find that all predication, and with it all use of logical meaning, *is in some important sense experimental*, when once the *social point of view* essential to its full interpretation is taken up.

#### § 6. PREDICATION AS EXPERIMENTAL MEANING.

It would appear on the surface that if logical meaning is to be common, and thus socially available for intercourse, its forms must be those by which on occasion the enlargement of the range of acceptance could be secured. The forms of predication would then be *ipso facto* instrumental to the production of further judgment and belief. But certain considerations force themselves upon us which forbid so easy an instrumental interpretation. We have seen that the growth of knowledge cannot be entirely personal and private; the necessities of social life, which are also personal, forbid. But it is equally true that the securing of common acceptance, and the enlargement of the body of inter-personal acknowledgments, cannot go on alone, as being the entire fulfilment of the rôle of knowledge; for the individual's judgment is all the while the norm of what is established as knowledge, and without individual consent there is no social acceptance? The propagation of a thought in a social set can only be by the intrinsic adoption of the thought by the individuals of the set one by one. Any other process would make not common knowledge but common hypothesis or proposal, with no relatively final solution or elucidation in knowledge. In such a case the final criterion to the individual thinker would not arise in his own processes of selective thought, but would be a calculus as to how many of the community already accepted it. Catholicity would take the place of what we call logical reasonableness or validity.<sup>1</sup>

<sup>1</sup> A sort of social pragmatism might be constructed along this line by reinterpreting—as we have—the individual's judgment of reasonableness back into the field of social acceptance—the 'hole from whence it was digged.' But this is just what current pragmatism is unable to do, since its entire development is on the basis of the reconstruction of experience *in the individual, for 'control' by personal action*. The question I put to this latter theory is how, if the dualism of inner and outer be one whose value is its instrumental utility for the control of action—how can self and other individuals—how can society—have any common meaning? A resort to a social discipline of individual judgment would seem to be shut out from the start.

There is in short the attitude toward society expressed in the sentence, '*I believe*, therefore have I spoken'—the attitude of conviction, *cælum ruat*—as well as the attitude, 'I would believe, help thou mine unbelief'—the attitude of social acquiescence. And we should expect that besides the evidently instrumental character of the appeal to society, there would be a corresponding instrumental appeal of society to the rules of individual thought. Put in terms of predication this would read—social proposals require individual elucidation, and individual proposals require social elucidation. The very development of knowledge, if it is to issue in a system of what we may call 'truths,' requires that both these forms of confirmation be present all the while.

Apart, however, from further theoretical discussion, we may point out the fact that as expressive of attitudes toward mental objects, meanings reach the poise and equilibrium of knowledge only through a two-fold elucidation. That of the speaker is still *to invoke that of the hearer*; that of the hearer is *again submitted to the judgment of a second hearer* when the former becomes speaker. The judgment of the individual is forever fed by the return wave from the circulation through the social tissue. On the other hand, the social set are never all convinced, and the outriders of society must be subdued to the informing and reasonable elucidation of the dominating individuals.

The process of formation of what we call 'truth' is, therefore, a continuous and dialectic one. Apart from the definition of the term truth, and the justification of its use for a body of subject-matter constituted as logical content, we may say that there are several sorts of truth. A predication which a thinker elucidates is true so far as it is not ineligible to the hearer's elucidation and belief; but it may still actually be mere hypothesis or proposal to the hearer to whom the elucidation is addressed. Again, a matter of social convention, of confident social elucidation and advertisement by acclamation, is true in so far as it is not ineligible, not mere proposal, to any individual thinker, for the same item is perpetually subject to the sharp-shooting of the more expert intellectual marksmen to whom the social judgment looks for its reconstruction and

direction. There are two sides to the dialectic, two poles around which the web of truth must be stretched; and until both sides be compassed and both poles surrounded, truth is unfinished.

From the instrumental point of view we discover, therefore, two sorts of schematism or proposal; and it is a result to which our discussions now directly converge that both are never finally banished — that *thought — and with it truth — remains in one sense or the other experimental to the last.*

Proceeding now to isolate the typical cases of proposal involved in situations of intercourse we find them to be two. First, there is the attitude or intent of question *in the speaker*, of proposal or assumption of something *he himself does not yet believe or presuppose*: this is the attitude in which the individual explicitly appeals to social conversion in order that his schematic context may be confirmed for his own acceptance and judgment. Second, there is the attitude of question in the hearer, the audience, the public, in presence of the elucidations of the speaker: this is the attitude in which the social set, the general intelligence, waits upon the judgment and predication of the individual that the final availability of its meanings may be assured. In the former case, there is the question, will it work in the whole of society? — will it bear the social test? In the latter case, there is the question, will it work in the individual's system of established beliefs? — will it bear the test of competent private judgment? — is it reasonable?

These are the two tests always present in the determination of new matter in the system of meanings in the logical mode — *the two tests of truth.* They are the test of *commonness* and the test of *reasonableness*, both being aspects of the intrinsic intent of all logical predication. They are the poles of reference of logical meaning in its growth, as first 'syndoxic' or 'held<sup>1</sup> in common,' then synnomic or 'judged as common,' and finally 'catholic' or 'judged in common.' The 'reasonableness' of the synnomic is just the 'appropriateness' attaching to a meaning *whose social intent faces both backward and forward.*

A further word on the relation of these two tests to each other.

<sup>1</sup> That is, "assumed" or "presumed" in common in a mode short of judgment.



First, it should be borne in mind that we are here not concerned, except in certain secondary ways, with the commonness of mere catholicity as numerical measure of acceptance; but with that more profound ingredient in knowledge whereby, in its very formation, the individual judgment intends a common meaning. The judgment of the individual once formed is necessarily a common judgment to him: it is synnomic in the sense of our earlier discussion. But the experimental process—the growth of this faculty of judgment in just this synnomic direction, both racially and in each individual—requires a series of situations in which the proposed or schematic meanings of the individual have first the syndoxic character “in common,” and so pass into judgments. The simplest case, of course, is one of fact in which the individual is not already possessed of the requisite information, and awaits the elucidation—the narrative—of another. He then, with this increase of syndoxic information, forms a judgment of his own that is synnomic. Thus arises a judgment of fact, the report of the other taking the place, by the operation of social conversion, of his own appeal to fact. Before such an appeal, or the reception of the equivalent information, his opinion would have been schematic and assumptive. It is this case, in which the accretion to knowledge is a matter of fact, whether reached by direct or by social confirmation, that has given rise to the description of this test as the ‘test of fact.’

In the more recondite operations of thought, the essential appeal is the same. It is for that informing element of content or meaning, derived through the common context of socially established fact, that brings out the synthesis of judgment. The individual resorts to some source apart from his own ready-formed context of meanings used by him hypothetically, some word of fact in the larger sense, through which his assumption may be grounded and his belief justified. The essential redistribution of meanings that constitutes the process of assimilation of the proposed data to the body of experience, now takes place. In the result the item gets its assimilation, and the context of believed and grounded items is so far enlarged.

The other test is different in its nature; but being a real test,

it is equally instrumental to the development of thought. It is that of items proposed for social acceptance but awaiting the judgment of the individual. It is the appeal to the 'reasonableness' in which the competent thinker renders his synnomic meanings.

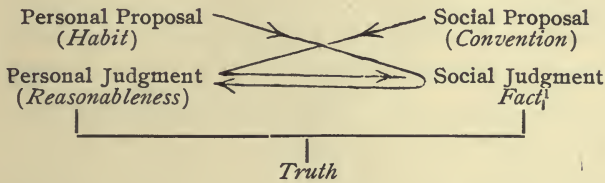
We have said above that this resort to the formed judgment of the individual is necessary to social acceptance — the acceptance of grounded social judgment. 'Commonness' in the simpler senses of that term — the meanings of 'common' short of the syndoxic<sup>1</sup> — such commonness may exist without logical bearing of any kind. There may be mere social aggregateness. But the passage from what we may call social proposal — rumor, contagion, plastic imitation, etc. — however aggregate it may be, and however socially diffused, into the status of logically common meaning, is always through the mediation of the judgment of individuals. All 'social meaning as such,' and all 'public' meaning resting upon it, are subject to the test of 'reasonableness' to the individual thinker. Social commonness, in short, rests upon individual acceptance or 'reasonableness'; while individual acceptance as 'reasonable,' has its roots in social commonness. The test whereby the social proposal, the aggregate or relatively catholic meaning, becomes one of genuine logical character, we therefore call the 'test of reasonableness'<sup>2</sup> as contrasted with 'the test of fact.'<sup>3</sup>

<sup>1</sup>See the descriptions of such meanings in my *Genetic Logic*, Vol. I., chap. VII., §§ 5 ff.

<sup>2</sup>I take the term 'reasonableness' as covering the general mark of knowledge wherein it satisfies and fulfils theoretical or logical interest from C. S. Peirce. As popularly used it has just the ambiguity of confusing the two phases of attitude we are trying so strenuously to separate, *acceptance* and *assumption*. We ordinarily say we believe a thing because it is 'reasonable' and also that we assume a thing because it seems 'reasonable.' This means that it is by a transition of attitude, rather than by a change of content, that knowledge and hypothesis are distinguished. A definite set of implications are reasonable, grounded, believed; a set of assumptions not believed but only proposed, are also reasonable *so far as they go in leading up to belief*. It is to the former intent, that of actual acceptance, that I shall apply the term.

<sup>3</sup>It may be recalled that in the treatment of 'Selective Thinking' in another place (*Devel. and Evolution*, chap. XVII.), I worked out certain tests from the individual point of view, calling them respectively 'test of fact' and 'test of habit.' The test of habit is what is here, from the psychic point of view, recognized as schematic assumption. In order not to repeat what is said

The factors involved in this two-fold dialectical movement may be shown by the following diagram. It should be remembered that it is the progress, or determination, of meaning from proposal (assumption) to elucidation (belief), that is in question, and not the development of pure implication or elucidation as a body of related contents already fully determined.



The point of interest just here does not reside in the further explication of either of these tests; it resides rather in the statement that no predicated or judged knowledge is ever free from that instrumental and problematic reference which one or other of these tests would further fulfil. Either that which is reasonable is still to be elucidated for some mode of acceptance, or that which is generally accepted is still to be proposed for individual confirmation as reasonable.

The process of intercourse, therefore, to be all that it is for thought, requires that elucidation should perpetually fulfil the demand set by the correlative function of proposal. The social reference of thought is all the way along prospective as well as retrospective: prospective, in that it presupposes a proposing society for which further elucidation is necessary; retrospective, in that it incorporates in its own competent judgment, just that strain of commonness which only an earlier prospective referentially there, I may simply call attention to the treatment in that place of (1) the 'platform' or level of determination or systematic meaning from which all new items are selected as assumptions, and (2) the resulting theory of truth as that which having passed the 'gauntlet of habit' or assumption then has to submit to the test of fact. Truth in the realm of empirical discovery, then, is what is in this twofold way selected. What is now added is the point that the hearer, society, does the same: brings back its 'assumption' as mere social habit to the test of individual endorsement as 'reasonable.'

<sup>1</sup>The socially established meaning may always be classed as 'fact' since it has no further rôle save as established control or test of the individual's meanings.

ence in its own case could have produced. Put differently, we may say that if, at any point, truth can be considered finished and absolute, not subject to further growth, but only capable of repeated elucidation, then at an earlier stage it might, *for the same reason*, have been so considered, and its present stage would not have been attained. And so on all the way down the line of racial progress. But, on the contrary, the elucidations of one generation only bring out the proposals of the next; the elucidations of society, the proposals of the man of genius. And in both cases the extraordinary thing is that in the proposal that requires a new platform of elucidation, the table is turned upon the thinker who makes his knowledge final. The judgmental content must be 'set' as final, seeing that it is common, synnomic, retrospective and in so far also legislative for all intelligences. But the newer gage of reasonableness, on the one hand, or of fact on the other hand, once thrown down with its claim to a new finality, the process of vital reorganization again goes forward. The older truth loses its presuppositions or finds them restated in a new set of postulations.

It is not in order at this point to indicate the bearing of this result in a theory of knowledge considered as epistemology. We are later on to consider the question as to which if either of these points of view, these tests, these references to facts and to theoretic satisfactions, is the more fundamental. The whole matter is here one of genetic adjustment of motive factors in a whole function. If one care to select one aspect of the whole and say, 'thought being experimental and instrumental and prospective, is pragmatic through and through;' very well, so it is, from this aspect of it — the aspect of accommodation, discovery, development. But if another select the other aspect and say 'all thought is retrospective, a platform, an organization, a social and common meaning, having its relational forms and rules of predication, a matter of habit and theoretical worth' — what is to prevent his doing so? But both are partial, both abstractions. Knowledge is a specific organization within whose subject-matter characters appear, on the one hand, that fulfil the theoretical interest without which no elucidation, predication, implication, *language*, would be possible; and again,

knowledge is an adjustment, motived by a 'pragmatelic,' end-embracing interest, without which no theoretical organization or meaning could ever have been developed. No good social psychology, and no epistemology based upon such a psychology, will be long content with either of these partial and fragmentary interpretations.<sup>1</sup>

The conclusions we have now reached are these: (1) that all elucidation, all predication that is really judgmental, all inner organization of thought in a system of implications, has been developed with constant reference to proposals to which it is the reply and elucidation, and (2) that all instrumental reference of knowledge, all discovery, all postulation, all practical insight through truth, are possible only on a basis of established judgmental content whose adequate theoretical elucidation it presupposes. And the reason of both these statements may be put in a sentence—the reason is that *knowledge is common property not an individual possession*, that individual judgment presupposes universal acceptance, and that truth is fitted always not only to *satisfy somebody's theoretical interest*, but also to *stir up somebody's curiosity and practical impulse*.<sup>2</sup>

<sup>1</sup> It may be said here, and has been said to me by a thinker who calls himself a 'pragmatist,' that we are still in the entire process dealing with a development for which the movement of cognition is instrumental: the development of psychic activity or function as such. To this I do not object, if we include *objective meaning* with function; although when I come to think it through I find the result very far removed from what is usually called 'pragmatism.' The whole development is, on the basis of our results, a social development, a larger social order, and with its postulation goes the contrast meaning, postulated equally in the logical mode, of a non-social and non-mental order, an environment. A dualism thus persists and will not down—a dualism whose implications forbid a return to any sort of subjective interpretation of reality, *as reached by thought*, which confines it to what is relatively organized in the individual's habit. The solution is to be found only in some sort of experience that is not indeed *a-logical*, but *super-logical and immediate* in its mode.

<sup>2</sup> This genetic process of building up a competent individual judgment, asserting its individuality as over against the social body which is its very *fons et origo*, is seen to be a phase of the 'dialectic of personal and social growth' developed in detail in my work *Social and Ethical Interpretations*. It is there shown that the consciousness of the personal self is formed and becomes relatively self-asserting, as over against society, by a process of imitative assimilation and ejective re-reading of social material, so that the individual is 'a social outcome, rather than a social unit.'

Language embodies, if our general position be true, that stretch of cognitive meaning that is both individually accepted and socially rendered. It shows the concurrence of the two points of view from which the development of thought may be observed. Moreover so far as the individual's psychic life is looked upon as one of relative isolation from his fellows, as a center, that is, of personal and subjective meanings, the stream of his personal development merges concurrently into that of the social whole in those meanings which he can render by speech. His other meanings, the purely selective ones, the appreciations and the quasi-conative ones, the sorts of intent that fulfil his personal interests and purposes, together with the purely private ones of the fugitive sort that never acquire social validity — all these lie outside the sphere of intercourse and fail of linguistic embodiment.<sup>1</sup> We can, indeed, imagine modes of social expression — we have them possibly in the crude quasi-linguistic symbolism, of some of the higher animals—in which this concurrent rendering of meanings personally in private judgment and also socially in common acceptance, has gone very little way. A society with only gesture language would be one with little such concurrent development; and one with only pictographic signs would be relatively rude in respect to that aspect of development represented by written language.

The principal and striking thing about language, however, as thus being both personal and social vehicle of thought, is its *testimony to the falsity of any individualistic theory of thought*. Thought must be social in order to be adequately personal, as we have seen: language summarizes and demonstrates this necessity. The gradual development of language shows the impulse and necessity for intercourse both as pedagogical instrument in the hands of society and also as vehicle of the individuals informing and reforming work in society.

<sup>1</sup> It has been interestingly shown, however, by Prof. Urban that there is a sort of 'appreciative description' whereby such meanings may be indirectly suggested by verbal description (*Philosophical Review*, Nov., 1905). It would appear quite possible to arouse in another an appreciative state like one's own by the use of indirect symbolism. We have the general resort of taking advantage of what is called above (in my Vol. I.) the 'commonness of common function' — of exciting a common function by 'analogous feeling stimuli,' to use Darwin's classic phrase.

# THE NATURE OF THE SOUL AND THE POSSIBILITY OF A PSYCHO-MECHANIC.

BY THE LATE C. L. HERRICK.<sup>1</sup>

## I.

One may accept, with all the assurance that ideas in this field are capable of exciting, the doctrine that energy is the real and that its 'standing in relation,' or limitation, is the basis of substance, while one perceives no less clearly than the dualistic philosopher the fundamental contrast between self and the outside world.

It is no part of our purpose to minimize this contrast or to detract from the respect which we feel for the spiritual as contrasted to the phenomenal world. Here our analysis must be patient and close and each step must be carefully scrutinized but with the constant recollection that everything cannot be said at once.

Even at the risk of using terms that have been much abused at times we are now prepared to realize the difference between phenomena and epiphenomena. A certain form of energy, expressed in alternating modes (a resultant of limitation or interference) impinges on equilibrated energy in an animal organism in such forms as to modify the latter. (We are well aware that torrents of energy are continually passing through our bodies and even our brains without awakening any response, and we also know something of the nature of the correspondences by which interaction is rendered possible and do not doubt that even these unperceived currents might, by appropriate transformations become suited for 'food for thought'). The equilibrated organism is affected (in extreme cases the equilibrium is destroyed) and the equation of the subsequent life of the equilibrium is permanently modified.

But the first result is a state (act) of consciousness. From the nature of the equilibrium it follows that only one interfer-

<sup>1</sup> Unrevised MS. submitted, as the author left it, by C. J. Herrick. — Ed.

ence can occur at any given moment of time. An equilibrated system may be constantly varying but it is always *one* system.

*Note, however,* that the unitary nature of an equilibrium does not prevent all sorts of fusions in the external stimuli before they affect consciousness. Thus an instantaneous view of an object may produce a synthesis which can be remembered in terms of multiplicity. But the analysis by judgment of a composite of various impressions does not prove that the act of perception was multiple in any given moment of time. The perception of a chord in music is a single act, though we may subsequently analyze it into elementary sense stimuli.

Experience is, therefore, composed of a series of impressions,  $a, b, c$ , etc., and these are projected as a phenomenal series,  $p, q, r$ , etc. But this is not all. Together with the subjective series there is something else which is not variable — which serves to make a series of the isolated facts of experience — which binds the experience series into a whole. This might be a constant from the organism, thus:  $ax, bx, cx$ , etc., so that each time  $a, b$  or  $c$  is experienced it is accompanied by a feeling tone from the organism and from this we derive  $x$  ( $a, b, c$ , etc.),  $x$  being a constant furnished by the organism in the act of experiencing.

In the same way the phenomenal series is affected by a somewhat, thus:  $py, qy, ry$ , etc., giving rise to  $y$  ( $p, q, r$ , etc.), where  $y$  is that constant which produces the sense of an external continuum or external world.

More specifically, what is  $x$ ? It may be suggested that the somatic sensations which, from their diffuseness, never enter consciousness in analyzed or differentiated form, constitute a background of consciousness which is at least relatively constant and serves as an  $x$  to be affixed to every  $a, b$ , and  $c$  of experience. If this were true then it would follow, if one were cut off from all such organic sensations by being paralyzed, let us say, in all afferent paths of somatic nervous discharge, no  $x$  would be supplied and one would have no 'self' concept or factor with which to affect the series of experiences, and it would remain a simple series of discrete sensations  $a-b-c$ . There are facts of pathological experience which go to prove



that some such truncation of self does follow from the shunting out of the somatic part of experience and we have every reason to know that the background of somatic or organic experience is a very useful means of synthesis for the remainder of experience and also a very prominent element in the 'self' tone which goes to make up temperament and disposition.

But our analysis would need to be more minute than this. It is supposable, nay probable, that the very existence of a neural equilibrium implies such activities as would keep up a tension of experience which, during a state of relative repose, might be undefined and unperceived, would be constantly varied by each break in the reposeful state, as when, for example, an external stimulus is received. Thus we may suppose, the material for self-consciousness would be preserved to some extent so long as the ability to receive stimuli at all remained.

$X$  then, is that constant of effort recognized (implicitly) at each presentation of an element of experience  $a$ ,  $b$ ,  $c$ , and the recognition of this constant factor in the variable series is what gives rise to the notion (which is of the nature of a dim feeling at first as  $x$  itself is a feeling of tone) of a continuous self, cotemporaneous with and existing between the series of experience. It seems to be a limitation of our consciousness that we do not experience unfilled intervals. In the experience of unlikes,  $a$ ,  $b$ ,  $c$ , etc., there is presented with these elements or between them, the recognition of change, thus:  $a$  (change),  $b$  (change),  $c$ , etc., which cuts the series into units of experience. On the other hand the series of subjective increments  $x$ ,  $x$ ,  $x$ , etc., has no such cleavage phenomena and fuses into one continuing  $x$  . . . etc. An absolutely unvaried experience, being incapable of analysis, has no succession and does not fall into the category of time. So we have the curious duplicity of experience of a broken series and a continuum or identity side by side with the former. This we express thus:  $x$  ( $a$ ,  $b$ ,  $c$ ) and the constant is the elementary self of consciousness, a something invariable in the midst of variety and permanent in the midst of fluctuating experience. To this constant the variables are referred.

But we are not guilty in every day life of the refinements that have been discussed above. We do not ordinarily stop to

consider the objectivity of the body to the conscious mechanism at all. Not merely the organic (and as such unreferred) sensations, but the relatively constant sensations of bodily presence and effort are readily and constantly recognized as having a greater constancy than sensations for which we have analytic sense organs, such as the visual and tactual sensations. These bodily sense stimuli are reported continually, and, just in so far as they are constant, they are not specially perceived. They pass over as factors of the mental equilibrium and are only perceived at such times as some change occurs or attention is directed to them for some reason. These sensations form a vast penumbra about the  $x$  of self-consciousness so that we have ( $x, x', x'',$  etc.) ( $a, b, c,$  etc.) and are able to recognize some of the factors of the subjective ( $x$ ) series objectively and  $x''$  may, for example, equal  $c$  on occasion, *i. e.*, the same sensory element may at one time form a part of the subjective constant and at another become an objective variable. At any rate the entire body furnishes us 'self-material' which can only be separated from the self-consciousness by a process of mental analysis, while in actual experience it is a real element in itself.

It has been suggested by M. Rabier<sup>1</sup> that "it were to little purpose if, the brain having been indefinitely enlarged, we could move about in it as in a mill; or having become transparent like glass, our sight might traverse it from part to part. We would see there no more psychological phenomena than we see in a mill or in a sphere of crystal," and this is true for the simple reason that it is the 'sight traversing it from part to part' and the 'moving about' and the 'seeing' that would be, by definition, psychological. If we could imagine the mill as a whole having a center of gravity in which all of its complex strains were referred and which persisted, ever changing but never destroyed, or could think of the crystal as having an optical center in which its various optical axes and bisectrices focused, and could imagine these centers of equilibrated forces being self-conscious, then the illustration might have some relevancy.

When the spiritualist insists that the psychological is something *sui generis* and distinct from the physical, we agree, if

<sup>1</sup> *Leçons de Philosophie*, T. I., p. 29.

only he will go far enough and recognize why this diversity exists and how complete and hopeless a separation it really is. But this he fails to do. He proceeds at once to set these two ways of looking at activity as two commensurable and coexisting realities in the world and gives to the psychical (which differs from the physical *because* it is *subjective* and, so far as our powers of discrimination go, only for this reason) a separate *objective* existence. This is one of the most singular, most persistent, and most hopeless of logical absurdities in current metaphysics.

When I, as a psychologist, examine my neighbor, I actually do attempt to enter his brain very much as Rabier describes. I find focussing there various activities. I find there a prodigious mechanism for bringing diverse stimuli together in one continuum in the cortex. So far from a device for projecting stimuli upon one point, as imagined by Descartes and most speculative philosophers, the stimuli suffer a sort of dispersion in their path toward the field of consciousness. I discover that this mechanism is in a terrific state of activity. Currents of blood and lymph supplying highly complicated currents of energy are passing through the mechanism continually and doubtless the energy actually operating in the brain, if convertible into gross forms of work, would lift many tons literally miles high daily, for we deal here with what the physicist would call intra-molecular types of forces as well as molecular and molar forces. Now all this vast activity reveals itself to us in scarcely any commensurate return. Just as the spectator looking at the solar system would see little evidence of the energy expressed in the equilibrated system of planets, every molecule of which is brim-full of activity in balanced condition, so looking at the brain as a mechanism for mental work, we find it set on a hair trigger, and a breath on an eye-lash is adequate stimulus to liberate vast stores of readjusting energy.

All the various discoveries which I may make, as a neurologist viewing my neighbor's brain, and all the observations I make as a psychologist upon the reactions to stimuli connected with that organism, supplemented by the study of the deficiencies and aberrations resulting from extirpation or accidental

removal of more or less of the mechanism, go simply to show that, beyond question, his physiological activities closely resemble my own and I am driven to conclude that he has feelings like mine. This inference is substantiated as fully as any mere inference can be and is the foundation on which the adjustment of all social activities is made.

A music director expends enormous sums to import from Europe a man who is able to cause thirty or forty other men to move horse-hair bows and metallic reeds and columns of air in certain prearranged fashions, and invites thousands of other people to pay large sums to attend the resulting commotion of air, because he feels sure that by such antics as these the spiritual ideas of the profoundest masters of human emotions may be reproduced in the souls of the thousands of listening individuals. And, making certain necessary allowances, and within narrow limits, he is correct. If there is anything that can be said to be known, it is this: when a cortical complex in the brain of one man is caused to react in a certain way, the consciousness of that individual will be affected in a way closely similar to that in which a similiar cortical disturbance in another man will react. To say that the brain does not affect the mind is to talk nonsense, and no one really believes such a statement, *or else it is to talk the most recondite metaphysics* and the statement stands badly in need of interpretation.

Yet we still admit, nay assert, that the psychical, as psychical is *sui generis*, entirely other from and non-commensurable with any physical process. Let us take some crude illustrations:

Here is a thing . . . yonder is the picture of it.

Here is a man at work . . . yonder is the time book.

Here is a rifle ball moving . . . yonder is its locus formula.

Here is an act of perception . . . yonder is a representation formed by it.

Let us attempt to apply the idea. A sensation is produced, then another and another. These leave behind them altered conditions of equilibrium. It is not so much that in two cells or complexes a vestige, in terms of structural alteration, has been left, but it is better expressed that among the streams of interblending forces in this equilibrium, one stream or line of communi-

cation has been reinforced. After a frequent repetition of this upsetting of the equilibrium there results a permanent distortion in the form, so that, in the long run, as a result of experience, education, etc., no single stimulus can gain admission to the sensorium without reawakening and bringing with it a perfect rain of associated activities, or perhaps better, the curve representing the trajectory of the new intruder to consciousness is one made up of the contribution from without and the vastly greater contribution from within.

Thus our field of knowledge of the external world gains in complexity and there is presented to consciousness with every color, sound, or feeling, a panorama already interpreted and elaborated in which the new presentation is placed with relations of all kinds to the complex.

This fabric of the imagination is the external world. The new presentation may be a line in the spectrum with a certain position and color. The observer proceeds to imagine a new element in the sun with certain physical properties and, later on, it may be, he identifies the same element on the earth. The educated imagination has thus vindicated itself.

Now which is the reality in my subjective furnishing? But stay, we are not yet ready for this question. It is conceivable that one might by sufficiently delicate processes of investigation detect the vestigial 'structural' or dynamic changes in the brain or in the force complex which it represents, resulting from experience, and thus make these objective to me in the case of my neighbor and by transferring the results to self, as one would be abundantly justified in doing, conceive of identical residual furnishing in his own mental home. But even so, this is something different from the experiencing of these changes or of thinking things in terms of the phenomenal world.

Then the doing or the thinking is the thing, and the phantasmagoria called the external world is relative or unreal? *No*, not at all. To attempt to discriminate the thinking from the thought, the doing from what is done is folly. This hair absolutely refuses to be split. The reality consists in thinking a thing — of affirmation of attribute — of union of subject and object.

We as souls are indissolubly connected with the rest of the universe and there is no use attempting to sever what God has united. Finally, therefore, we perhaps see that the psychical differs from the physical as the result of a logical analysis which is possible by reason of our limitation. So long as individuality shuts us up to one point in consciousness, and so long as consciousness seems to require equilibrated energy as a condition of its unity, so long this distinction of subjective (psychical) from objective (physical) will remain in force and will be to us the most vital of all distinctions.

This is, you may say, a point of view simply. To this we answer, in one sense, yes; but, from the standpoint of pure philosophy, it is the discrimination of attribute from essence. So far as I am concerned, this distinction is vital, but in my consideration of other men it has no significance at all. But surely other men have consciousness. Yes, and they doubtless discriminate subjective from objective (their essence from attribute), but men cannot be at the same time subjective and objective, and that they are *other* men makes them objective to me.

What then of the souls of other men? We escape from psychology when we ask this question for, by the prevailing definition, other men can have no souls. It is a curious absurdity growing out of the restrictive attitude of modern sciences whose hedges have grown so high that the workers can see only their own little plot of ground, forgetting that the same free air of heaven blows over all — it is a curious absurdity we say, growing out of the restriction of psyche to consciousness that there can be a psychology only of my individual experience and such a thing as a general science of psychology is impossible. The result is that what is now called psychology is a composite of neural physiology and non-related tags and scraps from individual consciousness.

Relying on the belief in the underlying unity of energy, we may attempt to explore a region where, apparently, angels have feared to tread and offer suggestions toward a *psycho-mechanic*.

## II.

Our work so far has accomplished one result (let us hope) which should lighten the task of construing the conscious life

in connection with what is termed ordinary physical manifestations; it has, namely, shown that the physical and the psychical inhere in one reality, an activity. If the energist be correct in viewing the phenomena of the physical universe as manifestations of various phases of one universal, indestructible but convertible energy, and if psychology be correct in asserting that all mental states are acts, and, furthermore, if we are not so blinded by prejudice as to shut our eyes to the overwhelming evidence of the interaction of these two sorts of activities (a fact more certain than any other whatever) then we are driven to conclude that body and mind are phases of one reality — that consciousness is not unrelated to gravitation, but is a part of the same universe of activity.

This as an abstract statement would give rise to few difficulties, but when it comes to the fact of our personal consciousness, *this* event seems unlike any other which we picture to ourselves as taking place in the world at large. It comes home to me as something intimate and self-acting — as myself, an activity *sui generis*. This contrasted condition of out-there-ness, which we feel in connection with an objectivized experience, as against the I-here-ness of subjectivity, is a necessary result of individuality.

But we believe that every other individual has this same kind of consciousness and yet his 'I-here-ness' becomes 'out-there-ness' to me. This distinction is, therefore, in this sense, a point of view, not a difference in form of activity.

Here arises a difficulty. A view-point presupposes a viewing subject. How are we to form any concept of such a subject? Is it not simplest to follow illustrious example and say frankly that this subject is a soul, of which we know nothing except that we are *it*? But, inasmuch as it is possible or necessary for us to abstract from *it* any quality of which we can form an objective concept, the soul represents simply the residuum after such objectivization, an empty capacity for being — something back of all that we ever did or experienced, our own sufficient reason.

To this result we are not, as dynamic monists, exactly driven, though we agree with the conventional conclusion that

I am a soul. We differ in being unwilling to discard all the realities of existence in defining the soul. If we were obliged to use the postulate of matter our quest would end here for it has appeared evident to all philosophic minds from the earliest times that the soul cannot be material.

For our present point of view this difficulty is removed and only one prepossession or preliminary concept is necessary, viz., that the mechanism of consciousness is dynamic. Only on this presumption can psychical phenomena be linked to the world of experience. Another attribute of the soul is at once recognized — it is an indivisible continuum and is simple. We need not take into account subconscious 'psychical' activities. Non-psychical psychical activities may have a meaning to a certain kind of mind, but it is difficult to see what inducement could be offered such a mind to study psychology.

Consciousness is unitary yet it is wonderfully complex. It is conceivable that the whole magnificent panorama of nature might be reflected upon it if our sensory apparatus were complete enough and yet the resultant at any given time would be a unit of consciousness. This is not a fact of introspection merely. Its philosophical necessity is bound up in the concept of individuality.

One may picture to himself a mechanism of cortical cells at the end of a series of 'projection systems' as complex as possible, and imagine every cortical cell in ceaseless activity. These subconscious phenomena might be as complex as possible but consciousness is always *one*. On the material hypothesis the one-ness of consciousness led anatomists and physiologists to postulate some center — some pineal gland — where all the various activities should impinge on some one element. As a matter of fact, this concept serves but to increase the difficulties. What is the use of all the complicated mechanism if all the changes have to be transmitted to one cell or cell-group? Either that cell group is marvelously complex and mirrors the complexities of the brain at large, or else there is some unity, not material, which can receive all these various influences and convert them into a unitary state of consciousness. Why one organ should be necessary in order to bring



the complexity to bear on the simple nature of the immaterial soul, no one can say.

On the dynamic view, however, we readily see that one condition alone corresponds to the requirements of the given phenomena and that is a condition of equilibrium. Diverse processes experience a unification only if brought into equilibrium.<sup>1</sup> Such a condition we have postulated.

Before attempting to apply this idea let us examine other dynamic elements in the hope of securing illustrations in a less complex sphere. In a uniform medium, as has abundantly been shown, the only condition of individuality is that of vector activity. Vortex rings serve as illustrations. The discussion of vortex atoms has brought out this peculiarity. Two forms of activity appeal to our senses, first, progressive or translational or molar, second, self-centered or vector activities. In the first case the point is conceived as moving in a right line or some other progressive manner so that the motion is indeterminate, in the second case the motion is cyclical and the center of reference is stable. In ordinary parlance, when a body falls, the motion is of the first sort but when brought to rest the motion is transformed into the second state. The body is in a state of rest and with reference to adjacent bodies is in equilibrium.

Vector motions have a remarkable stabilizing power, as witness, for example, the gyroscope. The two classes of motion have been called molar and molecular respectively but this perhaps involves too large a hypothetical step. The crude illustrations used may serve to show at least that the same force may have a conservative power in one phase and a dispersive power in another. But let one take the still simpler illustration of a solenoid. A current of electricity passing through a straight wire produces, it is true, an induction effect on the neighboring metals but when the same current is forced to pass through a spiral path the complex acquires an individuality — it is polarized as a whole and acts as a magnet. Similar solenoids react against it and a system could be formed from innumerable solenoids in equilibrium which would vary with the currents sent through the several elements, while the entire

<sup>1</sup> Baldwin's *Dictionary of Philosophy*, art. 'Brain,' Functions, I., p. 135.

system would be in equilibrium at all times. While it is not suggested that the brain cells are solenoids or anything of so crude a nature as that, yet it is believed that the afferent currents passing into the cortex produce in more or fewer of the brain cells a system of intrinsic activities which react, each with each, in the total cortical equilibrium which for each instant is the dynamic aspect of a state of consciousness — an act of mind. The whole involved activity, now more, now less, at any given moment, is equilibrated and forms a self-centered process of unitary nature. The structural mechanism of the brain is an uninterrupted flux of activity of a vital character. Vital activities are all analogous, rotational or vector, we might say (for illustration solely), as contrasted to translational or indeterminate or progressive activities. To be more general, what we call structure is evidence of statically condensed energy (energy in vector states) and this is competent to enter into reaction with afferent impulses and convert them into vector activities. The sum of the equilibrated activities in the body forms its vital continuum. One phase of the equilibrated continuum is the activity of consciousness. So far as we know, the conscious continuum is associated with the total vital complex. It is not proven that any other form of equilibrated vector forces is capable of assimilating the afferent stimuli and converting them into similar terms and so converting them into a conscious activity, though it may be said that we know of nothing to the contrary.

To return to our problem, what then is the highest reality in my being? *To me* it is doubtless the 'stream of consciousness' which constitutes myself as known to myself. But even here common experience, as well as our most searching analysis, shows that only a small part of this stream is resolvable into elements of consciousness which are capable of being recognized as such in present experience.

The great mass of dream experience, for example, fails to affect a nexus with the memory complex at all, and what we forget of each day's experience is vastly more than what we remember. But all is not lost that has disappeared. The wood has disappeared in the grate, but the genial warmth per-

vades the room, invades our blood, quickens our pulse, awakens vital action, and finally is wrought into the history of our lives. So each element of experience is wrought into the sum of our life.

The precise nature of my conscious reaction upon today's experience depends not on what I can formally recollect of past experience, but on the form of equilibrated unity which is the result of past experience in its progressive reaction upon my nature.

If we follow the prevailing custom and accept current definitions, the soul is identical with the stream of consciousness, *i. e.*, is the sum of conscious activities. We shall not quarrel with this definition. Psychology is the science of consciousness. The psyche is the object of this science—it is *thought or consciousness*. Very well; gastrology is, let us say, the science of stomachs and the object of this science is the organ or act of digestion. The suggestion is obvious. Because we, in our thinking, can analyze human activities into various departments and think of them separately it does not follow that the realities back of these departments are separate or independent.

Because thinking is a very important part of human activity and can be made the subject of special inquiry it does not follow that there is a thinking agent which does nothing but think. Do we come perilously near the idea of a brain that secretes thought as a liver secretes bile? I think not, but our peril is lest we should allow prejudice to steer us away from the narrow course marked out on the chart of truth.

The sanest thinkers have always included in the idea of a soul a great deal more than thought or even a thinking thing. Our strict modern scientific analysis sees the necessity for drawing the boundaries between the adjacent territories of thought very closely, but very frequently forgets that in nature there are no such boundaries.

The soul is a metaphysical concept the moment it becomes more than the totality of the stream of consciousness. Lotze said: 'Sensations, feelings, and acts of will constitute the group of familiar facts which we are accustomed to designate, though with a reservation in view of future discoveries, as the life of

*the soul.*' Here was a careful and very conservative statement from one who was as fully aware as any recent psychologist of the intricacy of the interrelations between psychology and metaphysics. But the definition is a metaphysical one. 'A peculiar being, *the soul,*' the life of which consisted in the manifestations which are the facts of psychology — such was the conception. But does this peculiar being do nothing else? True, whatever else it may do may not be subject matter for psychology, but we are walking with seven-leagued boots and care nothing for fences.

If our work so far has been valid, we cannot fail to feel that forcible isolation of parts which belong together is not logical bad faith alone but subversive to reality. 'Standing in relation' is an essential thing in reality. But we cannot hope to form a science out of materials which are isolated from all others by their nature. If the direct and disconnected testimony of our subjectivity is to be the basis of our psychology we must at once give up the undertaking. In other words the content of sense must be objectivized before a science is possible. This content, after being construed in apperceptive relations, is our material. The acts of thought, *as such,* are not available material for science, but only what we think of them, the predicaments of our thinking, or the affirmation of attribute applied to these elements.

This seems a curious and contradictory result. After laboriously reaching the apparent conclusion that the act of thinking is the psychological verity, to deny that these acts can be used, *as such,* in our science. But it is, when we rightly consider the matter, only what we might have expected, for all science is objective and is organized knowledge. We must be content to view all psychological processes from the outside. The moment we attempt to compare two processes or acts of consciousness, they become objective. In this sense the subjective is always epiphenomenal to science, which must rest content with her equilibriums and her algebraic expressions therefor. If any dynamic view be accepted and admitting the best known fact of all, *i. e.,* the effect of mind on body and body on mind, we recognize that the unity of soul and body is an organic one. This is LIFE. Lotze spoke of the life of the soul. Plain, every

day common sense recognizes life as including every phase of activity from core to periphery in human activity and we should beware of *laches* of common sense.

'Life' shares with 'soul' the rôle of mystery in science. We saw that in the construction of equilibrium rendered necessary by the unity of consciousness it was necessary to make the psychical equilibrium part and parcel of a more general vital equilibrium. A center of vector energy in a world of energy cannot fail to wrap itself up in parts of the extraneous energy, for this is of the very nature of resistance, just as a revolving wheel attaches to itself more or less of the mud through which it passes, causing currents therein and counter revolutions whereby balls of revolving mud fly in all directions as parts of a system of which the hub is the center. One moves a lever upon a friction clutch and tooth engages wheel and band moves upon pulley, till the whirl of a thousand wheels follows. Could we think of the friction pulley as gradually creating the machinery of the mill out of existing energy in resisting phases, as the wheel created the mud cycles, we would have a rough image of the vital organism.

But do you mean that my foot is part of my soul? Yes, I mean that the vital activities in my foot form part of my vital equilibrium and, in so far as these contain conscious participants in the stream of consciousness, they form part of the soul. But if I amputate a foot do I mutilate a soul? Certainly, though it may be better to enter into life maimed than to retain a foot and go elsewhere. By cutting off a finger a child's soul may be maimed of musical faculty. There are organs, the amputation of which affects the entire character for life, and one does not willingly dispense with the frontal lobes even if he does not know precisely what purpose they serve.

On the other hand, it is possible to add to the sphere of the vital activities, as when I place spectacles upon my nose or apply my hand to the throttle of a locomotive. Where then is the limit of self? It is not for me to draw it. I will not cut the narrow isthmus of flesh which connects me with my twin — the universe. The ancients believed that the eye shot out rays to grasp the objects of the visual world. What tentacula has not

modern science produced extending from all our organs to the phenomenal world?

But if we may not define the outer limits of the individual life, do we not destroy individuality? Only seemingly, for we need not despair of locating its center because the periphery of its sphere of activity is indeterminate. The leaven of life may be small, but, given time and appropriate conditions, it will leaven the whole lump.

Our analogy of the vector motions carried out would lead to the conclusion that wherever such a center originated it would tend to assimilate to itself all such activities as are capable of offering resistance to it and would, by virtue of the form or mode of its activity, cause allied activities to accumulate in harmonious adjustment about it, enlarging, and, at the same time, intensifying the energy in the original equilibrium.

Disturbances of this equilibrium there will be, but it will be one of the hardest things to exterminate we can imagine, for it is entrenched in one of the most recondite energetic conditions of the universe. Seed may be dried for years in the tombs but it will still germinate. No persecution ever succeeded in stamping out a vital truth. It is not to be wondered that humanity has enduring faith in a life eternal, but this is not the life of the soul, if by the soul we mean the 'stream of consciousness.' In so far as our life, as a whole, fits into the complicated sphere of the universal life it will be imperishable. Maimed and crippled, it may be, we crawl over the threshold of one world into the fresh glory of another, but if the life be really there, it will have no difficulty in assimilating to itself a body fit for its use, as the acorn finds its own body in the crevices of the rock and builds it forth in strict accordance with the pattern set in the peculiarities of its own vital equilibrium.

We need not look for pangens, biophores, gemmules, micellæ and the like in our study of heredity, or if we find them, we shall regard them as visible manifestations in some temporary form of types of equilibrated energy, vortices of specialized activity, specific in its form. The newt will grow a new leg. It is possible that the leg might grow a new newt if we were able to keep the conditions favorable, just as a branch may

grow a new tree. There is nothing so violently incongruous as might appear in the childish planting of nail parings in the hope of raising a crop of men.

Our point is that the type of equilibrium is impressed on the part as the energy of the part is reflected upon the whole. Germinative elements, or seeds, are special adaptations to this end but every vital part may share to some extent in this property.<sup>1</sup>

### III.

*Historical Notes.* — It is not worth while to attempt a resume of the history of opinion as to the nature of the soul and it will serve our purpose to review very briefly the more recent utterances in this matter. Among these recent utterances are those which from anthropological data undertake to voice the earliest ideas of dualism between soul and body, ascribing this conception first to the phenomena of dreams and memory (Spencer) and, second, to the sense of voluntary originative or initiative power within ourselves (Schurman, etc.).

The polyanimism of primitive peoples was not so very dif-

<sup>1</sup> On the day following the writing of this paragraph the following memorandum, published by Professor W. E. Ritter in the *American Naturalist* under date of November, 1903, reached the writer: "At the May meeting, this year, of the Philadelphia Academy of Science Miss Sarah P. Monks read a note on 'The Regeneration of the Body of a Starfish' . . . I quote from this report; 'In studying regeneration on *Phatria (Linckia) fascialis* she had cut arms at different distances from the disc, and a number of the single rays produced new bodies. The free ray produced a new body and the rest of the starfish produced a new ray . . ." Miss Monks is to be congratulated on having at last produced the experimental evidence demanded by the skepticism of recent writers on the soundness of Haeckel's conclusion reached long ago that 'jeder abgelöster Arm reproducirt die ganzen Scheibe nebst den übrigen Armen,' *Zeitschr. wiss. Zool.*, Bd. 30.

In a paper on 'Physiological Corollaries of the Equilibrium Theory of Nervous Action and Control' published in the *Journal of Comparative Neurology*, Vol. VIII., No. 1, 1898, many of the ideas expressed in this paper were hinted at, *e. g.*, pp. 26-27: "From the above it may be gathered that the ground of mutual reaction (between protoplasmic and nervous forces) may be sought in the fundamental similarity of the two processes, or rather in the close relation between the processes of waste and repair lying at the foundation of both. It is necessary to suppose, accordingly, that the central nervous system is continuously affected by the vital phenomena at large as truly as that the vascular system is under the control of the nervous system." Other passages of like tenor will indicate the bearing of the present theory for the neurologist.

ferent, in result, from the highly philosophical concept of a soul in all things; in the inanimate world as a principle or ground of phenomena, in form or attribute; while, in the animate objects it became the principle of life, of sensibility, and of motion.

It is perhaps correct to say that we have never risen higher than some early expressions of this idea and have often sunk immeasurably below it. With the early church fathers, Tertullian, St. Iræneus, and St. Justin, the soul was a thinner kind of body. Plato and St. Augustine, to be sure, recognized the soul as immaterial, but were led to a dualism which set up a conflict between body and soul as unfortunate as it was immoral.

To Descartes we owe the limitation of the soul to immaterial, invisible thought, reducing its content to thought alone and assigning its activity solely to the intellectual world of ideas. This distinction, once made, has taken firm hold on psychology to this day, although the phenomena of sensibility have been restored to the soul.

There has been a tendency of late to renew the concept that the soul includes the functions of animal life and even the physiological functions of the human body. This is animism as opposed to vitalism and the view presented here must not be confused with an animism which does not recognize the distinction between consciousness and all other phenomena, nor yet with a vitalism which manufactures a vital principle distinct from but somehow coördinated with the soul. Dynamic monism recognizes both manifestations in a synthesis of equilibrated energy which is capable of expressing itself in vital attractions and repulsions as well as in apperceptive coördinations.

A conservative position taken by perhaps a majority of recent writers of psychologies is well expressed by Compayre, as follows: "The great number of contradictory conceptions of the soul, considered by some as the principle of thought alone, by others as a principle that feels, thinks and wills, and by still others as the sole cause of life and thought, suffice to show how very necessary it is to postpone, if not entirely to waive, the obscure and controverted question of the nature of the soul."

That the statement of the limitation of the sphere of psy-



chology by recent writers to the stream of consciousness is not misleading may be gathered from such a passage as the following from Titchener's *Outline of Psychology*: "The psychologist can accept this definition (of psychology as the science of mind) . . . if 'mind' is understood to mean simply the sum total of mental processes experienced by the individual in his lifetime." "The question: Is there anything behind the mental process, any permanent mind? and, if there is, what is its nature?—is a question which is well worth while to answer but it is not a question that can be raised by psychology. Psychology sees in mind nothing more than the whole sum of mental processes experienced in a single lifetime."

How artificial this distinction is cannot fail to be apparent. It is like erecting a science of shadows in which it is forbidden to refer any shadow to the object that cast it. Yet there is a science of shadows and this science, if correctly builded, will be found to correspond, part for part, variation for variation, with the objects casting the shadows. But there is a real fallacy here. It seems to be assumed, by Titchener, and probably by the rest of us when trying to talk this language, that since consciousness is something *sui generis* by reason of its subjectivity, we must not disturb that attribute nor admit into our psychology any other element. But this shadow refuses to be caught. As subjective, we can't create the facts of experience into a science. The data of science are necessarily objective. A science of pure consciousness is forever impossible. Somebody else's consciousness is not subjective and we cannot use our own data of consciousness in science till they are objectivized. More specifically, neither in the case of another or of myself, when I begin to follow the natural course of mental synthesis, do I revive the actual states of consciousness, nor do the elements of the synthesis I conceive of actually exist in consciousness. My best efforts produce only an algebra of consciousness purely objective.

The monist contends, says C. Lloyd Morgan, "that, alike on its biological and in its physiological aspect, the organism is a product of evolution; that mind is not extranatural nor supernatural, but one of the aspects of natural existence." "What

is practically given is the man; and the man is one and indivisible, though he may be polarized in analysis into a bodily aspect and a conscious aspect." "Body and mind are distinguishable but not separable."

Opposed to this view of monism are two extremes—materialism on the one hand, according to which the body is the real substance and the mind one of its properties, and spiritualism, on the other, which states with Charles Kingsley that 'your soul makes your body as a snail makes its shell.' Dynamic monism reconciles these extremes by showing that body and mind are expressions of one life.

Compare the above with such statements as the following: "What mind is in itself is a question that lies outside of psychology and belongs to philosophy. . . . It may, however, be said that some idea of mind as a unity, which holds together and combines the several states of what we call psychical phenomena, is a necessary assumption or presumption in psychology." "We must always think of mind as attended by, and in some inexplicable way, related to, the living organism, and more particularly, the nervous system and its actions." . . . "The perception of difference at all is something distinctly mental, not to be explained, therefore, by any reference to nervous changes. No sound psychology is possible which does not keep in view this fundamental disparity of the physical and psychical. . . ." (*Sully.*)

Consciousness is "the common and necessary form of all mental states . . . it is the point of division between mind and not-mind." (*Baldwin.*)

"For all psychological purposes this (the relation between mind and body) must be regarded as a relation of interaction. . . . Now when we come to the direct connection between a nervous process and a correlated conscious process, we find a complete solution of continuity. The two processes have no common factor. Their connection lies entirely outside our total knowledge of physical nature on one hand and of conscious processes on the other. . . . No reason in the world can be assigned why the change produced in the gray pulpy substance of the cortex by light of a certain wave-length should be

accompanied by the sensation *red*. . . . It is equally unintelligible that a state (sic) of volition should be followed by a change in the substance of the cortex and so immediately by the contraction of a muscle." (*Stout*.)

Such confusion of ideas as the above ramifies the whole of modern psychological literature and produces a feeling of hopelessness. When conscious processes are set over against physical processes and the two are stated to be incommensurable and incapable of reaction in the next breath after a statement that 'for all psychological purposes the relation of mind and body must be regarded as one of interaction' it seems hopeless to expect clear analysis in any department of psychology.

This is much as though one would say "The concept of greenness, which I at present have, is not capable of being refracted by a prism and therefore is an entirely different process from a wave of red light." Or "The degree of curvature of an ellipse is not a commensurable process with the velocity of the planet describing that orbit."

If dynamic monism is correct, the acting in a certain way is a condition of thought, just as acting in another way is a condition of muscular contraction. The series of acts is continuous and what we can deduce by abstract thinking as to the peculiarities or properties of these several forms of activities is not to be placed in the same genetic chain as the things we think about them. We are (that is our life is made up of) the sum of what we do. It is possible to think the experiences of doing apart from the doing of them because the doing of each act, a simple perception for example, leaves the equilibrium complex permanently altered — produces back eddies beside the 'wave of consciousness.' These changes express themselves in 'psychological or interpretative' rather than 'psychic' or realizable terms and we should not attempt to interpolate from the formal into the real series nor *vice versa*. See Baldwin's discussion of genetic modes in his *Development and Evolution*, Chap. XIX. The two things are not things in the same sense and it should not surprise us that they do not fit in a causal nexus nor should we seek such nexus. It is absurd as it would be if in a machine we should attempt in one place to fit a shadow instead of the cog required. Yet a shadow is a real thing.

Professor Stout's regret that 'no reason in the world can be given' for redness in consciousness may be tempered by the fact that no reason in the world can be given for any physical ultimate or simple fact. It is curious metaphysics that expects it. An occurrence is its own reason and there can be no other. Science finds uniformities which it classifies but it finds no 'reason' for its 'laws.'

Nevertheless Stout very nearly reaches the point of view required, for in criticising materialism, he says: "Whatever plausability it (materialism) possesses arises from the use, or rather misuse of the word *function*. Digestion is the function of the alimentary canal. . . . The objection is that we do not make the two things the same by applying the same word to them, when in their own nature they are radically and essentially different. When we say that digestion is a function of the stomach we mean that digestion is the stomach engaged in digestion . . . but if we describe the brain at work there is no need to mention consciousness at all, and in naming and describing the conscious processes there is no need to mention the brain. The function of the brain as a physiological organ is to move the body; the contraction of muscles is the result of neural impulses and in describing it we have to mention the nervous system, including the cortex as engaged in it. But the processes of consciousness cannot be analyzed or resolved into such processes as chemical and physical changes in nerve cells. If consciousness be supposed to be produced by the nervous processes, the production is simply a creation out of nothing."

It were easy to reply that all this is pure assumption. We do not know (as it is agreed by a certain class of unscientific psychologists to claim) that all the energy entering the brain as afferent currents leaves it in efferent nervous energy; in fact, we know that this is certainly not true. We do not find physiological functions for all parts of the organs and have no right to assert that nervous energy is not used in performing all sorts of recondite processes which somehow serve as a basis for psychical phenomena. But we need not disturb ourselves about this matter, it is beside the point.

The fallacy begins in talking of conscious processes as con-

trusted to other processes and then using consciousness as an abstraction aside from the activity and discovering that it is then not of one class with the other activities. Our author says that it is the function of the brain to move the body. Very well; we move our arms in a complicated set of 'wig-wag' signals which the mind of the observer construes into a message of certain import. Is this result of the movements of the body for this reason physiological? In the brain certain other movements (of energy) are construed in apperceptive terms and resulting relations constitute the objective content of psychology (we have already seen that the pure experiences, as such, can form no part of science) and we call this resulting system, psychological. If the body caused the wig-wagging and its informing symbolism then, in exactly like manner, if not so openly and rudely, the body caused the thought. Both are manifestations of energy from which it is possible to abstract certain modes, etc.

We claim that mind or consciousness cannot react on the body because the two are incommensurable. (Here again the difference between experience which is psychic, and the activities concerned are objectively considered.) The living energy back of both is continuous through both, but the appearance in present experience called consciousness and the data of bodily action also converted into terms of experience in the mind form a series of commensurables because like in kind.

The doctrine of psychophysical parallelism, so commonly held to-day, might doubtless be expressed to conform to the dynamic hypothesis, but, in fact, it is not usually so understood. Stout says truly: "The reason of the connection between conscious processes and the correlated nervous processes is not to be found in the nervous and conscious processes themselves. Both must be regarded as belonging to a more comprehensive system of conditions and it is within the system as a whole that the reason of their connection is to be sought. . . . We must further assume that the material system in its totality is related to the material world in its totality as the individual consciousness is related to nervous processes taking place in the cortex of the brain. . . . The explanation of psychophysical parallelism is ultimately based on an idealistic view of material phenomena.

. . . In general all that makes matter material presupposes some consciousness which takes cognizance of it." "The world of material phenomena presupposes a system of immaterial agency. In this immaterial system the individual consciousness originates." (*Manual of Psychology.*)

Hoeffding's criticism of Lotze is quite to the point here and we may quote the former author in support of the dynamic view: "We have no right to take mind and body for two things or substances in reciprocal interaction. We are, on the contrary, impelled to conceive the *material interaction* between the elements composing the brain and nervous system *as an outer form of the inner ideal unity of consciousness*. What we, in our inner experience become conscious of as thought, feeling, and resolution, is thus represented in the material world by certain material processes in the brain, which as such are subjected to the law of the persistence of energy, although this law cannot be applied to the relation between cerebral and conscious processes. It is as though the same thing were said in two languages." (*Outlines of Psychology*, p. 65.)

#### SUPPLEMENTARY NOTE.

Of the strong swing of the pendulum in the direction indicated in these papers during the last few years evidence is furnished by the genetic series recently issued by Professor J. Mark Baldwin and the writings of the so-called Chicago school. See also the recent writings of Royce and James.

Moore says: "'Life'-experience is one inclusive activity of which consciousness and habit—the psychical and the physical—are to the analysis, constituent functions." This is interestingly akin the statement we made above.

Professor Bawden, has, however, made this view more explicit than any recent writer. See his article, 'The Functional Theory of Parallelism,' *Philos. Review*, Vol. XII., 3. "Mind is not an entity behind the process of consciousness in an organism, it is that process itself. Mind is just as truly a growth as any other living thing." (*Loc. cit.*, p. 308.) This view finds its physiological expression in the equilibrium theory of consciousness. (See Baldwin's *Dict. Philos. and Psych.*, Vol. I., p. 135.)

# THE PSYCHOLOGICAL REVIEW.

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STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF CHICAGO.

COMMUNICATED BY PROFESSOR JAMES ROWLAND ANGELL.

THE RÔLE OF THE TYMPANIC MECHANISM IN AUDITION.<sup>1</sup>

BY W. V. D. BINGHAM.

This paper reports a case of a person who enjoys good hearing in spite of the destruction of the 'sound-conducting' mechanism of both ears. When she first came under our observation, in the summer of 1906, her auditory acuity was such that a group of acquaintances who had been her constant associates for several weeks had not suspected any auditory impairment; and at the present time, although the condition of her hearing is not as good as it was then, it is still acute enough to enable her to carry efficiently forward her work as a teacher.

The statement that efficient hearing is still possible after both drum membranes have been destroyed and the larger ossicles removed comes as a surprise to those whose attention has not been previously directed to the pathology of the ear. It means that the account which Helmholtz gave of the mechanism of sound-conduction is untenable, at least as regards his theory of the sound-intensifying function of the tympanic membrane. Dissatisfaction with this theory has been rife in otological circles for some years, owing to its inadequacy when confronted by the facts of aural pathology. Beckmann<sup>2</sup> in

<sup>1</sup> The MS. of this article was received April 8, 1907.

<sup>2</sup> 'Zur Theorie des Hörens,' *Verhandl. der deutsche otol. Ges.*, 1898. See Treitel, 'Recent Theories of Sound-conduction,' *Archives of Otology*, 1903, p. 385. Treitel gives an admirable summary of the literature up to 1902, and concludes that the problem of the middle ear has not yet been solved.

1898 went the length of maintaining that the tympanic apparatus is not a sound-conducting device, but is merely a damping mechanism. Zimmermann<sup>1</sup> also substitutes a damping for a transmitting function, but holds, contrary to Beckmann, that the damping operates only with sounds of unusual intensity. He assumes that the sound waves are transmitted by air conduction across the tympanic cavity to the promontory wall, and thence through bone to the basilar membrane fibers. It is the function of the round window to make possible the most subtle reaction of these fibers. The ossicles and the stapedius muscle serve to regulate the intra-labyrinthine pressure. Secchi<sup>2</sup> finds in the round window the sole pathway for sound through the tympanum to the labyrinth. The tympanic membrane and ossicles together with the intrinsic muscles protect the inner organs against detonations and also serve to regulate the intratympanic pressure during attentive hearing. Of the defenders of modified forms of the Helmholtz theory, Bezold and Lucae are the most able and active. They are agreed that for high tones conduction through the larger ossicles is of little importance. Lucae<sup>3</sup> insists that the round window as well as the plate of the stapes is capable of receiving sound-waves. Both movements could exist together, a compensatory opening for minimal pressures produced by the inward movement of the stapes being found in the aquæductus vestibulæ, and for the fenestral membrane in the aquæductus cochleæ. Bezold<sup>4</sup> does not hold to the Helmholtz account of the sound-intensifying action of the drum membrane, but he contends vigorously for the theory of conduction through the ossicular chain. When the skull is set in vibration by direct contact with a sounding fork, the labyrinth as well as the chain is actuated, yet only those waves are effective which, on their way to the labyrinth have actuated the chain to transverse vibration. The function

<sup>1</sup> In addition to the articles summarized by Treitel, cf. 'Der physiologische Werth der Labyrinthfenster,' 1904, *Arch. f. Physiol.*, Suppl. Bd., S. 193. Also S. 409 and S. 488.

<sup>2</sup> *Arch. f. Ohrenheilk.*, LV., Heft. 3-4. Cf. Treitel, *l. c.*

<sup>3</sup> *Arch. f. Physiol.*, 1904, Suppl. Bd., S. 490.

<sup>4</sup> "Weitere Untersuchungen über 'Knochenleitung' und Schalleitungsapparat im Ohr.," *Zeits. f. Ohrenheilk.*, XLVIII., 107.



of the tympanic mechanism is the conversion of longitudinal sound-waves into transverse vibrations, which alone are capable of setting into sympathetic vibration the receiving apparatus of the cochlea. Bezold is reported as saying "that there is no hearing for the lower half of the tone scale without a tympanic membrane and an ossicular chain, and that in the case of the upper part of the scale the sound-waves are transmitted to the labyrinth by vibrations of the stapedial foot-plate."<sup>2</sup> The earlier part of this conclusion is controverted by the existence of such cases of audition as the one here described.

Thirty-six years ago, when Miss Evans, as she may be named, was five years of age, a siege of scarlet fever left her with a middle-ear discharge (suppurative otitis media) which ruptured both ear drums. In the right ear this chronic discharge has never healed: and in the left, except for two brief periods of temporary cessation, it continued until the fall of 1906. During girlhood the only method of treatment which was tried, that of syringing, proved very painful and was little used. The earliest aurist's record available was furnished by Dr. Clarence J. Blake, otologist of the Harvard Medical School, who treated the case in 1888-90. His records show partial destruction of both drum membranes at that time. "Hearing was effected by direct transmission of the sound waves to the base plate of the stapes. There was no evidence of cochlear involvement." An accumulation of cicatricial adhesion hindered the free vibration of the stapes, so that hearing was considerably below normal. (Note that the decreased acuity is not explained by reference to the condition of the tympanic membrane or the 'sound-conducting' mechanism. Dr. Blake says: "In the great majority of suppurative cases the decreased mobility of the stapes either from altered position of the ossicular chain or from tissue changes within the fenestral niche is the essential thing.")

In 1898, Dr. M. D. Jones, of St. Louis, operated upon the right ear, removing the remnant of the tympanic membrane, the accumulations of cicatricial adhesions and the two larger ossicles which had become much necrosed. No operation has been performed upon the left ear, but the incus has been lost

<sup>2</sup> Hartmann, in report of German otological society in Wiesbaden, May 29 and 30, 1903. *Archives of Otology*, XXXII., 286.

and the drum membrane is almost totally destroyed. In each ear the stapes is imbedded in an accumulation of scar tissue, and in the right, poorer, ear is completely hidden from view. The Eustachian tubes are completely closed at times, preventing the draining of the mucous of the middle ear into the throat, and causing an accumulation which interferes with hearing. Miss Evans states that her hearing varies with her general nervous condition.

In August, 1906, at the time of making the first of the auditory tests here reported, the ears were discharging very slightly and were therefore probably at their best as to function. Dr. J. B. Shapleigh, of St. Louis, who has had the case under observation for the past two years, informs me that usually "improvement in the local inflammatory conditions in these cases brings better hearing, but it is not uncommon to find that when all secretion ceases and the ear becomes dry, the hearing becomes less. This is undoubtedly due to the dry tissues being more rigid and stiff than when moist since with a recurrence of slight discharge an increase in hearing is noticed." These variations in hearing doubtless have their cause in "the varying mobility of the stapes and the membrane of the round window, but especially of the former. In many cases of exhausted middle ear suppuration with large loss of the drum membrane and with absence of the incus — the conducting chain being thus broken — very fair hearing may exist, provided the stapes is freely movable and not hampered by adhesions or thickened tissue in the niche of the oval window." A considerable diminution in Miss Evans' hearing ability has taken place since she was tested in the summer of 1906. This is due, however, to a recurrence of the old inflammation of the membranes brought on by a severe cold, and is not traceable to a complete cessation of the discharge with consequent lack of the moisture which seems to be essential for maximum flexibility of the annular ring of the stapes and the membrane of the round window. No use is made of 'artificial drums' or other mechanical aids to hearing.<sup>1</sup>

<sup>1</sup>The best 'artificial drums' so called are mere pledgets of cotton, deftly adjusted to increase the pressure upon the stapes to precisely the right amount. Sometimes, when the drum membrane is lacking, a bit of vaseline placed upon the head of the stapes serves to weight it properly and considerably augment hearing.

In the laboratory Miss Evans was first tested in auditory acuity, tonal limits, pitch discrimination, localization of sound and analysis of clangs. It is regretted that, owing to the brief period which elapsed between the discovery of the case and the necessary departure of Miss Evans from the city, some of the tests had to be rather fragmentary. Six months later it was possible to make a few supplementary tests which were directed in part to determining whether the subject's general sensitivity is supernormal. Some additional data were also gathered on the hearing of difference-tones.

In this connection it ought to be remarked that cases of audition somewhat resembling this one are not of extremely rare occurrence in the records of otological clinics. The additional features which give to this case an especial value for purposes of experimental observation are to be found in the high intelligence, the more than ordinary powers of concentration, and the facility in introspection which the observer brought to her tasks.

The Rinné test was negative: that is, a sounding fork which had become so faint as to be no longer audible by air conduction could be heard again if placed against the mastoid process of the temporal bone. The Weber phenomenon was prominent; when a vibrating fork was pressed against the top of the head, the sound was localized in the right, poorer, ear, even when the fork was placed much nearer to the better ear. Such results indicate that the hearing defect is due to trouble in the mechanism of the middle ear and not in the sound-receiving apparatus of the cochlea.

In testing auditory acuity, the Seashore audiometer was used, and also the whispered-word test. The audiometer gives a simple noise of fairly constant quality and of an intensity varying from 0 to 40 units of an arbitrary scale. The normal threshold lies somewhat below the middle of this scale. Eight students with apparently normal hearing were tested at the same time with Miss Evans, and their thresholds of acuity were found to range between 15 and 25.<sup>1</sup> At the first day's trial Miss Evans'

<sup>1</sup> On the standard instrument of the C. H. Stoelting Co., an acute ear can hear intensity 13. A comparison of our instrument with this standard, after the tests

threshold was determined as 26 for the left ear and 28 for the right. Later this was reduced to 25 and 27.

Since it sometimes occurs that good hearing for conversational speech is accompanied by poor hearing for certain simple noises, and *vice versa*, the audiometer test was supplemented by the whispered-word test. For determining comparative auditory efficiency in this way, Andrews<sup>1</sup> has prepared ten lists of ten numerals each, which contain the different varieties of consonant and vowel speech elements in much the same proportion in which they are found in spoken language. The use of numerals presents the advantage of uniform apperceptive value for all observers and for all the words. This is so well recognized among aurists that whispered or spoken numerals are almost universally employed in diagnosis. The traditional method of using this test is to determine the maximum distance at which the observer can hear the numerals. Auditory acuity is expressed by a fraction of which this distance is the numerator and the normal distance is the denominator. For purposes of accurate determination, Andrews criticises this method on the ground that its validity rests on two assumptions which his experiments have led him to question; first, that intensity of the sounds of speech decreases with approximate regularity as the distance from the speaker increases; second, that the sounds used as test words undergo with change of distance merely a quantitative and not a qualitative alteration. As an improvement upon this 'method of extreme ranges,' Andrews recommends the 'method of degree of accuracy,' in which auditory acuity is determined by comparing an observer's percentage of accuracy at a given distance with the normal percentage at the same distance under identical acoustical conditions.

Andrews' lists of numerals were pronounced to Miss Evans and six control observers at the same time. They were seated with the left ear toward the speaker, Miss Evans being given

had been made, showed that the magnet of the telephone receiver had lost some of its strength, and that in consequence the click was not quite as loud as it should be. This point should be borne in mind if comparisons are made between the figures given above and readings taken with other audiometers.

<sup>1</sup> *Am. Jour. Psy.*, 1904, XV., 36.

the central position. Each was provided with paper on which the numbers were recorded as heard. If the observers had been tested separately it would have been possible to have them hear the words from identically the same place in the room; but that plan would have sacrificed something of uniformity in enunciation. Even when the usual precautions, of using the residual breath after exhalation, etc., are taken, some differences in intensity must still remain. In the method here used, these inequalities were minimized. Accidental distractions, such as outside noises, were also the same for all the observers.

At a distance of three feet Miss Evans' degree of accuracy was 97.5 per cent. That of the others varied from 98.5 per cent. to 100 per cent., only one observer hearing every syllable correctly. At fifteen feet Miss Evans heard 70 per cent. correctly, while the record of the others varied from 88 per cent. to 99.5 per cent., the average being slightly less than 95 per cent. These figures show clearly by how much Miss Evans' hearing is less than normal. It would be entirely incorrect to characterize her as 'hard-of-hearing.'

The question may arise whether in Miss Evans' case the auditory nerve may not be more sensitive than that of the average person. Tests made in several different sense realms failed to disclose any general hypersensitivity. Both eyes are very slightly astigmatic and far sighted. Bright illumination is often painful. Tests with an oculist's chart showed that the visual acuity of the left eye was normal and that of the right eye a very little less than normal. Sensitivity to differences of brightness was tested by means of a Masson disc rotated in an illumination of diffused daylight. Miss Evans pointed out a gray ring which differed from the background in brightness by  $1/150$  and was uncertain as to the next ring which differed from the background by  $1/214$ . The four other observers tested at the same time pointed out both of these rings correctly, and one saw a ring which was even fainter. Miss Evans' sensitivity to differences of brightness is then certainly not supernormal. Tests in matching Holmgren worsteds disclosed an unusually well cultivated color discrimination. *Æsthesiometer* tests on the forearms revealed nothing unusual in her tactile discrimina-

tion of two points; and tests with small lifted weights indicated no peculiar muscular sensitivity. The only tests which point to a sensitivity above the average were with the Cattell algometer. The transition from the sensation of 'pressure' to that of 'pressure-plus-pain' was unambiguous. The threshold on the nail of each index finger was 1 kg. (average of six tests at different times; average deviation .1 kg.). On the right thumb nail the threshold was 1.5 kg.; on the left, 1.2 kg.; on the right and left temples, each 1 kg. While these results do not fall within the range of hyperæsthesia, they are below the average for women.

Although Miss Evans manifests no general hypersensitivity, it is natural to suppose that her auditory sensitivity has been developed to a high degree during the many years of middle-ear difficulty when it was necessary to exercise more than ordinary efforts of auditory attention.

In testing for the upper tonal limit, an Edelmann-Galton whistle was used. If Edelmann's calibrations on this particular pipe hold good for the light bulb-pressure used, and for the prevailing barometric pressures and temperatures of Chicago, a majority of observers can hear tones of from 44,000 to 49,000 vibrations per second (the pipe-length being from 0.32 mm. to 0.16 mm. and the width of lip 0.62 mm.). These are, roughly, the pitches  $f^8$  and  $g^8$ . Miss Evans heard on the first day tested 22,000 vibrations (2.17 mm. with same width of lip) with the right ear, and 24,000 vibrations (1.87 mm.) with the left. These tones are not far from  $f^7$  and  $g^7$ . A few days later Miss Evans could hear 32,000 vibrations (1.01 mm.) with the left ear. While this is half an octave below normal, it is well within the range where perfectly healthy ears of middle-aged persons often reach their higher limit.

The lower limit for the left ear was below 32 vibrations or within an octave of normal. With the right ear no tone could be heard from any of the Appunn forks, the smallest of which gives 64 vibrations. At the organ, it was possible to hear a pipe of 64 vibrations with this ear, if the swell box was open but not otherwise. When three pipes were sounding pedal *C* of the contra-octave, 32 vibrations, the observer could detect a sound

with the better ear closed, but it is probable that what she heard was a clang of upper partials. One of these same low pipes sounding singly could barely be heard with the better ear at a distance of 25 feet, while two other observers could hear it at 70 feet. In these tests it required an appreciable length of time for Miss Evans to decide whether a pipe were sounding or not. With pitches and intensities near her lower limit of hearing, her discrimination time was often as long as a second and a half.

A test for the integrity of the scale between 32 and 32,000 vibrations revealed no discontinuities or tonal islands. A series of tests to discover the fundamental tones of the tympanic cavities which the absence of an accommodatory apparatus would make prominent was not completed.

Miss Evans has not a 'musical ear,' and had had no practice in pitch discrimination. When first tested she made errors in gross musical intervals; but with a little practice she developed considerable accuracy in telling which of two tones was the higher. On the third day she was able to discriminate correctly differences of one vibration per second ( $1/32$  tone) from  $c^1$  of 256 vibrations. In these tests heavy Koenig forks mounted on resonators were used. It is much easier to approximate uniformity of intensity with these than with the unmounted forks sometimes employed.<sup>1</sup>

In the tests on clang analysis, the chief interest centered about the hearing of difference-tones. It will be recalled that a tone arising from the simultaneous sounding of two tones from independent sources does not actuate a resonator tuned to its vibration rate; consequently it must have its origin within the ear. To account for these so-called subjective difference-tones, Helmholtz advanced the theory that the asymmetrical form of the tympanic membrane necessitates that when it is set in vibration by two different sounds it must vibrate also at a rate equal to the difference between the rates of the two primaries, and

<sup>1</sup>Such instances as this one, where excellent discrimination of small pitch differences accompanies a total lack of natural musical ability and interest, call attention to a fallacy involved in Seashore's suggestion of using rough tests of pitch discrimination in determining whether a public-school pupil has a sufficiently 'musical ear' to make it worth while for him to be given any musical education. (*Univ. of Iowa Studies*, II., 55, and *Educ. Rev.*, XXII., 75.)

thus generate the difference-tone. A secondary hypothesis based upon the looseness of articulation between malleus and incus was held to be applicable when the primaries are very loud. Later workers in this field, notably Stumpf, Ebbinghaus, ter Kuile, Max Meyer, Hurst and Ewald, have developed theories of audition which seek to explain the facts of difference-tones by a mode of functioning of the structures within the inner ear, but no one of these theories has succeeded up to the present time in commanding general assent by meeting all of the facts.

Recently K. S. Schaefer<sup>1</sup> has shown that a telephone diaphragm will generate difference-tones which set in vibration properly attuned resonators; and the suggestion has been made that Schaefer's experiments point toward a rehabilitation of the Helmholtz theory that subjective difference-tones take their origin in the tympanic membrane.

An instance of good audition in which the tympanic membranes and larger ossicles are lacking presented the opportunity for a crucial experiment. The results were unequivocal: Miss Evans hears the so-called subjective difference-tones.<sup>2</sup>

For preliminary practice use was made of small Quincke tubes and high-pitched organ pipes. The observer was soon able to distinguish the first and second difference-tones. Then she was set the task of tuning a Stern tone-variator to unison with the lower difference-tone arising from two organ pipes actuated from independent sources of wind supply. On the first trial she succeeded. The second trial was a failure, the variator being tuned not to the pitch of the difference-tone, but to a pitch closely consonant with it. The observer was much fatigued by the taxing strain of these experiments, and her error is not surprising, especially when one considers the dissimilarity

<sup>1</sup> 'Ueber die Erzeugung physikalischer Kombinationstöne mittelst des Stentortelephons,' *Annalen der Physik*, 1905, XVII., 572.

<sup>2</sup> Dennert, in reporting his experiments with interruption-tones ('Akustisch-physiologische Untersuchungen,' *Arch. f. Ohrenheilk.*, 1887, XXIV., 173), says: "Ich habe nun Patienten ohne Trommelfell, auch solche ohne Trommelfell, Hammer und Amboss, mit nur erholtenem Steigsbägel, auf dieses Verhalten hin geprüft und gefunden, dass sie ebenfalls Combinationstöne hören." Unfortunately he gives no further information regarding the hearing of his patients or the manner in which the tests were made.



of timbre between the difference-tone and the objective tone of the variator.

On the following day the procedure was varied in two particulars. Heavy Koenig forks mounted on resonance-boxes were used to produce the primary tones, and the observer, who never sings, was asked to choose on a harmonium the tones corresponding to the first and second difference-tones. She would begin with the lowest note on the harmonium and try each one in turn until she found the desired pitch. While the observer was searching for the correct pitch the experimenter was careful to stand out of her field of view, to exclude the possibility of an unconscious choice on the basis of some involuntary movement on his part. At another time the observer was told that among the thirty odd forks before her were two which had the same pitch as the difference-tones, and she was asked to find them. In all of these tests she was uniformly successful.

The pitch-numbers of most of the forks used were in simple ratios, so that the difference-tones were in close harmonic relation to the primaries. Lest it should be objected that the observer, knowing in a vague way what was expected, had sought among the available tones until she found the ones that *fused* most perfectly with the primaries, two forks were selected whose vibration rates were as 5 to 7. The lower difference-tone would then be 2, and the higher 3. If the observer were selecting her tones on the basis of fusion she would have chosen the lower octaves of the primaries: but as a matter of fact she tried these when she came to them and rejected them as promptly as any of the others.

The successful issue of these experiments shows that subjective difference-tones may be generated without the aid of the tympanic membrane or any mechanism of the middle ear. This in no way reflects upon Helmholtz's mathematical proof that asymmetrical membranes must vibrate under the influence of two sound-waves of sufficient amplitude in such a manner that one, two or more additional pendular vibrations are generated. But it does prove that such an explanation is not an adequate account of the phenomenon of subjective difference-tones.

The question at once arises whether the tympanic mechanism, while not essential to the hearing of difference-tones, may not augment them. It is conceivable that combination-tones may have a physical origin within the labyrinth, as Schaefer urges,<sup>1</sup> and also in the tympanic mechanism, as Helmholtz held. It is possible that wherever two sonorous vibrations of sufficient amplitude simultaneously actuate the same body, they may generate a pendular vibration of a rate equal to the difference between their rates. Lord Rayleigh is authority for the statement that practically all bodies manifest the required asymmetry even in the case of aerial vibrations. He says, "Whether we are considering progressive waves advancing from a source, or the stationary vibrations of a resonator, there is an essential want of symmetry between the condensation and rarefaction, and the formation in some degree of octaves and combination-tones is a mathematical necessity."<sup>2</sup>

It was thus desirable to establish whether, in comparison with observers who possess tympanic membranes, Miss Evans is able to hear difference-tones relatively as well as she hears the primaries.

An attempt to determine this point was made when, in February 1907, an opportunity occurred to perform some additional tests. As has been already indicated, Miss Evans' hearing had considerably diminished since the first experiments were made. The audiometer showed an acuity of 31 and 40(?) instead of 25 and 27. Whispered words were heard with difficulty at three feet which had been heard at fifteen feet. The upper tonal limit was reduced to 3.45 mm. and 4.46 mm. (17,000 and 14,000 vibrations). The lower limit for the better ear had risen to 48 vibrations. Bone conduction for tones of 64 and 128 vibrations was as good as before, if not better; but the negative Rinné was greater in each case.

The procedure adopted was as follows: two mounted forks were selected whose vibration numbers were 768 and 896, a ratio of 6 to 7. Miss Evans correctly located the pitch of the

<sup>1</sup> 'Eine neue Erklärung der subjectiven Combinationstöne,' *Arch. f. d. ges. Physiol.*, LXXVIII., 505.

<sup>2</sup> *The Theory of Sound*, second edition, 1896, Vol. II., 459.

lower, louder difference-tone. By means of two auscultation tubes leading from a common stem, Miss Evans and a control observer well trained in auditory discrimination listened to the sound of the same fork. The experimenter, by moving the mouthpiece of the tube to and from the resonating box of the fork could make the sound appear and disappear irregularly. The observers, who were seated back to back, indicated by a movement of the finger when they heard the sound and when they did not. This made it possible for the experimenter to determine, with the aid of a stop-watch, the difference in the ringing-off time for the two observers. Lest there might be an inequality in the carrying-power of the two auscultation tubes, their use was alternated between the observers.

In eight trials with the lower fork, the control observer could hear it for an average of 13.5 seconds longer than Miss Evans; average deviation 1 second. The higher fork died away more rapidly, and here the difference in ringing-off times for the two observers averaged 7 seconds, average deviation less than 1 second. Lastly the two forks were sounded together, and the length of time that the difference-tone could be distinguished was recorded, together with the time between the disappearance of the difference-tone and the disappearance of the primaries for each observer. The experimenter had no check on the introspections of the observer as to the length of time the difference-tone was audible, as it was impossible for him to vary its intensity without modifying the primaries. Under such circumstances the imagination is certain to be a dangerous factor, and the difference-tone will sometimes continue to be reported as heard after it has passed below the limit of audibility. The higher of the two forks always died away before the lower, and if it were actuated lightly again, immediately after the difference-tone was reported as lost, the difference-tone did not always reappear, although if this primary were made as loud as the other, the difference-tone was once more reported as audible. Now for Miss Evans, the difference between the ringing-off times of the separate forks, 6.5 seconds, was only one second shorter than the average time between the disappearance of the difference-tone and the vanishing of the louder, lower primary. Appar-

ently the difference-tone could be heard nearly as long as both primaries continued to be audible. This was not the case with the control observer, who lost the difference-tone six seconds before he ceased to hear the weaker primary. One is forced to suspect that Miss Evans continued to hear the difference-tone in imagination after it had passed below her limit of audibility. She herself remarked upon her uncertainty in distinguishing between vanishing sensation and vivid image. How difficult this discrimination is, those who have practiced clang analysis well know. Because this undetermined factor was present, the quantitative results are unreliable, and one cannot assert with confidence the conclusion which the experiments strongly suggested, that Miss Evans' hearing for difference-tones is relatively better than that of a normal observer with intact tympanic membranes.<sup>1</sup>

A few tests in auditory localization in the horizontal plane were made in August, 1906. Use was made of the relatively pure tone of a tuning fork, the clangs of a stopped pipe and a reed pipe and the noise of a metallic click. The ease and accuracy of localization was in proportion to the complexity of the sound rather than to its intensity. Of the errors made with sounds not in the median plane, somewhat more than half were on the right side. At the present time, Bard<sup>2</sup> is championing the theory that the middle ear contains a mechanism which accommodates to distance and direction. The nature of the rhythmic movements of the chain of ossicles is in part determined by the angle of incidence of the sound-wave upon the membrane, and the perpendicular and tangential components of this motion supply elements to the inner ear which are significant for orientation of the origin of the sound. The tensor tympani adapts the tension of the drum-membrane to weak or loud sounds.

<sup>1</sup> Since the above was placed in type the writer has learned that K. S. Schaefer has found in Berlin several cases of patients who hear without drum membranes, and some who lack the larger ossicles; and all are able to hear difference-tones. A full description of these interesting cases with a discussion of their bearing upon theories of difference-tones may be expected soon from Dr. Schaefer's pen.

<sup>2</sup> 'Des diverses modalités des mouvements de la chaîne des osselets,' *Jour. Physiol. Pathol.*, 1905, VII., 665.

The stapedius however, according to Bard, is autonomous and not antagonistic. It draws backward the head of the stapes, and with it the whole chain and the handle of the malleus, making tense the anterior portion of the drum-membrane, relaxing the posterior portion, and adapting for the *distance* of the sound. The significance for such a theory of data obtained from an observer who lacks this accommodatory mechanism is obvious, and it is regretted that it was not possible to carry through an extended series of localization tests.

*Summary.*—A person who through disease and operation lost the tympanic membrane and most of the ossicular chain of both ears is not 'hard-of-hearing' but possesses very efficient auditory acuity. The foot-plate of the stapes in each ear is covered by scar tissue, and it is possible that if the vibrations of the stapes were not thus hindered, auditory acuity would be fully normal. Sensitivity in other sense realms is not supernormal. Absence of the tympanic membranes does not prevent generation of 'subjective' difference-tones.

As to the significance of the tympanic mechanism in audition, such a case as this one suggests that the physical sound-conducting functions have been quite generally over-emphasized; while the physiological, protective functions have been treated with neglect. What the eye-lid does for the eye, the drum membrane does for the ear. It protects delicate structures against irritation and injury, and permits the inner membranes to be kept moist and in a condition of maximum efficiency.<sup>1</sup>

<sup>1</sup>The writer desires to express his gratitude to Professor B. B. Breese for his kindness in granting, for the second set of tests, the privileges of the psychological laboratory of the University of Cincinnati.

## ON THE METHOD OF JUST PERCEPTIBLE DIFFERENCES.<sup>1</sup>

BY F. M. URBAN.

If a subject is required to compare two stimuli  $S_1$  and  $S_2$  many times the judgments vary without any apparent order, so that one is unable to tell what the judgment will be in a given experiment, but in a great number of experiments each judgment tends to occur in a certain percentage of all the cases. This is the formal character of random events and we introduce the notion of a probability of a judgment of a certain type, assuming that there exists a definite probability in every experiment that the experiment will result in a judgment of a certain type. Let us denote by the letter  $p$  the probability that  $S_2$  will be judged greater than  $S_1$ , and by  $q$  the probability that a judgment will be given which is not a 'greater' judgment. The latter group contains all those cases in which  $S_2$  is judged smaller than  $S_1$  and those cases in which the stimuli seem to be equal.

In applying the method of just perceptible differences one starts from two stimuli which seem to be equal, increasing one stimulus until a difference is perceived; this difference is recorded as a determination of the just perceptible positive difference. Then starting from inequality of the stimuli one diminishes the stimulus of greater intensity until the two stimuli seem to be equal; this difference is put down as a determination of the just imperceptible positive difference. Both these results are combined into a mean, which is called the limen or threshold of difference in the direction of increase. By a similar series of experiments one determines the just perceptible negative difference and the just imperceptible negative differ-

<sup>1</sup>Delivered at the meeting of experimental psychologists at Philadelphia, April 17 and 18, 1907. This paper is an abstract of a chapter of a monograph on psychophysical methods, which is to appear in the monograph series of the Psychological Laboratory of the University of Pennsylvania.

ence, the average of which is the threshold in the direction of decrease. A considerable number of such determinations for each standard stimulus is required, because a single determination is not very reliable. The discrepancies between the results are eliminated by means of an algorithm which is nothing else but an application of the method of least squares.

The method of just perceptible differences requires that the subject compares pairs of stimuli which have one stimulus, the standard stimulus, in common and that these pairs are ordered according to the magnitude of the comparison stimuli so that

$$r_1 < r_2 < \dots < r_n.$$

There exists for every pair a certain probability that the judgment 'greater' will be given and we call these probabilities

$$p_1, p_2, \dots, p_n$$

where  $p_k$  is the probability that in the comparison of the stimulus  $r_k$  with the standard the judgment 'greater' will be given. The probabilities that a judgment will be given which is not a 'greater' judgment are correspondingly

$$\begin{aligned} 1 - p_1 &= q_1 \\ 1 - p_2 &= q_2 \\ \cdot &\cdot \cdot \cdot \\ 1 - p_n &= q_n. \end{aligned}$$

Presenting this series of stimuli to the subject the first pair on which the judgment 'greater' is given, all the previous pairs being judged 'smaller' or 'equal,' is a result for the method of just perceptible differences. The probability that a stimulus will be noted as a result of the method of just perceptible differences is, therefore, identical with the compound probability that this stimulus is judged greater, and that on all the smaller stimuli judgments are given which are not 'greater' judgments. Denoting these probabilities by  $P_1, P_2, \dots, P_n$  we find

$$\begin{aligned} P_1 &= p_1 \\ P_2 &= q_1 p_2 \\ P_3 &= q_1 q_2 p_3 \\ \cdot &\cdot \cdot \cdot \cdot \cdot \\ P_n &= q_1 q_2 \dots q_{n-1} p_n. \end{aligned}$$

In a considerable number of determinations each pair will be obtained as an observation of the just perceptible difference in a number of times which is proportional to this probability, and the results of  $N$  series of experiments, after being brought in proper order, will have the following form :

The stimulus  $r_1$  occurred  $NP_1$  times, which gives for the final determination  $r_1P_1N$ .

The stimulus  $r_2$  occurred  $NP_2$  times, which gives for the final determination  $r_2P_2N$ .

. . . . .

The stimulus  $r_n$  occurred  $NP_n$  times, which gives for the final determination  $r_nP_nN$ .

The method of just perceptible differences requires that the average of all the values  $r_kP_kN$  be taken as a final determination of the threshold, which is

$$M = \frac{1}{N}(r_1P_1N + r_2P_2N + \dots + r_nP_nN) = r_1P_1 + r_2P_2 + \dots + r_nP_n.$$

The technical name of this expression is the mathematical expectation for the result of this series.

A number of interesting conclusions may be drawn from this analysis of the method of just perceptible differences, but its immediate psychological importance becomes clearer by the following considerations. Taking the average of a series of observations has the signification of determining the most probable value of the quantity observed. This interpretation, however, can be given to the arithmetical mean only if the distribution is symmetrical. It is obvious that such a supposition is not justifiable for any particular series of comparison stimuli. The distribution of the  $P$ 's depends entirely on the values of the  $p$ 's, which in turn depend on our choice of the comparison stimuli. It may be that the distribution is symmetrical in a particular case, but generally it will not be. The average of our observations, therefore, will not have the character of the most probable value, if we use only one series of pairs of comparison stimuli. For the further interpretation of the method one circumstance which is of the greatest importance, has been observed in almost all serious investigations without its importance being recog-



nized. As a rule one does not work with one series only, but different comparison stimuli are used and the results of all these determinations are combined. For such a combination of independent distributions the theorem holds which Bruns calls the conservation of the  $\Phi(\gamma)$ -type, and which may be formulated in this way: The mixture of independent distributions tends towards the  $\Phi(\gamma)$ -type. If we are careful to use several different series of comparison stimuli the average of all the results will have the signification of the most probable value. The most probable value is the one for which  $P_k$  is a maximum. One can show without difficulty that  $P_k$  is a maximum independent of our choice of the following stimuli if  $p = \frac{1}{2}$ . We come to the conclusion that the average of all the observations is that amount of difference for which there exists the probability one half that the judgment 'greater' will be given. By a series of similar considerations one finds that the quantity which we determine by the algorithm of the method of just perceptible differences as the just imperceptible positive difference is that amount of difference for which there exists the probability one half that the judgment 'greater' will not be given. The combination of the just perceptible and the just imperceptible difference, *i. e.*, the arithmetical mean, gives a more refined determination of the same quantity.

These considerations have some bearing on the practical application of the method of just perceptible differences. The first is that one must record all the judgments given in order to get the most out of one's results. In this way one obtains a set of results in the working out of which one may step over from the method of just perceptible differences to the method of right and wrong cases at any moment. If one records only the first pair of the series on which the judgment greater was given, one will obtain good results, but the little saving of clerical work is more than compensated by the loss in the lucidity of the results. The second important point is to vary the steps 'by which one approaches the threshold,' because otherwise one can not make the supposition of a symmetrical distribution. The third point is that the value of the  $P$ 's is not changed by the order in which the pairs are presented. It is, therefore, not essential to let the

pairs follow in the order of the magnitude of the comparison stimuli. One may give the stimuli  $r_1, r_2, \dots, r_n$  in any order whatsoever. All the judgments are recorded and from the records one finds the smallest stimulus on which the judgment 'greater' was given, and combining the results of several such experiments one obtains a result which is identical with that of the method of just perceptible differences. The method of giving the pairs in irregular order has the advantage of eliminating the influence of expectation on the part of the observer and there is no difficulty in working out the results since our discussion has shown that the order in which the stimuli are presented is not essential for the method of just perceptible differences.

This method was frequently the object of severe criticism and it is perhaps not void of interest to make some remarks on how its accuracy compares with that of the method of right and wrong cases. The empirical data of both methods are the same, namely empirical determinations of probabilities. The accuracy of such determinations depends on the so-called coefficient of precision in Bernoulli's theorem. This quantity depends on the probability which is to be determined in this sense, that it is smallest for the value one half and it increases when the probability which is to be determined approaches zero or the unit. In the formulæ given above the  $P$ 's are products of the  $p$ 's, and  $P_k$  is always smaller than  $p_k$  except for  $k = 1$  where  $P_1 = p_1$ . The precision in the determination of the  $P$ 's is, therefore, greater than in that of the  $p$ 's. The method of just perceptible differences makes use of the  $P$ 's and, with the same number of experiments, its accuracy will be greater than that of the method of right and wrong cases which starts from the  $p$ 's.

We will illustrate these theoretical considerations by some results of a series of experiments on lifted weights. The standard stimulus of 100 gr. was compared with weights of 84, 88, 92, 96, 100, 104, and 108 gr. The standard was always the first to be lifted and the judgments were given on the second stimulus. In the experiments a terminology was used similar to that suggested by Martin and Müller, but for the present purpose the results are classed as 'heavier' judgments and judgments which were not 'heavier' judgments. Table I.

TABLE I.  
PROBABILITIES OF A 'HEAVIER' JUDGMENT.

| $r_k$ | $h$    | $not-h$ | $r_k$ | $h$    | $not-h$ |
|-------|--------|---------|-------|--------|---------|
| 84    | 0.0222 | 0.9778  | 100   | 0.5289 | 0.4711  |
| 88    | 0.0244 | 0.9756  | 104   | 0.8156 | 0.1844  |
| 92    | 0.1111 | 0.8889  | 108   | 0.9044 | 0.0956  |
| 96    | 0.2933 | 0.7067  |       |        |         |

TABLE II.  
VALUES OF  $P_k$  FOR THE DETERMINATION OF THE JUST PERCEPTIBLE POSITIVE DIFFERENCE.

|          |        |
|----------|--------|
| 84       | 0.0222 |
| 88       | 0.0238 |
| 92       | 0.1060 |
| 96       | 0.2487 |
| 100      | 0.3169 |
| 104      | 0.2302 |
| 108      | 0.0471 |
| $\Sigma$ | 0.9949 |
| $R_1$    | 0.0050 |

shows the observed relative frequencies of 'heavier' judgments in the column marked ' $h$ ' and in the column ' $not-h$ ' the differences of these numbers from the unit for one of seven subjects. These numbers of relative frequency are empirical determinations of the underlying probabilities of a 'heavier' judgment and one may compute on this basis the value of  $P$  for every comparison weight. The results of this computation are given in Table II. This table shows that the  $P$ 's increase at first and then approach zero very rapidly after having attained a certain maximum. Multiplying these numbers with the intensity of the corresponding comparison stimuli and adding these products gives what we have to call the just perceptible difference, if the distribution is symmetrical. This result is given in Table III. We must get the same result within the limits of accuracy of an empirical determination, if we count how many times it occurred that each weight was the lightest weight of the entire series to be judged 'heavier.' This means that the judgment 'smaller' or 'equal' is given on all the preceding weights and that this

<sup>1</sup> $R = q_1, q_2, \dots, q_7.$

TABLE III.

VALUES OF  $r_k P_k$  FOR THE DETERMINATION OF THE JUST PERCEPTIBLE POSITIVE DIFFERENCE.

|          |         |
|----------|---------|
| 84       | 1.8648  |
| 88       | 2.0944  |
| 92       | 9.7520  |
| 96       | 23.8752 |
| 100      | 31.6910 |
| 104      | 23.9408 |
| 108      | 5.0868  |
| $\Sigma$ | 98.3050 |

weight is judged 'heavier.' The results of this observation are given in Table IV., where under the heading  $r_k$  the intensities of the comparison stimuli are given and under the heading  $N_k$  the number of times each stimulus was the smallest on which the judgment 'heavier' was given. These results are given for four different series each one comprising 100 experiments with each pair of comparison stimuli. It will be noticed that in some of the columns the sum of all these numbers is somewhat smaller than 100. This is due to the fact that those series in which no 'heavier' judgment is given do not yield a result by the method of just perceptible differences, which is also expressed by the fact that the  $P_k$  do not add up exactly to one as shown in Table II. The combined result of all the four series together is given in Table V. The difference between the computed value and the observed values is very small.

TABLE IV.

RESULTS OF OBSERVATIONS ON THE JUST PERCEPTIBLE POSITIVE DIFFERENCE IN FOUR SERIES (IVA., I., III. AND IV.) OF 100 EXPERIMENTS EACH.

| $r_k$    | IVA.  |           | I.    |           | III.  |           | IV.   |           |
|----------|-------|-----------|-------|-----------|-------|-----------|-------|-----------|
|          | $N_k$ | $r_k N_k$ | $N_k$ | $r_k N_k$ | $N_k$ | $r_k N_k$ | $N_k$ | $r_k N_k$ |
| 84       | 4     | 336       | 2     | 168       | 1     | 84        | 1     | 84        |
| 88       | —     | —         | 3     | 264       | 4     | 352       | 3     | 264       |
| 92       | 8     | 736       | 18    | 1,656     | 7     | 644       | 12    | 1,104     |
| 96       | 25    | 2,400     | 26    | 2,496     | 27    | 2,592     | 23    | 2,208     |
| 100      | 30    | 3,000     | 23    | 2,300     | 28    | 2,800     | 37    | 3,700     |
| 104      | 24    | 2,496     | 19    | 1,976     | 31    | 3,224     | 21    | 2,184     |
| 108      | 8     | 864       | 6     | 648       | 2     | 216       | 2     | 216       |
| $\Sigma$ | 99    | 9,832     | 97    | 9,508     | 100   | 9,912     | 99    | 9,760     |
| Average  |       | 99.47     |       | 98.02     |       | 99.12     |       | 98.59     |

TABLE V.  
RESULT OF THE COMBINED SERIES.

| $r_k$           | $N_k$ | $r_k N_k$ |
|-----------------|-------|-----------|
| 84              | 8     | 672       |
| 88              | 10    | 880       |
| 92              | 45    | 4,140     |
| 96              | 101   | 9,696     |
| 100             | 118   | 11,800    |
| 104             | 95    | 9,880     |
| 108             | 18    | 1,944     |
| $\Sigma$        | 395   | 39,012    |
| Observed result |       | 98.714    |
| Computed result |       | 98.305    |
| Difference      |       | 0.409     |

In a similar way one may find the just perceptible negative difference from the same series of experiments. For this purpose one first has to find the numbers of relative frequency for the 'lighter' judgments and the relative frequencies of judgments which are not 'lighter' judgments. From these numbers which are given in Table VI. one may find the probabilities  $P$  that a

TABLE VI.  
PROBABILITIES OF 'LIGHTER' JUDGMENTS.

| $r$ | $l$    | $not-l$ | $r_k$ | $l$    | $not-l$ |
|-----|--------|---------|-------|--------|---------|
| 84  | 0.9333 | 0.0667  | 100   | 0.2311 | 0.7689  |
| 88  | 0.8622 | 0.1378  | 104   | 0.0956 | 0.9044  |
| 92  | 0.7000 | 0.3000  | 108   | 0.0156 | 0.9844  |
| 96  | 0.4489 | 0.5511  |       |        |         |

certain comparison weight will be obtained as a determination of the just perceptible negative difference (see Table VII.). By

TABLE VII.  
VALUES OF  $P_k$  FOR THE DETERMINATION OF THE JUST PERCEPTIBLE  
NEGATIVE DIFFERENCE.

|          |        |
|----------|--------|
| 108      | 0.0156 |
| 104      | 0.0941 |
| 100      | 0.2058 |
| 96       | 0.3073 |
| 92       | 0.2641 |
| 88       | 0.0976 |
| 84       | 0.0145 |
| $\Sigma$ | 0.9990 |
| $R$      | 0.0010 |

multiplying these probabilities with the intensity of the corresponding comparison stimuli one finds the number with which each stimulus is most likely to come down for the determination of the just perceptible negative difference, and by adding these numbers one finds this difference itself. Table VIII. gives the course of this computation and Table IX. shows how the

TABLE VIII.

VALUES OF  $r_k P_k$  FOR THE DETERMINATION OF THE JUST PERCEPTIBLE NEGATIVE DIFFERENCE.

|          |         |
|----------|---------|
| 84       | 1.3104  |
| 88       | 8.5888  |
| 92       | 24.2972 |
| 96       | 29.5008 |
| 100      | 20.5764 |
| 104      | 9.7864  |
| 108      | 1.2180  |
| $\Sigma$ | 95.2780 |

computed result agrees with the observations on the same subjects. This table shows how many times it happened that each stimulus was the greatest to be judged 'lighter,' *i. e.*, how many times this stimulus was judged 'lighter' when all the stimuli of greater intensity were judged 'heavier' or 'equal.' The coincidence of the observed results with the computed results is very close as it is seen especially in Table X. The same experiments were made on six other subjects and the general outcome was invariably the same: the coincidence of the observed results

TABLE IX.

RESULTS OF OBSERVATIONS ON THE JUST PERCEPTIBLE NEGATIVE DIFFERENCE IN FOUR SERIES (IVA., I., III. AND IV.) OF 100 EXPERIMENTS EACH.

| $r_k$    | IVA.  |           | I.    |           | III.  |           | IV.   |           |
|----------|-------|-----------|-------|-----------|-------|-----------|-------|-----------|
|          | $N_k$ | $r_k N_k$ | $N_k$ | $r_k N_k$ | $N_k$ | $r_k N_k$ | $N_k$ | $r_k N_k$ |
| 84       | 2     | 168       | 1     | 84        | 2     | 168       | 4     | 336       |
| 88       | 6     | 528       | 12    | 1,056     | 13    | 1,144     | 17    | 1,496     |
| 92       | 30    | 2,760     | 23    | 2,116     | 28    | 2,576     | 33    | 3,036     |
| 96       | 29    | 2,784     | 29    | 2,784     | 24    | 2,304     | 30    | 2,880     |
| 100      | 21    | 2,100     | 19    | 1,900     | 28    | 2,800     | 14    | 1,400     |
| 104      | 10    | 1,040     | 13    | 1,352     | 1     | 104       | 2     | 208       |
| 108      | 2     | 216       | 3     | 324       | 4     | 432       |       |           |
| $\Sigma$ | 100   | 9,596     | 100   | 9,616     | 100   | 9,528     | 100   | 9,356     |
| Average  |       | 95.96     |       | 96.16     |       | 95.28     |       | 93.56     |

with the theoretical results is very close in all the cases; in some cases it is less, but in other cases it is considerably greater than in our example.

TABLE X.

RESULT OF THE COMBINED SERIES.

| $r_k$           | $N_k$ | $r_k N_k$ |
|-----------------|-------|-----------|
| 84              | 9     | 756       |
| 88              | 48    | 4,224     |
| 92              | 114   | 10,488    |
| 96              | 112   | 10,752    |
| 100             | 82    | 8,200     |
| 104             | 26    | 2,704     |
| 108             | 9     | 972       |
|                 | 400   | 38,096    |
| Observed result |       | 95.240    |
| Computed result |       | 95.278    |
| Difference      |       | 0.038     |

We come to the conclusion that the experimental procedure which was described by Fechner and Wundt as the method of just perceptible differences, by Müller and Titchener as the method of limits, is peculiarly well adapted for its purpose. It may be handled in such a way as to yield experimental data which can be worked out as well by the algorithm of the method of right and wrong cases as by that of the method of just perceptible difference despite the fact that the pairs of comparison stimuli are not presented in the order of their intensity which seemed to be an indispensable feature of this method. The theoretical basis of the method of just perceptible differences is the same as that of the error method, namely empirical determinations of the probabilities of judgments of different types on given differences of intensity. The result of the so-called method of just perceptible differences is that amount of difference for which there exists the probability one half that it will be recognized.<sup>1</sup>

<sup>1</sup>The MS. of this article was received May 27, 1907. — ED.

## THE ULTIMATE VALUE OF EXPERIENCE.<sup>1</sup>

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In a brief article appearing in this REVIEW last November, I pointed out what seemed to me to be certain essential characteristics of experience, emphasizing particularly the thought that experience is the ultimate essence of the universe, and as such is subject, and never object. Hence it follows that this most fundamental of all activities cannot be known, since we can know only objects. The experience of the moment is pure being, immediate and underived, while objects experienced are always conditioned being, mediate and derived; yet only through these, can experience as such be described or comprehended.

This experience, however, as subject, while thus distinguishable from the objects of experience is not something separable from them. Without them it could not exist as experience. It is not something left over and above them, but becomes an actuality only through its objects. Just as light is invisible where there are no objects for it to illuminate, so experience vanishes when the objects of experience are no more. Yet, although experience becomes actual only in its objects, it is not merely a logical shadow of these objects themselves. It actually *is*, although itself it is incapable of being experienced. To give it a mere formal existence to satisfy the demands of thought would be absurd. It is more actual than any or all of its objects. It belongs to another order of being, unknowable because unmediated, final, undefined.

Nothing, then, can be said of this experience except to deny to it certain qualities which its objects possess. Its objects flow and develop; they are limited by temporal and causal categories. With them nothing is final; all is relative and incomplete.

<sup>1</sup>This paper was read before the Western Philosophical Association, Chicago, March 30, 1907.



They have no values in themselves, but possess worth only in terms of their origin and goal. Their significance is acquired in the process of their development into and integration with other objects of experience. Experience as ultimate being, however, cannot be limited, or dependent on anything else for its value. If it possesses worth and significance, this cannot be because it leads anywhere, nor because it serves any ulterior purpose. If it has value that value must be ultimate and complete.

Little satisfaction, however, can come from such negative determinations as these, and we might well let the whole matter drop here, were it not for the fact that among the objects of experience there exists a group which, although clearly derived and secondary in their nature, still in a way function for this unknowable, absolute experience, and come to take its place. This group of experienced objects which I refer to, forms the core of our objective existence. They reside largely in those sensations that are at the basis of instinctive expressions, that lend color and warmth to more external objects — they combine into emotions, and give the notion of the self as a feeling and active being; they are subconscious; they suggest a beyond; they point, as they vanish from a world of conscious objectivity to a realm of completed being which contains all and conditions reality.

These subconscious experiences, then, functioning for an absolute into which they seem to recede and from which they appear to be derived, may be studied by the psychologist, analyzed and defined, and this analysis may be taken in a certain way as representing the pure, subjective experience of which they are symbols. These concrete experiences, however, should never be identified with the subject of experience, as is often the case. They are subjective only in a relative sense. Even the self-experience itself is an object among other objects and cannot be considered as anything more than a phase or aspect of experience, certainly not the experience as such.

This relatively immediate aspect of this group of objects of experience is, I take it, the psychological entity to which Professor James has given the name of 'pure experience'; it is the

part which may be called simple sensation, mere feeling, undefined longing, objectless impulse. It is as such an abstraction, because it never exists in its purity, or if it does so exist it is essentially unknowable. This pure experience is that part of the total experience which is least objectified, that tends the least to develop; that, however, as far as it does develop, gives up its original character, and passes into something quite different. In so far as it remains undeveloped, however, it resists analysis and hence comes to be regarded as quite apart from the clear-cut objects of experience in the center of consciousness. Thus, vaguely defined and relatively unknowable, it has been the fruitful source of mysticism and absolutism in philosophy. Here is found, for example, Fichte's Absolute Ego, which refuses to reveal itself completely in the personal me, and of which no assertion can be made.

Such, then, is this phase of objective experience which may be studied by the philosopher and psychologist as representative and symbolic of the unconditioned subject of experience, or experience as such. One of its most striking and interesting characteristics is that it in a certain sense possesses an ultimate value. This core of our objective world does not readily pass over into the more fleeting objects to which it gives value and degrees of worth; it tends to remain in itself and to be satisfied with itself. Its worth, like that of the absolute experience, is in the moment, non-temporal and in a sense eternal. *Its value is simply because it is*, not because it grows into something else. It is not good or bad because it is pleasurable or painful. As experience, it is good; it can be bad only in the sense that it is not as rich an experience as might be possible. The good of the universe from this standpoint is not summed up in the thought more pleasurable experience, but rather more experience. Common sense recognizes this fact in often cherishing those experiences that have been full of pain and trouble because they have given glimpses of realities unknown to more mild and pleasurable states of mind. "To have loved and lost is better than never to have loved at all," for the experience itself with all its bitterness has an ultimate value because it is an experience.

In these days, however, we seem to be in danger of losing sight of this fact, not in our practice probably, but very possibly in our theorizing. We see this tendency to forget that immediate experience has a value in and for itself exemplified in the modern theory of utilitarian and prudential ethics, and in its companion theory, in intellectual philosophy, twentieth century pragmatism.

This is perhaps somewhat striking when we remember that utilitarianism is the legitimate offspring of hedonism, which in making pleasure the norm of action, affirmed the ultimate value of experience. For pleasure is pleasure of the moment. It is the eat-drink-and-be-merry-for-tomorrow-we-die variety. Only when it began to rationalize pleasures, put some above others as more worthy or satisfying, did hedonism and modern utilitarianism depart from its original position and seek values not given in the experience as such.

The same seems to be true of pragmatism to an extent. It also starts with immediate reality in the pure experience of James, and seems clearly to reaffirm this principle of immanence in the doctrine that truth is satisfaction. My purpose here is not, however, to dwell on this phase of the inconsistency, but rather to point out that in the rational development of these two philosophies they seem at times to have very thoroughly forgotten the immanent basis from which they alike originated. To emphasize this latter point we may consider more definitely modern utilitarianism in some of its teachings.

The essence of this doctrine may be summed up, I believe, in the statement of 'voluntary general altruism' (so called), that the end of virtuous striving is to secure the greatest good for the greatest possible number on the whole and in the long run. This demands that any act, if it be truly ethical, shall consider all the consequences that may flow from it, and thus justify or condemn itself. On the surface there seems to be no possible objection to such an ethical philosophy, except perhaps the difficulty of securing any satisfactory criterion on which to base an evaluation of conduct. This, however, is no real objection to the theoretical bearings of the system. If we look more closely, however, I believe we can detect an inherent weakness

in the doctrine, which relates itself to the general topic under discussion in this paper, and which shows this school of ethical theorists to have been better logicians than they were psychologists. I can perhaps make my point clearer by a concrete example.

Let us suppose that a person has fallen into the water and is in danger of drowning. Someone standing on the bank may have an impulse to jump in and attempt at the risk of his own life to rescue the other. Now if the man on the bank chances to be an utilitarian philosopher he must consider the consequences of his deed in terms of the general good. Perhaps the man that is drowning is of little value to the world, while the person who feels moved to risk his own life in order to save the unfortunate in the water may occupy an important place in the affairs of men. Then he should refrain from the attempt, since the greatest good demands his own safety be considered as of primary importance. This seems a simple case of logic, but I am persuaded that it is too simple. In the analysis something has escaped that is more valuable than that which has remained, an act of heroism and a heroic impulse have perished. Clearly this has worth — a worth arising not merely from the consequences that flow from heroic deeds, but a worth in itself. It is good to be heroic. As an ultimate experience heroism has value; considered in a mere timeless relationship it is good.

So the utilitarian philosopher must revise his reasoning in this particular emergency. He must include in his calculations of ultimate benefits this impulse of heroism and find its place in his scale of values. He must see to it that it finds its due place. Now this readjustment may seem to satisfy the demands of the situation. Logically the system may be thus justified; but psychologically such an attempt would prove an absurdity.

For let us assume that the utilitarian philosopher attempts in the evaluation of his act to consider the worth of the impulse that prompts it; let us suppose that he brings into his focal consciousness his instinctive heroism. In that moment the impulse vanishes, the instinct dies. No one can be heroic if he analyzes his heroism. As has already been pointed out it is impossible to bring these subconscious tendencies and feelings into attention and have them remain in their true value.

Thus it happens that utilitarianism can never evaluate this element. It falls into an obvious dilemma. If the impulse is to exist, it cannot form a part of the ethical scheme, which thus becomes inadequate; if rational analysis attempts to place it in the scale of values it disappears from experience. Its value as an ultimate reality precludes the possibility of its entering into the mediate world of rationalized and clearly objectified experience.

Of course it would be quite possible in retrospect to evaluate this impulse. This, however, would not give it a place in the realm of ethical values in the moment of their existence, and would not help, therefore, in the actual situations of life. Further this evaluation, in retrospect or in prospect, of impulses tends to destroy these impulses as such. If we lay bare our affective life it becomes deadened and mechanical. The real enthusiasm, the spontaneity of expression, fail us; sympathy becomes mere prudence; courage, rational foresight; just indignation, calculating expediency, and so on. This is one of the greatest faults of the practical ethics of our present age; over-analysis has often eliminated the 'Schöne Seele' and even the 'Categorical Imperative.'

If we turn from a consideration of utilitarian ethics to utilitarian epistemology we find a parallel difficulty. It is here in the noetic realm exactly on a level with hedonism in the conative realm; for hedonism says pleasure is the norm of goodness, pragmatism says that satisfaction is the measure of truth. So any pleasure that is genuine is good; any satisfaction that is real is truth. Here is pure immanence, a genuine absolute, self-contained and unconditioned. Yet soon we find these two philosophies seeking to go outside this immanence to distinguish between pleasures and satisfaction in order to rationalize their view-points and organize their thinking. Naturally such a procedure is necessary if a system is to be built up. My sole criticism here would be that their immanent starting point would never in itself have developed into such a system without the injection of something quite foreign to it in its original form. Hedonism and pragmatism can be attitudes of feeling and action, but never in their original forms ethics or epistemology.

Although in the discussions on pragmatism which have appeared during the last few years truth has been often spoken of as a feeling of satisfaction, the pragmatist has not actually held to this description of the experience without soon going beyond it. Ethical utilitarianism was long ago forced to depart from its immanent starting point to evaluate goodness; so, too, pragmatism has continually sought justification by measuring satisfaction in something outside of the immediate satisfaction. It has recognized that it could not consider satisfaction as such the badge of truth, but only that satisfaction which is based on wide experience and clear intelligence. Otherwise the satisfaction of the unthinking dogmatist would stand for a greater truth, generally speaking, than the more mild and less permanent contentment of the critical seeker after reality. Clearly this further evaluation is quite desirable and necessary. It is not, however, in accord with that aspect of pragmatic philosophy that has its basis in pure experience.

In its growth pragmatism like utilitarianism has gone very far from a subjective basis; it has become indeed the complete opposite of absolutism, whether subjective or objective. It is a philosophy of development, it has no finality, no abiding, no permanence. Its only universal truth is that there is no universality to truth. What is good in the scheme of utilitarian ethics to-day may be bad tomorrow; what is true in the fabric of utilitarian epistemology to-day may be false tomorrow.

The parallelism between the two doctrines may be carried still farther. It has already been pointed out how the ethical utilitarian in attempting to evaluate conduct and to arrive at the greatest good, leaves out of necessity the very impulses from which good actions spring, which impulses are of themselves of final worth, not because they lead anywhere but because as immanent experience they have an ultimate value. So, too, intellectual utilitarianism in carrying out its principle that truth depends on relationships is compelled to ignore that factor which gives truth its final value, namely that sense of conviction that comes with every conclusion. This impulse to assert that the truth we arrive at is not a merely relative affair, and to believe that in some way it has a transcendent value is charac-

teristic of all thinking that ends in a proposition. There is a feeling that in some way an abiding fact has been reached.

Of course in the next moment, the thinker may find his assertions unsatisfactory and incomplete, and thought may develop toward a new resting place. However, in the moment that we have an experience of truth, we possess a feeling of conviction. This conviction is quite at variance with the attitude that holds, to relativity and incompleteness. This intellectual emotion does not thrive well under pragmatic logic. Enthusiasm for truth does not tend to abound and spread over the earth, when it is made known that truth as such is not to be gained. The utilitarian who confidently asserts that a situation is true because it works (or "because you can work it"), is not apt to realize that the very reason why the situation works is because there goes with it a feeling of conviction. Action does not develop in uncertainty. To hesitate is here as elsewhere to be lost. The feeling of certainty is necessary but is not easily included in the pragmatic scheme; here it tends to lose its instructive force and immanent value; for like the tendency toward right action, this impulse toward true action vanishes as soon as it is forced into the world of partial and conditioned values. The instinct of certainty will not work if it is valued only as a thing to be worked; but, since it is at the basis of all workable propositions, nothing will work without it being present; yet no pragmatist may say, — "Go to, I need this certainty, in order to have my situation work out truly, therefore I will possess myself of this feeling in order that I may work it to my practical advantage." And even if the pragmatist could accomplish this impossibility; even if by such a means he could make his situations work as best satisfy his demands, he would have failed to have gained that ultimate experience of truth, which knows no relativity in the moment of the experience and which in the scale of human values has a final and abiding worth.

Such a humanizing experience can never come to the philosopher nor scientist who believes that the truth he now possesses, at this moment, is merely a relative affair, and true only in the sense that it fits temporarily into a scheme of workable relations. As in ethics speculation on a moral impulse helps to

destroy it, so in logic reflection on the instinct of certainty tends to remove all certainty, and thus to hinder intellectual progress. The result is the same in either case, a moral or an intellectual sophistry.

To sum up the foregoing:

Ultimate experience as such cannot be known, since only objects can be known; yet such ultimate experience is an actuality. Of it as such nothing can be said, except to deny to it the characteristics of the objects of experience. There is, however, in every experience a group of objects that function in a sense for the ultimate experience (the subject of the objects experienced), and which may be taken as symbolic of the pure experience that does not reveal itself. One of the most important characteristics of this relatively subjective and immediate aspect of experience is that it seems to have an ultimate value and finality in itself. In modern times two philosophic creeds have arisen out of this immanent experience, the one utilitarianism and the other pragmatism. Both have in a sense assumed the validity of this immanent experience, the one in the doctrine of pleasure as the ultimate end of striving, the other in the assertion that satisfaction is the badge of truth; yet in the development of their philosophic beliefs both have departed at once from the immanent point of view, thus ignoring their origin. Further, these two systems in their evaluation of goodness and truth have not taken account of the goodness that is good in and for itself, and the truth that is self-contained and unconditioned. They have in other words, disregarded the ultimate worth of that part of our experience that is relatively subjective and which ordinarily does not enter into the flux of a constantly changing world.

The true point of view seems to be that there are elements in our experience that have what may be termed a final value in the moment of that experience, that point back to no conditioning reality, nor forward to a growing system of facts. Here are found impulses and feelings that lie at the basis of our moral and intellectual judgments and give all experience its significance, not only because of that which is to follow, but also because of that which actually is. These impulses and



feelings are necessary for our right living and true thinking. They give a final worth to action and an abiding value to truth. An utilitarian philosophy should evaluate them, and find a place for them in its world of contrasts and relations. This, however, it is singularly incapable of doing, since when it attempts such an evaluation the very being of these impulses vanishes. Thus there must always be an inadequacy in this philosophy. It can never give more than a partial view of the world because it ignores one of its most essential constituents. On the other hand, an intuitive ethics and an absolute logic, while not free from errors, both consider the immanent aspect of experience in which these impulses are found. Here a moral impulse and an intellectual thrill are given their worth. Rightly or wrongly, too, they are held to function for a pure experience, outside of the objective flow of consciousness, that contains absolute worth and abiding truth. Here is the psychological basis for a philosophy of permanent values and transcendent significance.

## ON TRUTH.<sup>1</sup>

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### I. THE MEANING OF CORRECTNESS.

Our discussion of truth may be considerably abbreviated in view of the preceding genetic discussions;<sup>2</sup> for the lines of progression converge very plainly to a consistent point of view. It has become evident that the progress of mind is marked by the differentiation of control spheres into which the classified and dependable and typical modes of experience fall. All this has been traced in terms of the development of 'dualisms.' We find certain great psychic dualisms developing and undergoing constant transformation and restatement with the development of the mental life as a whole.

Further, it is simply a necessity of this development of dualism, as between the inner and outer control factors, that there should arise modes of what we have called 'conversion.'<sup>3</sup> This is necessary since the progress of consciousness is toward setting up its constructions as under mediate control, that is as relatively remote from the original experiences with their direct coefficients. The entire development of inner control is, as we have seen, toward the more and more independent construction of a content of presentation and thought, which has its reference however back through some process of mediation to the sphere in which it is to find its direct confirmation again. Images are read as memories, and not fancies, according as they are convertible into experiences of the perceptual type. Private experiences make good only as they are convertible in turn into the corresponding experiences of other persons besides. Thoughts are

<sup>1</sup> Being part of Chap. XIII. of *Thought and Things or Genetic Logic*, vol. I., 'Experimental Logic', somewhat modified to make reference to criticisms of vol. I., by Dewey and Moore (see the 'Comment' below in this issue, p. 297).

<sup>2</sup> See Chap. XI. of vol. I. of *Thought and Things*.

<sup>3</sup> *Ibid.*, Vol. I., Chap. IV., §§ 3, 4.

true and valid when they find confirmation in some more direct mode of experience that they are true to.

We have, therefore, the rise of two modes of meaning — one that of mediation, and the other that of lack or failure of mediation. The fact of mediation is just that of relative reference to the further and more direct control which the given construction mediates. The lack or failure of mediation, while not a negative thing in itself, yet arises from the same motive as that whose positive requirement is mediation.

Now we have found it necessary to recognize at least two great cases of outright mediation — cases in which the evident value and rôle of a construction is to present an original control and conserve its force, at the same time that it is made relatively remote and mediate. These typical cases are those to which we have already given the character of ‘mediate control’; namely, memory, taken in the broad sense of reproductive imagery, and thought. Memory is a context that mediates perceptual control by possible conversion into it; this we have shown in the three great cases of the physical, the social or personal, and the merely temporal (the memory of events).<sup>1</sup> Thought, too, is a context set up in a way that mediates the control of the spheres from which its materials come, whatever that may be.

Here we may add, that to deny this character to these two modes of construction — whatever else we may deny of them — is to destroy them, as the modes of psychic meaning that they are. To make a memory inconvertible into direct experience is to make it no longer a memory, but a fugitive or fanciful image, an illusion, a dream; for such states are differentiated from memories just in that they lack this mediation of the coefficients of perceptual or other simpler control. The character of memory, then, that makes it what it is in the actual progression of cognition, is its *correctness*, its accuracy, its way of ‘matching up’ with the experiences whose control the memory mediates.

So it is with thoughts. Their first and essential character, as a system of meanings set up in a mind, is this: they have a content that is not capricious, fugitive, disconnected, but one

<sup>1</sup> *Ibid.*, Vol. I., Chap. IV.

that mediates the sphere of control from which the contents were drawn. Thoughts are correct or incorrect, according as they are referable or not to something or other in a world in which there is a matching with the simpler contents whose control is thus mediated. The correctness or incorrectness of memories we call their 'accuracy' or inaccuracy; that of thoughts we call their 'truth' or falsity.

I use the word 'match' deliberately, only to discard it later on for the case of truth, since it is actually applicable to memory, and has suggestions that are valuable throughout. In memory there is an actual image, a sort of visual or other picture, constructed on the lines of the original perceptual content, and we can often bring it up in mind so definitely that the real thing can be compared with it, and the details actually matched one upon the other. I know when my memory leaves out a note, when my visual image leaves out a feature, so soon as I have the actual tune or shape reproduced for me, so that I can directly match the two.

In memory, the need of correctness is evident enough. Action in the larger sense, on the part of the knower, depends upon the accuracy of the image that stands for the actual thing. The individual acts upon the thing; then he acts similarly on the memory of the thing; this he can do because the memory has this prime character of *mediating the thing*.

Admitting the analogy between the cases of memory and thought, we may then suggest for memory a pair of questions that are much discussed with reference to thought. Are the memories, we may ask, correct *because we can act on them* instead of on the things, or is the proper account the reverse — that we can act on memories instead of the things *because they are correct*? In reply, I should say that the latter is the proper way to put the case; since, while we cannot act successfully on what is not correct, we can establish correctness without implicating the motive to the specific sort of action. That is to say, granted that action is implicated, and that it is necessarily carried out in actually securing the matching that confirms the correctness, still it is not genetically the motive to the acceptance of the memory item as correct. The same is true of truth, in my

opinion, and so it may be well to examine the case of memory more fully here.

Suppose we take a case recently used by others<sup>1</sup> in advocating the opposite view. One is lost in the woods, and has a 'thought' — in this case it would be largely a memory — of the way to get out. Of all the possible plans of direction, turnings, etc., he acts on the one that seems 'right.' He comes out at his home. Now what has constituted the correctness, or truth, of his plan? — why is the thought of the situation on which he has acted to be labelled 'correct'?

The 'action theory' — so to call it briefly — says the plan is true or correct because it has led to successful action: but for his success in getting out, his plan would have been false. The essence of the correctness or truth of the thought or memory is to be found, then, in its being a plan of successful action.

But certain difficulties with this are so evident that they 'fly up and strike one in the face.' Suppose we ask, how the case would have differed if the man had not got home; would he not still have used the thought as a plan of action? Yes, it is said, but not successfully. Then the critical point is not merely the action, but the success of the action. Now what is *the mark of success* of the action? — how does the man know his action is successful? The only answer is, *by what he sees* or otherwise finds before him when he recognizes the familiar surroundings; that is, by *the perceptual experiences* found to be what the thought or memory presented in image. Without this recognition or identification, *action is vain*. The test then is a *perceptual experience fulfilling<sup>2</sup> the details of the plan that guided his action*. Instead then of the action establishing or guaranteeing the correctness, it is the correctness alone that justifies the specific form of action. In other words, we are correct in our first proposition made just above, namely, that action cannot get to its appropriate goal without the preliminary presumption that the thought that guides it is correct. Accuracy of imagery and truthfulness of thought are the conditions

<sup>1</sup> Russell and Dewey, *Journ. of Philos.*, III., 599, and IV., 201.

<sup>2</sup> That is, establishing, confirming, realizing, in the sense of giving the same contents *with the perceptual coefficients*.

of the substitution of these constructions for the original things, which as guides to action they mediate. If the man fails to recognize his home when he sees it, the plan may still be true though to him his action has not been successful.

The 'success' necessary, therefore, does not attach to acting thus or so, but to the mediating of the original physical control for the individual's experience, or for a larger social experience with which the individual's normally agrees.

Now let us take up the second statement, to wit, that correctness may be established without the motive to specific action. Suppose a school boy is put to drawing a map, and draws one that the teacher pronounces correct or truthful, using only the data of his history and geography books, together with verbal hints and instructions from others. Wherein consists the 'correctness' of the map? We are told by the action theory that it is correct or true because one might well act upon such a map, in going say from Baltimore to Washington. Very good, but is this the reason the boy made this map just what it is in its details; is this his motive for accepting the details as correct? Suppose instead of doing what his teacher told him to, he had placed Washington north of Baltimore instead of south. Apart from any experience he has had, any promptings to action on his part, that would do just as well. What then has determined him, what has motivated his actual construction in respect to correctness, what has guided and controlled the making of the map? Evidently the fact that *he did what he was told to do, what all his copies required*, getting what, in other words, *could be converted into experience of a different cognitive order*—in this case into the reported experience of other persons. All this is what we have called 'secondary conversion.' It accepts the personal control of another person's thought as mediated by one's own present thought. This makes the thing accurate for oneself.

Here the successful mediation of a socially common control has established the correctness of the personal thought, apart from any further mediation of the actual physical control in the country represented in the map.

Suppose again, instead of making a map, the boy is to give

an account of a historical scene, or to narrate a series of past events. Here, as we have seen, the events, the transitive parts of the thought context, are *per se* subject to no further confirmation than that given by concurrent testimony.<sup>1</sup> It is the larger social control that mediates the by-gone events as true. The truth is tested by its social acceptability — its corroboration by testimony, written records, etc. — the process of verification being that of secondary conversion into a recondite context of original testimony. In some vague sense, we might say that this could be tested by action; it does have, as all knowledge has, its following, its dynamogeny of active impulses, always proper to the thought; but the motive to the acceptance of the result as correct is not that of doing something or going somewhere, but that of matching the details of one person's thought with those of another's.

We may put this a little differently in order to sharpen the essential issue. To act on a plan is to set up the plan as an end for realization. The action is merely a means to this end. Successful action is action that *gets the end* thus set up — no longer as mere presentation but as fact. Now how is one to know when he gets it? — certainly this confidence is not given in the mere action, in the means. It comes only in the realization of the thing, the something of fact that the construction represented, the fulfilment that the end prophesied. The correctness, the truth, then, is the *end-realizing character of the presentation set up*.

These points seem to me very plain in the case of the control mediated by memory. I say to you that your memory of this or that is correct or incorrect. Or course, you can use it for practical purposes, to get the original things, if it is correct; and you can take the risk if it is not correct. Your justification in either case resides in your acceptance of its right to mediate a sort of experience called fact, reality, or existence.<sup>2</sup>

<sup>1</sup>Apart from the remote possibility of tracing out physical effects — substantive changes — following upon the event.

<sup>2</sup>It may be said in objection that by action is not meant alone the gross activity of going to or handling things, but also those functional processes of attention, etc., by which the presentation is constituted what it is. 'What is true' is only another name, it may be said, for 'what is,' under these determin-

We may observe too, before going further with the discussion of truth, that correctness is independent of the mode of origin, and the degree of validity for theory, of the original control meanings thus mediated by conversion processes. However consciousness got the meaning 'physical control,' and however there arose the secondary or mediate controls by which this and others are mediated, still the relative modes remain what they are in their respective progressions. Given a process that has memories, then the entire place and rôle of that mode would be destroyed if there were no conversion of it — no mediation into it of the coefficients already made up in the earlier processes. There are in the progress of consciousness ways of returning to a relative immediacy; this appears in the play and semblant modes; but the character of such modes is shown just in this to be different from that of memory: their *differentia does not consist in relative correctness and incorrectness*. They are not held to the original dualisms as memory is. Memory has its justification just in the relative correctness with which it mediates the coefficients belonging to the worlds of fact or existence.

In an important sense this is true also for thought; it mediates but does not banish dualisms. Yet the processes whereby the mediating control of thought or reflection arises are so complex and their subsequent meanings so legislative and seemingly independent, that the discussion becomes very much more complicated.

Before going on, however, I may point out a distinction that sums up the opposing interpretations suggested above, and shows itself sharply in the two current uses of the term 'control.' As in the processes. This recurs below where we find the 'truth' to be just the 'what is' when the 'is' is the control in which 'the what' is acknowledged. But there our analysis is the same as here (as is anticipated in Vol. I., Chap. III.), *i. e.*, we find that the control sphere is determined by coefficients of various sorts of existence and is not resolvable into the motor processes that operate with and upon them. As soon as there is a control meaning at all it is a dualistic or pluralistic control meaning. There is no valid sense in which these coefficients can be called 'habits' or 'motor complexes'; for habit belongs at the pole of 'inner' as over against external control; and conflict of habits or of habitual selves is within the entire inner sphere that encompasses them (as in the larger synergetic process of attention).



used in my work it means any coefficient or character of a content that classifies and delimits it, giving it a sphere in which it *is or might be present as itself*. We may say of any presentation that it is or might be present in its proper class or sphere of presence or existence. Now on this view the development of knowledge is by the formation and development of these spheres of control; and however far away from the original control coefficients a representative or ideal content may be, it still has the meaning that gives it its assignment to that and no other control. From this point of view knowledge develops within the distinctions of control; there is development of knowledge in idea or thought only through the original controls mediated by these modes — as we have just seen to hold of memory.

Calling this the theory of *knowledge through control* there is a variant upon it that may be called the theory of *control through knowledge* — the ‘control’ of action, and through it of experience, by means of the mediating context of thought. This is, as I understand it, the ‘control’ of the *Studies in Logical Theory* and other works of the so-called Chicago school.<sup>1</sup> It is control of a personal sort, management — considered actively — or effective handling of the details of experience through knowledge, reflection, etc. This distinction is, in the sequel, important.<sup>2</sup> Both phenomena are real, ‘knowledge through control’ and ‘control through knowledge’; but here it may be easily seen that to the latter theory control is what is to the former ‘inner’ or personal control, one of the sorts of control in general found actual by the former. The ‘control through knowledge’ is a concept of this active functional relation between self and its world of experience; that of ‘knowledge through control’ is one of logical or content relation between different modes of experience.

It is of the utmost importance, in my opinion, that this distinction should be clearly understood. We may, therefore,

<sup>1</sup>I hope here and below I am not again misrepresenting Professor Dewey. On the whole, though unfortunate, such experiences are frequent, generally mutual. The writers mentioned accept so much that I also hold to, that it is desirable that we keep on ‘discussing.’ My use of ‘control’ goes back to my address on ‘Selective Thinking’ given in December, 1897.

<sup>2</sup>It is developed in detail in a later chapter of Vol. II. of *Thought and Things*.

seek to sharpen the line of cleavage between the two conceptions — ‘control of knowledge by facts,’ and ‘control of facts or experience through knowledge’ — by showing the fundamental way in which the present day distinctions are really based upon their implicit recognition.<sup>1</sup>

Let us take a detached point of view for the consideration of the context of thought or ideas. Here is a set of presentations hanging before us for interpretation. We may consider it in the greatest detachment simply for itself, as having its own organization and relationships; so considered it is the content of formal logic. Formal logic strips thought of its references, its implications, both of material truthfulness and also of worth for appreciation. For it, inference is purely a matter of relation, whether or not it be *about* something true or something good. There is then a neutrality as to further intent in both aspects; the ideal of such a discipline is pure validity. For it thoughts are subjects and predicates and nothing more.

Now it is evident that there are two ways of leaving formal logic behind. So soon as we ask what further meaning may attach to such a system of thoughts, we come upon the two conceptions just distinguished: either the thoughts represent and so mediate a control in which they are true, or they represent and mediate a mode of appreciation which they fulfil. In the one case, there is a recognition of a world of facts to be acknowledged or extended; in the other, there is the intent to find worth or value in experience in and through the thoughts. By the mediation of control we have the development of the world of facts, for which the thought is instrumental. Here we

<sup>1</sup>I give this of course as my way of describing the difference of view between the two conceptions, not ‘saddling’ it on anyone else. I cannot accept Dewey’s account of our difference without modification — an account that makes my point of view ‘epistemological’ and his own ‘logical’ (*Journ. of Philos.*, May 9, ’07, p. 255). For while my own is epistemological, recognizing a dualism of self and not-self meanings, his view, while, as having only the dualism of idea and fact in view, it can be called logical, yet as theory of control and reconciliation of the terms of the dualism, it is in its implications more epistemological; for it implicates control entirely of the inner or active sort. It postulates in other words a closed inner process, thus making the entire movement of experience ‘inner.’ To do this is I think to mutilate thought by banishing the ‘outer’ control while clinging to the ‘inner’; but the position is still epistemological.

have *experimental or instrumental logic* — the science of the *control of thought through facts, or the extension of knowledge as truth.*

This science may be looked at in two ways according as facts or thoughts are made primary. We may consider the motive to be the *establishment of thought* by appeal to fact, giving ‘experimental logic,’ as a method of the proving of thoughts; or we may consider the motive to be the *establishment of facts* in thought, when we have the science of the development of knowledge as controlled by facts: this is epistemology. We may with confidence write down both instrumental logic and epistemology as sciences of ‘truth’ — the sciences of the control of thought through facts. Facts of any world, is meant, of course; and facts are experiences of an original order of control coefficient.

But now in contrast to this set of motives and the sciences that issue from them, there is the other great way in which the context of thought has meaning. The neutrality of purely formal logic may be departed from not alone in the way of establishing truth by the control of thought by facts; there is the other departure from neutrality found in the intent to fulfil personal purpose and interest. The system of thoughts is now set up not merely for discovery or confirmation; it is made *means of the fulfilment of ends.* All the selective and purposive motives to individuation come up in the further reading of the context preferentially and so to speak ‘axiologically.’<sup>1</sup> The mediation of thought is now not the control by fact and the embodiment of truth, but the acknowledgment of worth. Truth is now means to satisfaction. All the interests besides the theoretical come into their own; and the theoretical interest itself appears as a personal and selective motive.

This is what, I take it, such phrases of current discussion as ‘control of experience,’ ‘control of a situation,’ ‘dealing with things profitably,’ ‘readjusting conflicting habits’ — phrases used by the new school of theorists of the instrumental order — really come to. Their emphasis is on the *management* of situa-

<sup>1</sup>The term ‘axiology’ was suggested, I think, by W. M. Urban for the science of *worth-predicates* as contrasted with predicates of fact.

tions, the *manipulation* of experience, through the use of a context of knowledge. Knowledge enables us to cope with the worlds of things, facts, experiences, situations, *to get good*;<sup>1</sup> and we use knowledge as means to an end. The inner control factors—habit, attention, disposition, interest, constituting the self—by which the whole movement is motivated, are left strangely unexplained. These are not logical terms; they are affective-conative contents.

This it is evident is the sort of mediation supplied to the factor of inner control by the context set up. The ideas are said to guide conduct, the knowledge to become practical insight, the concrete situation to yield to the interpretation and use that thought suggests. All these expressions deal with the relation of the reflective to the concrete, of the idea to the fact; but as soon as we use the word control with reference to it, we see that the 'self' of judgment—the selective, purposive, set of factors—is the control that is mediated. By the knowledge, the insight, the facts are interpreted, the judgment guided, the self factor, whatever its constitution, determined and advanced. There is then the control of facts through knowledge, by the inner synergetic process that counts as 'self.'<sup>2</sup> The motive is the personal one of reaching an end; a meaning is set up as a desire, a remote worth, and the ideas are accepted as means.

Even the phrase 'solving a problem' used most often by these writers invites this criticism; for the 'solution' of the problem is in terms of 'readjusted habit,' 'successful action,' etc., all factors of just what I recognize as advancement of 'inner control' or 'self.' Such a 'solution' actually gives an expansion of self-feeling, and a sharpened objective plan of the *truthful facts*; *it is dualistic to the core.*

## 2. WHAT TRUTH IS.

We may introduce the discussion of the mode of truth as such by asking what would be necessary to constitute an active con-

<sup>1</sup>This is the suppressed premise of the whole theory. It substitutes 'good' for 'true,' and fails to recognize the nature of the inner control, for which the good is 'good.' As soon as this is allowed, the correlative dualistic term, the 'external' control, returns also, and the problem is the epistemological one of truth—of 'knowledge through control.'

<sup>2</sup>The organized self over against impulse, partial habit, etc.

trol process — a mode of action — as the sole criterion or mark of truth, and then ask whether thought or reflection realizes such a requirement. In this way, we throw into relief the differences between the two points of view already spoken of and secure the added interest that comes from having current theories in mind.

If then we ask what would be necessary to banish the requirement of correctness, considered as agreement or correspondence with some control read as external or foreign to the process, our answer would be — simply the banishing of the coefficients of externality. The question then would come back to one which we asked and answered in the first volume of our work — the question as to whether the active dispositional processes could be conceived as entirely making up, and hence as fully fulfilled in, the psychic object, apart from data having coefficients requiring reading as 'external.' This we found to be unrealizable for consciousness such as it is; for the existence both of things of the physical order, and of persons apart from oneself, requires the operation of the motives that mature in the mind-body dualism. In other words, the dualism of existences, as meanings of separate control, forbids a purely active determination of things; and replica of the things — the image-objects — together with the variations in the correctness of these latter, are meanings that testify to the truth of this. Now, how is it with the higher mediation, that of truth, in which the terms of the dualism are those of reflection or thought?

It must be admitted that we find here remarkable progress in the sort of mediation which would banish the external control factor, and so tend to reduce all controls finally to one, and that the control of active inner process. This aspect of the development may be spoken of first, before other motives are taken up.

Two great movements are to be noted: one that whereby the control of reflection as mode of inner experience is constituted, and the other that whereby the individual judgment becomes 'synnomic,' that is, competent without further control from that of other persons. Let us look at these two movements in turn.

The process whereby thought, functioning in acts of judgment, becomes a mode of mediate control, has already been described. It establishes a heightened and unified consciousness of self, as inner control function, which is in a dualism with all the objects of thought. These objects mediate the inner control which the self in judging exercises over the material it deals with. On the other hand, this inner control process arises by a unification of those more partial factors which represent the inner aspects of prelogical meanings. There is, therefore, a redistribution of the objective meanings also, their resetting as outer pole of the dualism of subject-object. The question now urgent is as to whether the original controls by which the objects of thought were set up and recognized as outer, etc., are now in any sense still operative, when the whole context is made one of thought.

There is, in fact, from the point of view of the personal life-process, no motive that arrests the original control factors, so that we can say that they are banished. The objects of thought, like those of memory, seem to require the sort of fulfilment, in fact of some kind, that the objects of memory do. Yet we find certain complications now for the first time present. For whereas the objects of memory were in a sense 'liftable' from the original things they reported, and also on occasion actually lifted from them; yet this was merely an incident to the essential fact that whether thus separated or not, the two series dovetail together, submitting, on occasion, to all sorts of vicariousnesses and substitutions without confusion.

In the redistribution found in reflection there is no such continuity with fact. The mode of inner control through thoughts establishes itself in a much more radical way. The contents are not only 'lifted' from things and constituted as a different mode of meanings, having a way of mediating the original control, but this is done by a mode in which the whole dualism is established in the inner world. The dualism is one of conscious reflection. In its mediation of the original existence spheres it sets its own form of dualism — a new and characteristic one. The question at issue now is whether, by becoming a system both of whose terms are within the one inner control,

thought loses the intent to refer to spheres of control other than itself. Put in terms of action this would read: granting that the control processes of the inner world are active — motivated by purposes, ends, satisfactions, efforts, etc. — can this set of control processes find fulfilment in the mere contents it sets up, or must there be still a recognition of the external? If the former, then any 'truth' attaching to these contents would be derived from their relative worth as fulfilling personal purposes and interests. That is, there would be no necessity of going to a sphere of fact, to any sphere of simpler perceptual or memory process, to secure further fulfilment.

Only on such a supposition, I conceive, can an action theory of truth be put through — or any theory distinctively pragmatic. It would require the elimination of transcendence *as meaning*, the loss of the external meaning of objects, that is, of any control-reference beyond the set of ideas themselves. Only if ends were fully fulfilled in thoughts and thoughts had no further meaning than to serve as ends — only in such complete coincidence of thoughts and ends would further reference be unnecessary as corrective or control of either.

Now thought does not accomplish this — no more than does memory. Thoughts do not satisfy purpose; purpose runs up against hard facts foreign to it. "If wishes were horses the beggars would ride." Interest does not stay with thoughts; it seeks fulfilments in various external-seeming modes. The thought system mediates these remote controls; it does not banish them.

The struggle of mind, however, to do what the pragmatists attribute to it, is interesting and pathetic. It develops a system of meanings that approximate and personate the completely 'lifted' and self-contained.

Yet it cannot finally absorb all contents as only ends of action, completely dominated by processes of inner control, and rest with that. Not so. It marks its failure indeed by falling into *the diametrically opposite extreme*. It aims to banish dualism of controls and so suggests the effacement of 'self.' For it develops the neutrality of a purely *theoretical interest*, and sets up a *theoretically valid system of thoughts* — a system that is

valid not because it can be acted upon, nor because it is true to anything else, but because, simply and only because, it is reasonable and self-consistent.

We have seen this motive in operation, and have described it as the prime and only progression proper to thought.<sup>1</sup> It is all the while recognizing the necessity of control from fact. It is inductive, tentative, experimental, schematic, quantitative, existential. But in the very bosom of this recognition of foreign controls, it hits upon the contradictions and limitations in the body of its data that motive the validity of thought proper. The whole, set up as identical and self-consistent, then floats off in the ocean of logical form as such. Its validities take the place of former inductive confirmations; its relevancies establish themselves within its own body; its beliefs propagate themselves in the form of syllogistic conclusions; and a body of implications is born that dispenses with any further control than just its own constitution as a system of related meanings.

Now what has happened? It is clear that something important enough has happened. It would seem that thought, the system of implications, has won a victory. The flow of valid relation would seem to take the place both of the concrete appeal to action, and of its dualistic mess-mate, the matching of thought by fact in a world of foreign control. Personal interest has become theoretical, and a body of logical validities has arisen to fulfil this personal interest.

This movement is analogous to the similar swing of the pendulum—just where we should expect it—in the mode of imagery, where the same two factors work out their respective places on a lower plane. Mere memory is everything, fancy is worthless; memory is the thing to be interested in, it guarantees correctness and action; it reports what actually is and must be. Therefore let us rule out preference, personal interest, the vagaries of desire; let us recognize the ‘is,’ and banish the vain ‘might be.’ So here also; thought sets up a system of relations that become for it the valid *simply by being linked up together as they are.*

*But this of course is not final.* Personal desire, purpose,

<sup>1</sup>In chapters before this (*Thought and Things*, Vol. II., Part III., Chaps. X. ff.).



action; 'find themselves' in the very process by which theoretical interest asserts its exclusiveness. A new dualism arises, one of a self that thinks over against the system it thinks about. The selections for action are not annulled even when the dictations of fact seem to be. Thought even when most abstract is after all a system of acceptances, beliefs, personal satisfactions; and the demands of such intent are charged into the abstract forms of the syllogism. A whole world of valuation comes to find its embodiment in the system of thoughts. Thoughts are thus made ends in turn, just as before, and the external controls, the things of fact, are reestablished for the 'realization' of those ends.

We have to recognize, therefore, two general movements in this progression of truth. First, there is the development of validity pure and simple taking the place of the inductive matching and conversion processes of external control. And second, there is the persistent return of the control of fact through the demands of action and appreciation in all the matters of concrete life. Both of these are in so far irreducible. The satisfaction of active tendencies reasserts fact, while the demands of abstract validity tend to mediate truth in a system of static relations.

In short, if things were different, if the life of purpose and action did find complete fulfilment in thought, so that thought had no further reference than just this fulfilment, then such a meaning as 'truth' would be impossible. The 'valid' too would have no meaning. The 'good' would take their place.<sup>1</sup> Thought fulfils desire and desire arouses and propagates thought. There would be no further question as to the existence of the desired in any realm other than or beyond thought. For to suppose such a realm would open just the question of a sphere other than that of purpose or action, giving something beyond *for the true to be true to*.

I think we may safely conclude, therefore, in this matter of the birth of personal judgment as a control mode, that while it seems to show the possibility of bringing all the objects of thought under a unifying principle of control by self, and so to subject the whole content of reflection to the rule of personal action and purpose; yet it works out differently when we con-

<sup>1</sup>Opening James' *Pragmatism*, which has just come to my table, I find this heading in the Table of Contents "Truth is a good, like health, wealth, etc."

sider the actual result. Over against the self of control there is developed a system of implication which is universal, self-consistent, and relatively independent of the processes of individual control and judgment. With the growing personalizing of the knowing process comes the depersonalizing of the content of thought. And thereupon there arises the new mode of inner assertion through purpose and appreciation.

From another point of view, also, we reach results of some interest — the point of view of the ‘community,’ the common meaning, of thoughts. This introduces a somewhat neglected but withal important set of considerations.

We found it necessary, it will be remembered,<sup>1</sup> to recognize as attaching to all judgment two modes of intent both of which come under the general character of ‘community’; there is community in the two senses covered by the statement that the judgment is a content having both a ‘by whom’ and a ‘for whom’ force. Whatever is asserted is ‘synnomic’ in that *it intends to be true for everybody*; and it is also ‘syndoxic’ in that *it is actually held only by somebody*. And these two aspects of community are not coincident. One gives the force of the judgment as *fit for acceptance*; the other assigns the *degree of actual prevalence*. One indicates the universality and validity of the implication contained in the whole meaning; the other indicates the aggregate or catholic process that acknowledges this validity.

Now the question of truth is necessarily a question of truth-to-whom as well as of truth-for-whom; of acceptance in a social group, as well as of worth for acceptance by any single mind. And the interpretation of the nature of the truthfulness or falsity of a body of implications must not be one that mutilates the full two-fold intent of community.

First, then, looking at the synnomic force — the intent for-whom — of a logical content, we find the state of things just described allowing of certain further extensions. The solidification of the inner control, by which a self is determined over against the objects of thought, goes far to bring about the dominance of the selective and active control processes; especially

<sup>1</sup> Again alluding to a chapter not yet published.

in the pursuit of hypothetical and inductive research. For here the schematic meaning rendered as hypothesis is largely a matter of personal interest and active pursuit. Allowing this — despite the fact that in the result this tendency yields to that of setting up an independently valid relational content, as remarked just above — allowing, that is, that the processes of active control are thus greatly emphasized in the individual, still a further question arises as to the determination of the self in these active terms. Is the self that now judges, one of merely individual and private action and purpose; is the control of the self-of-reflection in any sense a private control?

No, it is not. All our work of analysis — and that of recent social psychology — goes to show that the self of judgment is the self of common function, of syndoxic control, of processes so interknit as among individuals that it is reached only by the elimination of personal and private factors. The self of judgment is not the private self of appreciation and valuation; that is expressly excluded in the terms whereby judgment is achieved. The factors of inner control are generalized inner data, read back and forth in the dialectic whereby the 'socius' arises. All the way along, the child's self is not one that asserts his crude first preference or impression, but the disciplined and chastened self that has grown, by continuing processes of secondary conversion, into agreement with others. The opposite process also shows the same result: 'the self that judges legislates its own result, so far as now and here accepted, back into the minds of others, *being obliged to intend it to hold for everybody*.

The result for our theory of truth is clear. Truth is not a matter of individual interpretation at all, whether in terms of action or of cognition. Suppose we remove the factor of external control altogether and say that truth consists in availability of knowledge to minister to action; still the question comes up, whose action? Certainly not any individual's action; this would reduce the 'for-whom' to the realm of private preference and impulse, making the true that which ministers to personal gratification in a narrow and private sense. This directly contradicts the requirement of synnomic community. The interpretation in terms of action would require the sort of common function or

action that would support and guarantee the intent of universal acceptance.

But this it is evident would again, in the larger social whole of meaning, destroy the distinction between true and good. If the truth is to be the socially available, in a pragmatic or utilitarian sense, it is then identified with the social end or good. What is good in the larger social sphere of welfare is the social end; and this would then coincide with the thought, determined as fulfilment of that end. The same result is reached then on this construction, as on that stated above in individualistic terms, — the determination of truth in terms of good — except that now *both terms are socially controlled*.

This result does seem to be fairly reasonable and just. The derivation of ethical good from social usage and habit, the reflection of social utility in individual conscience, does seem to result in a correspondence, in the processes of natural history, between the accretions to truth and the accretions to good. But the further difficulty would seem to be precisely that which we found in the similar correspondence between individual good and truth; the difficulty of eliminating the factor of external control which appears in this case also in the realization of the ends. Social or common thought could not of itself *fulfil* the social end: that could only come from 'things' that realized the thought. Social welfare is not — just as individual purpose is not — *ipso facto* fulfilled in the setting up of ends, in this case of common ends. There is still here also the need of converting the social ends set up into actual conditions of social life; just as there is the corresponding need in the case of the individual's purpose. In other words, while the socially true is always that upon which *social action may go out*; still there is the *recognition of actual social fact, whether or not it is what is desirable for action*.

The conclusion, then, is that the recognition of the synnomic character of the judgment function, while broadening out the reference 'for-whom' to judgment process generally, does not remove the essential dualism between end and fact.<sup>1</sup> The

<sup>1</sup>This is my line of answer to Professor Moore's attempt to restate the case in 'social' terms (see below in this issue, p. 294).

demands of action are not fulfilled, but only mediated, by the thought context. So too with the coefficients of fact; they are mediated, but not banished, in a socially available system of thoughts. The system, the entire accepted mass of social judgments, thus *mediates both controls*, the socially inner or synnomic and the external, physical and other,<sup>1</sup> in a new dualism, *that of fact and end*. Truth is still a relative conversion of the contents of social acceptance into the facts of a system of external controls. Socially considered, truth has an existential reference that is *not removed by the statement of social desiderata*. As of the individualistic formulation so of the 'social' — the criticism is the same — the *determination of the true is not entirely through the postulates of conduct*.

This result is further enforced from the point of view of the other aspect in which all judgment has an intent of 'community' — the aspect 'by whom,' the aspect of relative catholicity.

Catholicity means relative actual *prevalence of acceptance*, or quantity of aggregate belief. It is that aspect in which meaning is always for a hearer no less than for a speaker, for further propagation no less than for repeated statement. We have seen that in this aspect, as embodied in the linguistic forms of thought,<sup>2</sup> logical meaning never loses its hypothetical or schematic force; there are always in the social whole individuals still to instruct or convince, always a future of generations yet unborn to whom the linguistic is to be the mode of essential training into competent judgment. What shall we say, as to the interpretation of judgmental matter as true, from this point of view?

We have to recognize at once that in this intent of renewed 'proposal' to others the meaning is reduced from the logical — the fully accepted or 'synnomic' — to the prelogical, the schematic and personal. That which is not yet accepted is, to the intelligence not yet convinced, problematical and personal. The question then becomes, how can such meanings, set as suggestion or 'proposal,' become for that person truth. Evidently only

<sup>1</sup>The other including the other persons who are read as the centers of active and appreciative process just as the one individual is.

<sup>2</sup>See the PSYCHOLOGICAL REVIEW, May, 1907.

by the processes of confirmation essential in all such cases of the passing of hypothetical proposal into judgments of acceptance. The processes are those of material confirmation, of experiment and induction. But this means a direct resort to those coefficients of control by which fact is established. It is a resort to the sphere in which the hypothesis set up finds its relevant control. The whole affair, then, the possibility of advance in the matter of diffusion, propagation, gain in prevalence and catholicity — the process by which more individuals concur in a statement as true — is one that reasserts the external controls by which the judgment secures its classifications and limitations. I see no escape from this conclusion.<sup>1</sup>

It means that the essential process by which relatively catholic acceptance, *by whom*, passes into 'synnomic' acceptance, *for whom*, a matter absolutely requisite to the availability of judgments for social use — that this process is one of *direct resort to the controls of fact*. It is, once for all, not a resort to the sphere of end or action. For the assertion at this stage of the individual's purpose or desire would only emphasize that divergence that would keep the meaning forever in the selective and a-synnomic stage of personal preference. Suppose I decided every matter placed before me in the line of my personal interest and preference; then the agreements by which common truth and value alike are reached would be impossible. There could be no truth, because there could be no judgment at all in the mode of 'synnomic community' — no judgment of that universal import which implicates general agreement.

The consideration of the community intent of judgment, therefore, reinforces, on both counts, our theory of truth. As synnomic meaning thought is available for action *in so far as it is true* — it is not *true because available for action, either social or individual or both*. Of judgment in the forming, of meaning

<sup>1</sup> It has been brought against me that in my address on 'Selective Thinking' (chap. XVII. of *Development and Evolution*), I made truth 'not what is selected because it is true, but what is true because it has been selected.' But this does not at all contradict what I now say; for in that address I explicitly made the '*test of fact*' — the gauntlet of external coefficients — part of the process of selection, just as I do here. Truth is what is selected by the whole experimental judgmental process.

having a progressive intent 'by whom,' this is all the more true; for the content not yet accepted could never be accepted, were the rule of determination anything else than confirmation in the sphere of control or fact in which the 'truth' is finally to be acknowledged as open to common inspection.

There is, moreover, a further point to observe in this matter of community. It is a point that comes up in connection with catholicity considered as being a motive that recognizes the individuality of the single person. We say that it is impossible to construe thought entirely from the point of view of the community of synnomic intent, that is, as a body of completely established and once for all given truths. The reason is that there is always also the intent of further propagation and acceptance in a growing social whole. The other aspect or intent of community must come into its own as well, and this recognizes further judgment process not included in the generalization of the personal attitudes, 'for whom,' whereby the synnomic meaning was constituted. This brings up the singularity and separateness of individual judgment centers in a curious and interesting way. The reference of the meaning to the singular persons who do not believe is as real as that to the community of persons who do believe.

Of course, we are not concerned here with the implications of the acknowledgment of single individuals by others; here we have to enquire only into the effect of such acknowledgment upon the theory of truth. This is shown in two ways that we may now point out.

In the first place, the process of conversion, whereby the proposed meaning passes over into judgment, is one of recognition of personalities. It consists in one's taking their thought as source of supply for one's own. The act of getting social confirmation proceeds always by such recognition of others as resourceful selves, whose knowledge is to be drawn upon. Thus the very process by which thought is accepted as true implicates the recognition of a set of judging selves reaching a common result. The inference is that no theory of truth can stand that does not involve a mode of consciousness having not only the subject-object dualism — myself and what I think

about — but also a plurality of subject individuals having a common body of acknowledged objects, or a common body of truths. There is then a *common presupposition* in the implication of *truth*, but an *individual presupposition* in the implication of *belief*. Truth is one; knowers of the truth are many. The commonness of any item of truth is achieved by the act of judgment; but the progress of judgment, and with it the extension of truth, implicates *a set of persons individuated as singular selves*.

The second point is that the individuals so implicated are, each for himself, a center of inner control process; and so are they all *in their meaning to each* — a set of objects having this character. The social selves are, therefore, truths in the same sense that any body of contents are. For me, it is true that you are Mr. Brown, just as it is true that my hat is white. The essential singularity of you, as Mr. Brown, resides in the meaning I must give you, of being a self which besides being a true meaning to me, *also has the common fund of true meanings with me*. The true context of thought as a whole for each then, includes in it all the others who are also reaching the same true context of thought.

Here is a snag upon which the current instrumentalist theories often strike (*e. g.*, Moore, in this issue of the REVIEW). The readjustment of 'conflicting habits' is depicted as a process of attention, a process of restoring equilibrium of action which, if more than a figure, must be *in the individual*. But when it is pointed out that this is individualistic, resort is made to the social force of the content and of the social character of the self (often quoting my 'social dialectic'<sup>1</sup>). But this is not a reply; for there is no *social attention*, no process of reconciliation of *socially conflicting wills*, except by a *return to the individual* as a center of action and thought. This problem, whether set in terms of action (especially) or of thought (no less finally) must be solved in terms of the individual's experience, however fully

<sup>1</sup>My earlier work shows the common character of the self-content, but does not for a moment deny the later logical individuation of singular selves. In my present work I trace out this latter movement. Moreover I am disposed to agree (and in fact I argued for it in the paper on 'Selective Thinking') that the mechanism of subjective control is, as Mr. Moore claims, that of attention.



it may also implicate common meaning. Either all controls (other persons, as well as external things) *must be entirely and finally reflected in the common character* of individual judgment, or thought in the individual *will reassert itself* in a mode of self-notself dualism, which is *also one of personal pluralism*. This latter is the outcome in the mode of thought as such, the mode of truth. Any essential reconciliation by an act of judgment is impossible, since judgment sets up its own dualism of reflection. The position that objectivity arises only when conflict is not mediated by judgment, and that judgment brings a new immediacy, seems to me flagrantly untrue (see the exposition of Miss Adams, *The Aesthetic Experience*<sup>1</sup>). For when I judge, I set up and acknowledge a content *as object* over against myself. The dualism of fact and idea is mediated, in the establishing of truth; but just this it is that also erects the further dualism of self acknowledging and things acknowledged, together with that other most pregnant dualism between fact and end.

The true, then, is simply the body of knowledge, *acknowledged* as belonging where it does in a consistently controlled context. The characters of truth are those attaching to the content of judgment as being under mediate control. The meaning of truth is its intent to mediate the original sphere of existence meaning in which it arose. It is possible and necessary, just as any other sort of relative correctness is, wherever there is an original experience having coefficients which the mediating later experience intends and invokes. It is strictly an experiential mode, since the controls which it mediates are those of developing psychic meaning.<sup>2</sup>

<sup>1</sup> I suppose Miss Adams' is as accredited exposition — and I should say a very clear and able one — of the position of the 'Chicago School.'

<sup>2</sup> Further paragraphs follow on 'How Truth is Made,' 'What Truth is True to,' 'Falsity and Error,' 'What Truth is Good For,' 'Relative and Absolute Truth,' etc. — topics for which space cannot be taken here. The solutions all depend, however, on these fundamental positions (1) that truth is a system of objective contents set up and acknowledged as under a variety of coefficients of control; (2) that this system is socially derived and socially valid, though rendered by acts of individual judgment; (3) that the whole movement issues in a dualism of self-acknowledging and objects-acknowledged, a dualism from which thought as such cannot free itself.

## DISCUSSION.

### A FURTHER APPLICATION OF A RESULT OBTAINED IN EXPERIMENTAL ÆSTHETICS.

In a recent experiment on the æsthetic value of a series of repeated units in architecture and design,<sup>1</sup> a certain marked difference in the introspection of my observers suggested opposing ideals in their æsthetic appreciation, which, it has seemed to me, may have a wider application than was claimed for them in that paper.

The difference was this: In looking at designs consisting of a dozen or fifteen repeated figures, which together made a band of simple decoration, the observers described their reactions in two distinct ways.

The first, whom I have called the rhythmic type, enjoyed the units solely in terms of their rhythmic sequence. The activity of moving the attention uniformly from one unit to the next like it was the only charm, and they could not describe their pleasure in the repeated design in other terms than those of simple temporal sequence, analogous to their pleasure in auditory rhythm.

The observers of the other type, from the first described their experience in different terms. They said the passage from one unit to the next had no part in their enjoyment, but was often in fact a hindrance. Their pleasure depended on the satisfaction they got from any unit as a fixation point, with a marginal amount of attention bestowed on the other units extending both sides of the central figure. The experience was a stable one, on any figure for itself. The fact that any one could enjoy rhythm of succession for its own sake, apart from the value of the individual unit, they could not understand. This divergence in method of apperception was at first puzzling, but it ran systematically throughout the experiment. The rhythmic type had little choice as to the unit of the series, provided it was repeated; the static type could not enjoy the repetition if the figure was not intrinsically agreeable — otherwise repetition only made matters worse.

The rhythmic type could not enjoy the series unless enough time was allowed them to look along the design and get accustomed to its rhythm; the static type enjoyed it more if they were not forced to look

<sup>1</sup> 'Æsthetics of Repeated Space Forms,' *Harvard Psych. Studies*, Vol. II.

along its length, but could keep one figure, whether for a long or short time, as the center of balance.

As might be expected, the rhythmic type was more sensitive to uniform spacing between the units. If these interspacings were altered so that there were, irregularly, longer breaks between some than others, the entire rhythm was broken; the static type, however, could not detect that they *felt* the interspacing to be equal, although they *knew* it to be. They spent so much attention on each unit for itself that they lost any impression of a rhythm in going from one to the next.

These and other differences between the two classes of observers have suggested that their two ways of enjoying decorative design are typical of a deeper difference which characterizes two opposing demands of art as well as of life. Many other conflicts in taste may perhaps grow from this fundamental difference of attitude, but I have taken as a possible illustration the characteristic art-appreciation of two great classes of people, the American and the Japanese.

That there are both types of observers in every race and in every community is of course indicated by this laboratory experiment. But it is easier to point out wide divergencies in a national than in an individual taste, and I would suggest that in an average of many cases, the Japanese would fall preëminently into the static division, while the American would fall with more probability into the rhythmic. This anticipation seems justifiable since every one of the apperceptive differences among the laboratory subjects, points to a more extended but similar difference in the ideals of the two nations.

There is a most interesting account of the aims of the Japanese artist in two books<sup>1</sup> by Mr. Okakura, sometime director of the Imperial Art School at Tokio, and now of the Hall of Fine Arts in the same city, and they illustrate in a striking way the apperceptive method of the extreme static type, as opposed to the more rhythmic ideals of America.

These examples are the more interesting since we look to Japan especially as the leader in decorative art. It might seem thus, that uniformity in repeated designs would be its prime characteristic, but on the contrary, it is just the reverse.

It is western Europe and America that have adopted uniform repetition in design, but it is Japan and the East which demand variations to a degree that is confusing at first to one educated on the other basis.

<sup>1</sup> *The Ideals of the East and The Book of Tea.*

The Japanese artist may embody the same idea over and over again to suggest infinity, but in his decorative series, the figures and often the interspacings, are not uniform. His method of apperception is to immerse himself completely in each unit — which is, of course, utterly opposed to the active hurrying from point to point which the rhythmic observer feels essential to his pleasure.

It is indeed possible to go through the list of characteristics as they appeared in the laboratory observers, and apply them with equal correctness to the art of the two nations. Much of America's improved taste has come directly from Japan, so the styles which our public has adopted, and which it has, so far, refused to adopt, show distinctly where falls the division line, between the two typical tastes.

1. The rhythmic types were but little affected by the beauty or ugliness of the unit, so long as it was repeated.

We are certainly familiar with this taste in every-day architecture. Rows on rows of undifferentiated pillars, windows, and machine-made decorations valueless in themselves are tolerated; but the tiresome character of the units does not shock us, as would one or two placed above the level, or at unequal distances. Contrast with this the horror of monotonous repetition in the mind of the Japanese (p. 96, *Book of Tea*). "Uniformity of Design was considered fatal to freshness of imagination." "In the tea-room the fear of repetition is a constant presence." This dislike of repetition has gone so far as to center the skill of Japanese artists on birds and flowers, rather than on the human figure; for a human spectator being always implied by an art-work, there would be a repetition of a similar form, if one were also represented in the picture! The Japanese cannot understand our habit of decorating dining-rooms with pictures of game or fruit. Since we of necessity eat in the room, it is the place of all others where food should not be duplicated in the pictures. One finds continually in cloisonné vases different designs within the same pattern, as if the designer were impatient of that very recurrence to which we are accustomed. In any art, observers of both types would agree that in proportion as a unit has individual value, serial repetition becomes less allowable, so it would naturally follow that to the observer whose every art-object is an end in itself, repeated series would be intolerable.

2. The rhythmic observer in demanding a given amount of time to feel his rhythm, demands necessarily that the succession be not hampered by unequal attentive periods on the different units. On the other hand the ideal of the Japanese is to 'catch a glimpse of infinity' in each beautiful figure, and the notion that he is bound to a

time limit to move from one unit to another similar one, is abhorrent to him. Each figure speaks for itself, and involves submersion *in it*, not activity in moving *from* it.

Even the single art object must avoid symmetry (p. 17, *Book of Tea*) since that implies a repetition of equal distances two sides of a middle point. This in itself is in striking contrast to the American habit of decoration.

3. Another interesting tendency of the rhythmic observer in the laboratory was to greatly overestimate his interspacings. Both types were asked to arrange a set of figures at distances from each other equal to the width of the figures. Since these units had groups of lines within themselves, they had the character of an optical illusion, and both classes overestimated the spacing, but in an average of three trials, the rhythmic type overestimated twice as much. Apparently the very motor activity which constituted his pleasure, carried the rhythmic observer beyond his limits and made him 'see large,' whereas the static type, more absorbed in each unit for its own sake, had not the same motor impetus to overcome, and saw smaller.

Could there be a more obvious distinction between the tastes of the two nations? The heavy façades, long colonnades, many steps and wide doors which characterize American architecture contrast strikingly with the delicately small proportions of the Japanese buildings. We do not mean to imply the superiority of the 'static' demand; certainly the simple repetitions of the Greek temple make that impossible; but the common American 'commercial decorating' illustrates the rhythmic ideal without the balance of the opposing tendency; and it may be that degenerate Japanese decoration might show the opposite fault of confusion, though as yet they seem to have preserved better their artistic conscience.

If one might generalize even more on this laboratory suggestion, it would seem as if the Westerner's love of activity for its own sake was an expression of his rhythmic life, his enjoyment of every experience in terms of regular accented successions; while the isolated absorption in the unique experience of the Oriental was an equally characteristic indication of the static method of apperceiving life as well as art.

There are both kinds of observers in every race, but in a general sense the rhythmic activity of one leads to music, rhymed verse forms, and regularly repeated designs, even to athletics and science, since these are relative activities, never the perfect moments of repose.

On the other hand the static type tends more to the visual arts, especially to exquisite materials, color and workmanship, to small

detail and endless variety in design. Moreover it is in the East that mystic philosophy and religions flourish, since they express not relativity but absolute values, where temporal successions have no meaning.

Now that Japan is open to the west and gaining our scientific activity, she is having to fight hard for her national art, while we are learning from her the value of unique beauty as distinct from the relative.

Perhaps the perfect art-lover as well as race, will represent a union of both apperceiving types.<sup>1</sup>

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### EXPERIENCE, HABIT AND ATTENTION.

In my review of Professor Baldwin's *Thought and Things*, Vol. I., in the PSYCH. BULLETIN for March of this year, I referred to Professor Baldwin's criticisms of the attempt to state cognitive experiences as part of the whole process of the readjustment of conflicting habitual and instinctive activities through attention. Professor Baldwin's objection was that such an account cannot take care of the case of 'a new and unwelcome object which simply forces itself upon us, \* \* \* which rides full armed through our walls and compels its recognition.' My reply was to the effect that this very 'new,' 'unwelcome,' involuntary, 'forced' character of the object, when *analyzed* instead of being accepted as ultimate and quasi-miraculous, turns out to be just as much a function of habit and attention as the 'voluntary' cases.<sup>2</sup>

Without any further attempt at analysis, Professor Baldwin in the May number of the BULLETIN reaffirms his objection and adds another edition of it from the standpoint of volitional instead of cognitive experience to the effect that in such a conception of experience there is no 'motivation.' He says 'I can't rest content with a dynamic that has nothing outside to move it and no reason inside for moving.' This sounds wonderfully like an appeal to the outside 'unmoved mover' the insoluble difficulties with which our Greek forebears, to say nothing of Locke, Hume, Kant, et al., discovered. To rehearse these would, I take it, be an unpardonable anachronism. As for 'no reason inside for

<sup>1</sup>The MS. of this article was received April 4, 1907.

<sup>2</sup>Most of this discussion was in MS. when Professor Dewey's article, which more than anticipates the main point of this paper, appeared in the *Jour. of Philos., Psychol., etc.*, for May 9. But as Professor Dewey in that article points out the necessity 'for constant dripping to wear down the stony hearted' I send this to print as a contribution to the 'drip.'

moving,' what better reason could there be than the conflict of the habitual and instinctive activities with its accompanying dissatisfaction.

Again, Professor Baldwin asks: "If experience proceeds by readjusting *to* situations, whence comes the situation that 'puts it up' *to* it to adjust" (italics mine). Now the use of the preposition 'to' both locates and at the same time begs the whole issue. In the view which Professor Baldwin criticizes experience proceeds by situations *of* readjustment, not by adjustments *to* situations. The situation to be readjusted is one *in* and *of* experience, not one which is 'put up' *to* it from without. That Professor Baldwin must be aware in some measure of this view seems implied in his next question: 'Why does it (experience) grow discontent with *its own* habit world' (italics mine)? This certainly assumes that somebody regards the readjusting situation as made by the discontent of experience with *its own* habit world.

As for the answer to the question: 'How this discontent can arise,' that is not far to seek. As has been pointed out again and again, it is due to the fact that habits are constantly *coming into conflict*. In more general form experience has constantly to face the results of its own work and utilize them as the material of its own further development. And if it be further asked how this conflict reveals itself, the answer is; through dissatisfaction and pain.

The same point is involved in the following questions on my answer to which Professor Baldwin says he 'will stake the whole business':

"First. How can experience of the dynamic-relative type secure or utilize knowledge that is socially valid without at the same time reinstating other things as valid, as the social fellows, including the thinker himself?

"Second. How can an experience that has no environment except its own habit and no reality, save its present function, set up any dynamic at all?

"Or to put these two questions in one: In what sense is the will of the mother spanking the child part of the habit of the child, and why does the child's experience take on this particular phase of relative dynamic — this occasional and very disconcerting phase of habit?"

In this last inclusive and very concrete form of his question I assume that Professor Baldwin does not intend to put me at any empirical disadvantage by having the 'mother' instead of the father do the spanking — an arrangement which, personally, both as a child and as a parent I have always favored. As for 'staking the whole business

on my answer,' that happily is not necessary, as that is a responsibility already shared by many others.

In general, Professor Baldwin's questions all reveal the chronic and apparently incurable determination of most critics of pragmatic doctrines to take, at any rate in their criticisms, the terms 'experience,' 'consciousness,' 'habit,' 'attention,' etc., in the sense of the 'experience,' 'consciousness,' 'habit' and 'attention' of some *one* individual. Whereas all these terms, when they are used without explicit reference to a particular individual, refer to the *entire world of activity* in which all experiencing individuals have their being — 'experience' being the general term for that world of activity, the other terms meaning particular modes or functions of that activity.

This does not mean that these particular modes or functions, such as habit and attention, may be regarded as some sort of disembodied 'things in themselves,' capable of an existence apart from individuals. They are the functions, the modes *of* the activity of individuals — habit being the conserving, the mechanical, the structural mode, attention the reconstructive, reforming, readjusting activity. While this conception does not then in any sense attempt to substitute experience, habit, or thinking in general or at large for the experiences, habits and thinking of individuals, it does protest just as insistently against regarding these activities as shut up within the epidemic confines of some one individual. However much John Smith's habits and ideas belong to him, they belong *also* to the whole community in which he lives and which is affected in any way by them, be that as large or small as it may. Conversely, just this community center of habits and ideas *is* John Smith. That this is to be taken literally and not figuratively, Professor Baldwin himself shows in his volumes on *Mental Development*.

Now if this conception of the habits and ideas of the individual as *also* functions of the whole community life, be kept steadily in view, it would seem that the impossibility of framing such questions as the above is as obvious as their answer.

Turning to the first question, Why should anyone speak of 'reinstating social fellows' and 'other things'? Who has turned them out? Surely not those who teach that problems arise, run their course and find their solution not in the solipsistic realm of John Smith's habits and ideas as a complete world in itself, but in the habits and ideas of John Smith as a conserving and reconstructive agent of the whole community life.

As for the second question, in view of what has already been said



of the place of habit in experience, it seems redundant to add: (1) that habit cannot be regarded as an external environment *to* experience, or (2) that experience does not have to 'get up' any dynamic. The 'dynamic' is already there: (a) in the obviously active character of the habits; (b) in their coming into conflict; and (c) in the reconstructive work of attention.

Professor Baldwin's putting of the 'spanking' question lends itself somewhat temptingly to facetious treatment, but as the case is really a serious one for all parties concerned, I prefer to treat it so and to observe; first, that in urging the distinction between the experience of the mother and that of the child, the question seems irrelevant to the original issue, which is the possibility of stating the *whole* situation whether it involves one person or a thousand, few or many things, in terms of a conflict of activities resolved through attention. It insists that the *whole* situation, including the mother, the child and the spanking, whether regarded from the standpoint of the mother, the child or both, is a system of conflicting activities undergoing reconstruction. And from this standpoint there is no more need for identifying the ideas or will of the mother and the habits of the child in the sense of making them the *same* thing or making one a 'part' of the other, than of identifying habit and will in the mother, or in running together distinguishable functions or aspects of any other process.

Admitting, *freilich* then, the distinction between the activities of the mother and those of the child, we must yet keep hold of the fact that if they are not 'parts' of each other, yet *they are 'parts,' in the sense of constituent interacting activities, of one situation.* This is reflected, in general, in the very terms in which we state the case. The performance as a whole may be stated either as 'the mother spanking the child,' or 'the child being spanked by the mother.' It depends on the point of view. Again, the term 'mother' implies that one of the individuals is the *kind* of an individual that has the habit, the attitude of caring for 'her child.' And the term 'her child' implies that the other is the *kind* of an individual that is to be protected by the mother even to the extent of being spanked, if need be.

Following the analysis still further, and still speaking from the standpoint of the *whole* situation, how can 'the will to spank' be regarded as the exclusive production of the mother? It surely is the outcome of the conflict between the mother-attitude of perceiving and keeping the child in safety and the child's present activity of, say playing with the fire. It is a joint product of these two sets of activities, and one is as essential as the other. The attempt to regard the will-

ing as the exclusive production of the mother alone transforms the concrete will to spank-this-child-now-playing-with-the-fire into an abstract 'will to spank' *überhaupt*, with nothing particular to spank,—the essence of a profoundly tragic situation.

But Professor Baldwin may say, after all 'the spanking' is 'forced' on the child as the perception of the-child-playing-with-the-fire is forced on the mother, to which I would rejoin: (1) Even so, this but sustains the original contention that however 'new' or 'forced' or 'unwelcome' the experience may be, it still is storable in terms of the readjustment of conflicting habitual activities through attention, and even if for any reason one wished to state the case from the standpoint of the mother or the child alone there are no other terms so far as I can see for the statement. (2) The spanking is no more 'forced' on the child than on the mother. In fact, psychically it may be much less so. However skeptical, we may have been about it as children, we have since learned that our mothers spoke truly when they said: "I am sorry that I am 'forced' to punish you." (3) For both, neither 'the spanking' nor the playing-with-the-fire viewed as *an occurrence* is any more 'forced' than anything else that may have preceded, as running, talking, sewing, etc. Even the image of the child playing with the fire is no more forced upon the mother than her own breathing, her impulse to rescue the child, or her will to spank it. In this sense, all those activities which constitute the 'self' of the mother upon which other things are said to be 'forced' is as much 'forced' as the things. In this sense everything is 'forced.' 'Forced' here means simply 'happens.' And in this sense things are no more and no less 'forced' upon us than we are 'forced' upon things, or 'forced' upon ourselves. What goes on *within* our 'walls' is as much 'forced' as the thing 'which rides full armed through them.' As a matter of fact, this mere happening of things, however 'new' or 'sudden,' *e. g.*, Professor James' classic thunder-clap, is not experienced as 'forced' *unless* it *conflicts* with activities or attitudes already going on. And even then the 'force' obviously is not all on the side of the 'new' factor. It is met by the force of the activities already there. Pursuing the figure, the forces behind the 'walls' are not asleep waiting to be aroused from without. They are already active. And if the new factor be recognized as an improvement, it may be made the basis, the ideal, of the reorganization, in which case the old habits instead of the 'new' content, will appear as the 'opposition.' It is, then, only when there is a *conflict* of happenings and some content is selected as an *end*, that the other activities, the readjustment of which

this end demands, seem 'opposed' and 'external' to the *end*, but not opposed or external to the *whole* situation or to 'experience.'

As these remarks are already beyond their allotted space I cannot take up the other and relatively minor points to which Professor Baldwin refers. However, regarding my complaint of confusion in the use of terms I should like to ask what is meant by 'trans-subjective' and 'extra-psychic' realities in view of the following: "The envelope of the developing psychic process is *nowhere ruptured*. The controls, 'foreign' as well as 'inner' are *all* psychic meanings." (BULLETIN for May, p. 126). A foot-note, p. 12, *Thoughts and Things*, says extra-psychic 'means independence merely from the *individual's* psychic process.' But a foot-note on the psychic 'envelope' in the above passage says: "It is, however, an envelope of *inter-psychic* or common, in no sense private, meaning." So far as I can see these passages use 'psychic' in three senses: (1) As meaning 'the individual's psychic process'; (2) as including other individuals; (3) as including *all* 'foreign controls' whether other persons or things (*italics mine*).

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#### COMMENT ON PROFESSOR MOORE'S PAPER.<sup>1</sup>

Professor Moore's position assumes 'habit' and 'instinct' and also 'conflict,' and withal 'attention' to 'readjust' them. But genesis must account for all these things; the same question of accommodation *vs.* habit arises in the simplest organism and the 'motivation' of a process is not explained by the assumption of its whole machinery. It is this that leads us—the critics—to say that the scheme is thoroughly individualistic. It would seem necessary to restate it *in social terms*. To this Professor Moore agrees; but then, as I think, he fails to give us a coherent restatement in social terms. The point at which he fails is one indicated in the article above and in detail in my book; in brief, the social process has no 'attention,' the conflict of wills gets no sort of readjustment in such terms as habit and instinct—save by a superficial analogy—and the whole mediation must go back to the individual proc-

<sup>1</sup>As it happens a proposed contributor to this issue deferred sending in his paper; and I take the space to print part of a chapter of volume two of the work that called out Professor Moore's remarks. In that article (above, p. 264) I answer both his and Professor Dewey's criticisms (*Journ. of Philos.*, May 9, 1907) more effectively, by expanding my own view, than I could in such more fragmentary discussions as this.

ess again, *dealing now with socially derived and socially valid meanings*. That is, social truth must be rendered in individual judgment — must be what I have called *synnomic*. But just here the individual factors of the whole mode of personal judgment reassert themselves, and *the new dualism of self and things*, knower and known, is constituted. In other words, the factor of foreign control again arises, in the constitution both of things and of the persons of the objective world of reflection.<sup>1</sup>

I am, as Professor Moore is, seeking for a reconciling mode of experience; I do not, however, find it where he does. I cannot avoid seeing that *for the knower* there is a very compelling and intruding sort of experience — that is what the much criticised sentence about the 'unwelcome presence that rides full-armed through our walls' means, and about all it means. This is *for and by him, the knower*, read as a 'foreign control' over against the tendencies — habits, instincts, volitions, etc. — that come to mean, all the way through, inner control. Judgment bridges this chasm, but opens another one — that of the dualism of reflection. The real mediation is found in the 'semblant' consciousness as I intimated in my closing remarks on Professor Moore's review (*Psychological Bulletin*, April 15, pp. 124-6).

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<sup>1</sup>In this connection I may answer Professor Moore's question as to the meaning of 'psychic.' It is as he says "(1) the individual's psychic process, (2) as including other individuals [among *the meanings* it gets and entertains] and (3) as including all 'foreign controls' whether other persons or things [also among the meanings it gets and entertains]. My explanations are inserted in brackets. It is all 'psychic' in the one sense; and that hits upon the requirement noted above, that even when the common or 'social' point of view is taken, the function of readjustment, of advance, of mediation must be interpreted as going on within the 'psychic-envelope' of the individual's mind.

# THE PSYCHOLOGICAL REVIEW.

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## THE NATURE OF FEELING AND WILL AND THEIR RELATIONS.<sup>1</sup>

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### I. THE PROBLEM.

The problem of feeling and will and the nature of their relations is perhaps the most difficult within the entire field of psychological analysis. The reason for this is not far to seek, for nowhere is it more important that the distinction between appreciative and non-appreciative description should be realized and a true theory of their relations formed, and nowhere is there such confusion on these points as precisely in this sphere.<sup>2</sup>

To illustrate my point in detail, the distinction between feel-

<sup>1</sup>In two recent articles entitled *Definition and Analysis of the Consciousness of Value*, PSYCHOLOGICAL REVIEW, Vol. XIV., Nos. 1 and 2, a definition of feelings of value and an analysis of the different modes of worth experience were developed which, as was explicitly stated, presupposed a theory of Feeling and Will not fully given in those papers. The present article, while in a sense an independent discussion, nevertheless serves to answer certain questions left unsolved in those studies.

<sup>2</sup>The consequence has been the widely divergent analyses with which psychologists have been scandalized. The original distinctions within this sphere were made from the appreciative point of view because analysis of feeling and will first began with the worth problem (Plato and Aristotle and later the English Utilitarians). As the original interest became secondary to that of non-appreciative description, the distinctions developed in appreciative description, when the meaning of the feeling, *i. e.*, its presuppositions, was taken into account, were applied without reflection to hypothetical feeling abstracted from its presuppositions. Tradition was all powerful here (for we are naturally conservative in all that affects the feeling and worth side of experience), and when at last independence of analysis appeared, the question of the retention or elimination of these distinctions seems to have been determined largely by personal inclination rather than by considerations of scientific method, and hence again the divergence in analyses.

ing as passive and will as active is an appreciative distinction. One concrete attitude is relatively more passive with reference to its meaning in a series of attitudes, with reference to what succeeds or precedes; but when we abstract from the meaning of the attitude and apply the distinction to hypothetical content, it involves us, we shall find, if it is made absolute, in contradictions, and is far from representing the facts. The distinctions between affect, impulse, desire, wish and will are primarily appreciative, made with reference to the meanings of the attitude and, as we shall see later, go back to certain cognitive differences in presuppositions. And finally, the distinction pleasantness-unpleasantness, and its selection as the dominant in the feeling complex or attitude to the exclusion of other aspects, is one which has been determined largely by appreciative purposes, *i. e.*, it is the abstract aspect which appears emphasized when the attitude (subjective) is transformed into a state, as object of another attitude. Now when these appreciative distinctions, which are largely concerned with the intent of an attitude rather than with the content of a state, are taken to apply to content from which meaning has been abstracted, interesting difficulties and contradictions arise. When the distinctions between passive and active, and feeling and conation (will), are taken as non-appreciative ultimate distinctions, we have a dualism in affective-volitional meaning which the several different dualistic theories seek to bridge by establishing relations of *causal determinism* between the two aspects. One finds feeling, as a distinct element (passive pleasantness or unpleasantness), the necessary antecedent of all conation; another, giving the primacy to conation, finds in the passive feeling the sign of the satisfaction or arrest of some antecedent active impulse or desire; or, finally, the dualism may be pressed so far (as in the recent work of Schwartz) as to admit the existence of volition without feeling.

The extent to which these fundamental conceptions color all worth analysis and theory is obvious. Psychological hedonism, with its incapacity to explain a good part of worth experience, is the result of the first. A theory which is unable to include the æsthetic in the sphere of worths is the result of the second.

From the third we get the strained formalism of Kant and Schwartz. In view of these difficulties, no theory of feeling and will and of their relations (and some theory is necessary) is of any value unless it is formed with a clear consciousness of the problem involved in the relation of the appreciative to the scientific description of the psychical.

There are two views which have been formed with this clear consciousness of the methodological presuppositions involved. On the one hand, Meinong tells us, to take him as typical, the relation of feeling and will can only be determined from the worth standpoint, while Wundt, to take him again as typical, looks upon the distinctions introduced from the point of view of worth analysis, such as the distinctions between feeling, desire and will, as 'pure logical artifacts, not in the least, however, psychical ultimates distinct from each other.' As a consequence, the distinction between feeling and will is for the former ultimate, while for Wundt's monistic theory, there is a fundamental identity (of feeling elements) underlying all these retrospective artificial distinctions.

Between two such divergent views, with such different methodological presuppositions, there would appear to be no middle ground and yet to my mind both have a relative validity and are susceptible of reconciliation. More than this, I am inclined to think that the *Identity* theory, developed from the standpoint of analysis of content, is the only one which will harmonize with the distinctions in affective volitional meaning, developed from the worth standpoint or the standpoint of functional intent.

## 2. DUALISTIC THEORIES OF FEELING AND WILL. CRITICISM.

We may begin our study, then, with a brief critical examination of those views which, upon the assumption of absolute distinction between feeling as passive pleasantness or unpleasantness and conation as active, seek to establish a relation of causal psychical determination between them. If the distinction is one of content viewed apart from its intent or meaning, then it is necessary that experience shall show us either passive feeling as the necessary antecedent of all active states which are called

conative or, on the other hand, that all passive states of feeling have as their necessary antecedents arrest or accommodation of conscious impulse or desire, in its very nature, as content, different from feeling.

(a) The first of these dualistic views, in its original form of psychological hedonism, was beautiful in its simplicity. Feeling, as a passive state, is always an effect of content, sensation and idea, and their relations. The aspects, quality and intensity, vary with the changes of sensational and ideal content, and the intensity and quality determine impulse, desire, etc., the active side of consciousness.

A very superficial examination of the facts suffices to show us that, if by feeling we mean simple passive pleasantness or unpleasantness with certain intensities, it is by no means the necessary antecedent of any given impulse or desire. On the one hand we have simple impulses for which there is no such conscious hedonic antecedent. When the impulse to take exercise comes over me at a given time, introspection will show me that it is *necessarily* preceded neither by a conscious feeling of unpleasantness nor by an anticipation of pleasantness, although either *may* be the antecedent. On the other hand there are phenomena of a more developed conation which we have seen described as 'intensitiless' acts of preference where affective disturbance is at a minimum, and which, if feeling be described as passive hedonic intensity, certainly show no such feeling antecedent. Impulses with the note of obligation in them are frequently of this character.

That there are changes in affective volitional meaning (Gemüthsbewegungen, in the broadest sense), described as impulse and desire, which do not presuppose an antecedent passive hedonic consciousness or consciousness of hedonic difference, is clear. If we include in feeling other qualities such as tension-relaxation, restlessness-quiescence, it is merely a verbal quibble to raise any question of antecedent and consequent. We have already attributed to the concrete feeling state the essential character of the conative side, a virtual acceptance of the *Identity* theory.

This fact, that there are numerous impulses and desires which



follow immediately upon presentation and judgment without appreciable hedonic consciousness intervening, is, moreover, admitted by the upholders of this theory of dependence, without however sacrificing the theory. Thus Kreibitz speaks of dispositional feelings below the threshold as determining impulse and desire, while Ehrenfels speaks of desire as determined by feeling or *feeling-dispositions*. And even when it is actual feeling which is conceived as causally determinative, it is not, as we have seen in our previous analysis of Ehrenfels' worth definition,<sup>1</sup> feeling as a separate antecedent state, but the feeling difference as determined by the object as existing or not existing and the feeling disposition of the subject. In the case of the impulse to exercise it would be — not necessarily the unpleasantness of the present state nor the anticipated pleasure — but the difference between the two which constitutes the necessary presupposition of the impulse or desire.

But it is precisely in these admissions, and consequent modifications of the original theory, that we see the failure of this entire theory of dependence growing out of the separation of feeling from conation. For a feeling which does not rise above the threshold is a pure conceptual construction. So also is the feeling difference when made the presupposition of desire. For a feeling difference can be an actual psychical determinant in only two ways: either it is a presentation constructed upon two presented feelings and then we have presentations as the presupposition of the desire, or else this difference is felt as tension or restlessness, as an expectancy generated by the hypothetical disposition, the active conative moment supposed to be determined by the feeling, in which case there is no need for such duplication of phenomena. In the latter case then, where feeling difference is conceived to be the presupposition of conation, it is either not distinct from conation or else it is a purely conceptual construction.

(b) The second theory of dependence, which has been developed upon the assumption that feeling and conation are ultimates from the point of view of content, is that all feelings have as their necessary antecedent some phase of conscious co-

<sup>1</sup>Cf. articles already referred to.

nation, and that feeling is the sign of arrest or satisfaction of desire. Here, again, if conation is conceived to be an aspect of consciousness which, as content for non-appreciative description, is distinct from feeling, it is difficult to establish a thorough-going relation of dependence. It is true that affective attitudes on the plane of worth suggestion presuppose the activities of acknowledgment or rejection, but even here it cannot be said that the relation is one of antecedent and consequent, nor can it be said that the worth feelings are passive pleasantness and unpleasantness. But it is by no means easy to include in such a generalization all the phenomena of feeling. There are in the first place the feelings which accompany simple sensations, the agreeable or disagreeable affective tone of an odor or color. There are also the sudden emotions of surprise and fear and finally the instinctive emotions, inherited and appearing at first without any conative experience as their antecedent.

As to the first group of phenomena, those who hold the view that feeling has its rise in arrested conation insist that even these phenomena fall under the general law. So also does the functional theory in general when it is consistent and sharply distinguishes feeling and conation. Thus, in a recent article written from this point of view, unpleasantness is conceived to follow upon arrested conation while pleasantness appears only when conation is accommodating itself after arrest. States which do not contain conative moments are neutral.

Nevertheless, the difficulties in the way of such an answer are not to be minimized. If we examine the reasons given for this inclusion we find that they are of two kinds — the first being analytical and introspective, the second functional. The first is to the effect that it is impossible to get the feeling tone of a simple sensation uncomplicated with the aspects of tension-relaxation, restlessness-quietness, with their suggestion of conative presuppositions; the second, the functional argument to the effect that the law of decrease of affective tone through habit and repetition of stimulus, is primarily a law of adaptation of tendency to stimulus, and that, when an odor or tone loses its affective tone through repetition, it does so because the tendency, or need of excitation of the organism, produced by arrest,

has been satisfied. When we look more closely at these arguments, the difficulties referred to appear. Here again, as in the preceding theory, the relation can be made universal only by going beyond immediate experience and supplementing it with hypothetical conceptual constructions. The aspects of tension-relaxation, of restlessness-quietness, if they appear in the simple feeling tone of sensation, are analytically separable from the feeling as antecedent content, intrinsically different from feeling. Impulse and desire are not conscious presuppositions of the feelings. When the intensity of feeling tone diminishes with repetition, it does not necessarily mean that actual impulse or desire gradually disappears but merely that some disposition or tendency diminishes in strength with repetition of the stimulus. The proposition that all feeling presupposes conation holds only when modified to read, *or* conative disposition and tendency.

The same reflections hold good for the other phenomena of feeling, the sudden emotions of surprise and fear and for the inherited instinctive emotions. When, upon walking through the woods, I am surprised with the odor of flowers, this surprise has as its presupposition no specific experience of impulse or desire. Such surprise is possible with relative passivity of consciousness although, were there complete passivity, even surprise would be impossible. The situation seems to be that at least some general conative tendency toward objects other than the flower, objects of presentational activity, must be arrested in order that surprise shall arise. The surprise is not occasioned by the odor directly but by the arrest of some other conative interest or tendency. It does not, however, presuppose actual desire. The same may be said of the instinctive emotions. Such affects presuppose dispositional or instinctive conative tendency, not actual conation: they are themselves experiences which may with equal right, be described as feeling or arrested impulse. Finally there is the æsthetic feeling in which, while conation is presupposed dispositionally, certainly no conscious impulse or desire necessarily precedes. Analysis shows the aspects with conative connotation, relaxation and repose, as well as the merely hedonic, but these are aspects of the total attitude, not *different states* except for retrospective analysis.

(c) The conclusion of these reflections is then that a thorough-going dependence of feeling, as distinguished from conation, upon conation can be established only when we modify our proposition to read conation *or* conative disposition or tendency. This is practically the conclusion reached in the examination of the theory which makes conation determined by feeling. But when we have introduced the dispositional concept, that is when we have gone beyond the distinctions of immediate experience and supplemented them with conceptual constructions, it does not matter greatly whether these dispositions are described as feeling or desire dispositions. As Ehrenfels wisely recognizes, for worth theory — which is concerned with the changes in valuation and their laws, as determined by changes in dispositional presuppositions — it does not matter whether these dispositions are described as affective or conative: the laws of valuation will hold on either assumption. The conclusion which is of importance is, however, that the distinction between feeling and will is not one implicit in psychical content, but rather an appreciative distinction due to the intent of that content.

### 3. MONISTIC AND GENETIC THEORY OF FEELING AND WILL.

The chief outcome of our consideration of two theories of the relation of feeling to will which start with an absolute distinction between them, as between the active and the passive, is that no thorough-going relation of dependence can be established either way except by leaving the sphere of psychological fact and supplementing it with the conceptual constructs of physiological dispositions. If, however, in order that we may fill out this relation of dependence, we include among the attributes of feeling restlessness-quiescence (which have the conative connotation in them) it is doubtful whether anything is gained by this complete separation of the two aspects of experience. The 'Identity' theory denies that this distinction is fundamental, but asserts rather that it arises only from the difference in point of view from which we look at one primary content of consciousness. My own view is that this theory, rightly understood, affords the most satisfactory basis for a true theory of values as well as does justice most completely to the facts of analysis.

We shall now turn our attention to the development of this theory.

(a) In its most general form, it has been well stated by Wundt in the psychological part of his *Principles of Morality*.<sup>1</sup> There we are told that these distinctions are purely conceptual, determined by the point of view from which we observe a series of inner events, the flow of consciousness itself being not concerned with them. "Every act of will presupposes a feeling with a definite and peculiar tone: it is so closely bound up with this feeling that, apart from it, the act of will has no reality at all. On the other hand, all feeling presupposes an act of will; the quality of the feeling indicates the direction in which the will is stimulated by the object with which the feeling is connected."

This view is developed in more detail from the standpoint of psychological analysis of content in the last edition of his *Psychology*. Here the affect (or Gefühlsverlauf) is taken as the ultimate of concrete affective-volitional meaning or intent and the affect (which as content, is a complex of feeling elements) may be called emotion, impulse, desire and will according to the nature of this movement or complex. "The question is no longer what specific conscious content the will is, but what aspect an affect must assume to become volition." This specific difference he finds (1) in the character of the end feelings of the affect and (2) in a certain meaning or intent of the total affect which can be formulated only in retrospective logical terms. As to the first point, conation or will process is an *affect* which through its movement produces a final feeling which in turn destroys the affect. It is the *final* feeling of relaxation which distinguishes the conative process from emotion. Again, in the entire affect, when experienced as conation, there dwells a *Zweck-richtung* which is realized in the relaxation of the end feeling. Primary conative processes, such as impulse, are affects with this meaning; secondary derived conation, such as desire and will, are affects in which certain single feelings and presentations, elements in the total affect, are singled out as the

<sup>1</sup>Wundt, *Ethics*, Vol. I., 'The Principles of Morality,' pp. 6 and 7. Also *Physiologische Psychologie* (5th edition), Vol. III., chapters 16 and 17.

motive for the final feeling of relaxation. This Zweck-richtung, which we retrospectively find the distinguishing character of affects with conative meaning, arises from arrest. So that 'desire is not so much the preparatory stage of an actual, as the feeling basis of an arrested conation.' The actual affect which constitutes desire may be viewed as feeling or conation according to the point of view from which it is observed. All these concepts are finally logical artifacts and not fundamental distinctions of content.

A similar view was, in all its essentials, developed by Brentano<sup>1</sup> before Wundt's present formulation, and developed, moreover, from the point of view of worth analysis. His well known claim that in a given series of affective-volitional meanings, a vital series of adaptation passing from feeling to will (as for instance the following, sadness, longing for an absent good, desire to secure it, courage to undertake to secure it, decision to act), it is possible at no point to make an absolute distinction between feeling and will. It is rather a continuous series of meanings in which these two aspects can be distinguished only relatively and conceptually.

The criticisms passed upon this conception by the upholders of the dualistic views are instructive as showing the contradictions involved in the theories which make these distinctions ultimate differences of content. The upholder of such a dualism must put his finger on the point in the series where feeling ends and conation begins. Ehrenfels finds it immediately after the first stage of the series. Sadness alone is pure passive unpleasantness. All the others have the active principle of desire in them. But both the superficiality and the contradictions in such an analysis become immediately evident. For what is involved? Clearly, to make the distinction at *this* point necessi-

<sup>1</sup>The considerations which were influential in this analysis of Brentano were precisely those which we have already taken cognizance of. If feeling be taken as identical with passive pleasantness and unpleasantness, valuation cannot be reduced to determination of conation by feeling, to pleasure causation. Feeling, it is true, viewed merely as pleasantness and unpleasantness, is present throughout the entire accommodative or vital series, such as that described above, but it becomes less and less significant in the latter stages where the dynamic tension aspect becomes dominant. Hedonic intensities become irrelevant redundancies and we have practically intensifless conation.

tates the throwing of the emotions of hope and courage from the feeling to the desire side of the distinction, as indeed Ehrenfels does, and the logic of such procedure would be to confine feeling to pleasantness and unpleasantness as passive and unspecified states. But even if this violence were done to appreciation and its descriptions, the superficiality of the analysis would come to the foreground. Can we say that sadness is pure passive unpleasantness? Certainly not. Already in the relatively passive state of sadness we have the preliminary stage of the accommodative reaction, the vital series. This is to be found in the expansion-tendency of the feeling. The concentration of images in this phase of brooding sadness, the expansion tendency of the feeling, contains already an immanent activity, differing only in degree from succeeding phases of more explicit conation. The fact of the matter appears to be that feeling seems to be *mere* feeling, and passive, only when we separate it, retrospectively, from the functional whole, the vital series of which it is the first phase. Prospectively, in the first phase of expanding feeling, is already contained a sense of the strength and extent of the conative system arrested, which passes without a break over into the relatively more active emotions, desire and will, acts which follow as the arrest increases in strength and duration. From the standpoint of these, the initial feeling, viewed as a *cause*, seems relatively passive.

If, on the other hand, we seek, as some do, to find the point of distinction between the more active affects and decision, at the end of the series, the only point of difference that we can find is again an end-feeling of relaxation. The origin of this end-feeling, and of the characteristic sensations which go with it, is to be found in the simple fact that the general disturbance, displayed in the series of affects preceding the moment of decision, has found a definite motor channel in some specific bodily movement or word-formation. But to separate this final phase, this end-feeling, from the affects which precede it, is again to give us a mere torso, an unreal abstraction. The entire vital or worth series is one, with a continuity of affective-volitional meaning. Each phase may be interpreted as conation or feeling according to the point of view from which it is observed.

(c) The consideration of these two attempts to mark off the active and passive aspects of experience—to differentiate, in terms of elementary content, the affective and conative phases of a total vital worth series—shows that such an effort must prove unsuccessful. If we abstract from the meaning which the attitude has by virtue of its place in such a series, the distinction between active and passive, and with it that between affection and conation, lapses. We have in these conclusions therefore, without further analysis, the grounds for our negative position with regard to the dualistic theories of feeling and will which find the worth moment in feeling conceived as passive pleasantness-unpleasantness or in desire, and for our criticism of any conception of causal determination between them. They afford positive grounds moreover, for our definition of worth as ‘affective-volitional meaning’ and for the view that the worth experience is a concrete feeling attitude, in which references to conation are always present and conative dispositions always presupposed.<sup>1</sup>

#### 4. INTERPRETATION OF THE MONISTIC THEORY; ITS RELATION TO THE DEFINITION AND ANALYSIS OF THE CONSCIOUSNESS OF VALUE.

(a) Nevertheless, while this duality, this distinction between feeling and will, is not one of elementary content, it is still a duality of meaning which becomes fundamental from the appreciative point of view. They are two *meanings* of the same general content, but what determines the difference in meaning? How is this differentiation to be understood? Our answer to this question must be in the general terms of the Identity theory,

<sup>1</sup>It is interesting to note that in a recent article, ‘The Nature of Conation and Mental Activity’ (*The British Journal of Psychology*, Vol. II., part 1) Professor Stout, while defining conation ‘as a complex experience’ which, however, contains as one of its elements ‘a simple and unanalyzable element uniquely characteristic of it—an element from which the whole derives its distinctively conative character’ (which he describes as felt tendency and which is not identical either with motor sensations or affection), nevertheless admits that this felt tendency and affection, though distinguishable, do not occur separately, and he proposes to use the term ‘interest’ to express the unity of conative and affective characters in the same process. I cannot see that this view differs essentially from the one developed here. As analyzed by Professor Stout, these two aspects are retrospective abstractions.



that is, that the difference can be described only in conceptual, logical, retrospective terms. By this it is meant — to make the general statement more specific — that this duality, this distinction, is one of recognitive and selective meaning. The passive or active meaning is one which the attitude gets by reason of its place in the vital series and one which becomes explicit only when the attitude is viewed in relation to preceding or succeeding phases of the series. They are differences of genetic mode.

If we seek to characterize retrospectively these two modes — if, in other words, we seek to convey their internal meaning, after the fact — we find that we can do so only in terms of cognition, by description of the cognitive presuppositions of the attitudes. According to Wundt, the special aspect which an affect must assume to become volition, is an immanent *Zweckrichtung*, and this aspect can be understood only as change in cognitive attitude, not in content. In this connection the attempt of Münsterberg to characterize the distinction is instructive. “In feeling,” he says, “an object, independent of us, is interpreted through conation (*Trieb*). This *Trieb* remains, however, as overtone and as a help in apperception of the object, thought of as independent, which we judge in feeling. If we make the object dependent upon us, so that we perceive it as retained or excluded, then we experience conation and impulse but not, properly speaking, a feeling.”<sup>1</sup> Now, to make the object dependent upon us is to assume its existence or non-existence, as the case may be, that assumption being motivated by the subjective control of the disposition presupposed. To think it as independent of us (which according to Münsterberg’s analysis, we do when we feel rather than desire) is to judge or assume its existence or non-existence, the motivation of the cognitive act being, in this case, a control of a more objective origin and character. The significance of this analysis is to be found in the fact that the distinction between feeling and will (conation) is one which, in the last analysis, is reducible to a difference in the immediate functional meaning of a germ content and that, when this meaning is retrospectively described, such description involves recourse to cognitive presuppositions.

<sup>1</sup> *Grundzüge der Psychologie*, p. 360.

There can be no doubt, however, that this difference in immediate functional meaning, though retrospectively describable only in terms of cognitive attitude, is really *implicitly* present prior to explicit cognitive acts of judgment and assumption, below the level of worth experience — that this duality has its germs in the simplest types of organic accommodation and habit. The ‘dependence upon’ or ‘independence of’ subjective control, which on the higher level is explicitly cognized in acts of judgment and assumption, is implicitly felt in the fundamental attitudes of habit, and accommodation after disturbance of habit. If we view in this more external way such a vital accommodative series as that described by Brentano, we find that what distinguishes the phases which are predominantly affective from those predominantly conative is the degree of inhibition of a presupposed disposition or tendency. Whether we call the phase in question feeling or will depends upon the point in the process of accommodation in which we, so to speak, catch the experience. In the Brentano series the first stages are characterized by the apprehension of the object as relatively independent of the subject (in this case the apprehension is judgmental) — and in introspection they are interpreted as feeling. In the later stages, the object is apprehended as more and more dependent, until in the last phases, the belief or judgment that it will be accomplished enters, and voluntary decision has been reached. Likewise, when Wundt describes the relation in the statement that ‘feeling may just as well be looked upon as the beginning of a conative process, as on the other hand, will may be conceived as a complex feeling process, and that the affect is a transition between both,’ he is distinguishing different phases of one accommodative process.

(b) With this conception of the nature of the fundamental duality in meaning of feeling (as passive), and desire, volition (as active), we are in a position to justify our definition and analysis of worth experience. Feeling and desire are differences of genetic mode, relative differences of functional meaning, not of content. The worth of an object is therefore its affective volitional meaning, and is given in feeling attitudes in which there is always reference, transgredient or immanent,

to conation. We describe the worth fundamental as feeling, or concrete affect, because pure passive affect and purely active conation are limiting terms in the series and really exist merely as abstractions. But the affective-volitional meaning, or worth, of an object, namely — *its relation to desire and conative disposition as interpreted through feeling* — becomes explicit only on the cognitive level where accommodation is in the form of cognitive acts of presumption, assumption and judgment. It is the actualization of the dispositional tendency, either in feeling or desire, through these cognitive acts, which gives to the feeling or desire that meaning which we described as worth.<sup>1</sup>

This leads us finally to the question of the relation between feeling and will, of affective-volitional determination in worth experience. We have seen from our critical analysis that no thorough-going relation of antecedent and consequent can be established between feeling and conation when conceived as two ultimate content qualities. The only sense in which feeling may be said to condition desire, or desire feeling, is that feeling always presupposes conative tendency and desire feeling disposition. The *disposition* is the significant concept in our definition. The feeling and desire dispositions are one and the same conative tendency and whether, when actualized, the disposition will give rise to feeling or desire depends upon the cognitive acts through which the object is brought into relation with the disposition, these cognitive acts representing accommodations after inhibition of habit.

The manner in which feeling is presupposed in all phases of experience described as desire, and conation is presupposed in all phases described as feeling, is well expressed in the second portion of Münsterberg's analysis already given.<sup>2</sup> In feeling the conation (Trieb) is present with the perception as 'overtone'

<sup>1</sup> Cf. definition of feeling of Value in papers already referred to.

<sup>2</sup> Münsterberg develops this point more fully in another passage in the same chapter: "Im Trieb ist die Wahrnehmung des Gegenwärtigen nur ein mitklingendes secundäres Element des Gesamten Inhalts, der sich auf die Zukunft bezieht, im Gefühl, dagegen, ist der triebmässige, auf die Zukunft bezogene Empfindungescomplex nur ein farbungegebender Nebenfaktor der Wahrnehmung. Das Gefühl ist ein Trieb im Dienste der Wahrnehmung, während im reinen Trieb die Wahrnehmung sich dem Streben unterordnet." (*Grundzüge*, p. 361.)

as part of the meaning, as means of interpreting the situation. With equal right it may be said that in the predominantly passive experience which we call feeling, conation is present (in the transgredient and immanent references) as overtone, as part of the meaning of the feeling. The various modes of this meaning we have already analyzed in the earlier articles. The importance of this entire conception lies in the fact that it disposes of that complete distinction between feeling as passive and conation as active which, when made absolute, leads to the dualistic conceptions already criticised and to inadequate conceptions of worth determination. It enables us to look upon the relatively pure feeling and will as limiting concepts and to include all worth experience, even the æsthetic, under our general definition of affective-volitional meaning.

In conclusion it may be pointed out that in this conception of the nature of feeling and will and of their relations we have a psychological basis for the study of the *laws* of valuation. The concrete laws of valuation are not reducible to general laws of feeling, abstracted from conation, nor of desire abstracted from feeling, but rather of affective-volitional process conceived as a whole. If we apply the term *interest*, employed by Stout in the connection already referred to, to designate conative process in its two-fold aspect, we may quite properly speak of these laws as laws of interest, laws of acquirement of affective-volitional meaning.<sup>1</sup>

<sup>1</sup>The MS. of this article was received in September, 1906.—ED.

## A FOURTH PROGRESSION IN THE RELATION OF MIND AND BODY.

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If all signs fail not, the valiant inconclusiveness of philosophy is giving way. No doubt the lists are still crowded and battle cries resound but there seems to be, withal, a new eagerness as of hope long deferred coming to pass. It is, then, natural, to enquire to what this is due. If a squire who has his spurs yet to win, may venture an answer, it is, 'To science, especially to psychology.' Now this is not spoken to encourage that lusty youngster, for he needs none, his boisterousness and self-assurance being, the rather, a cause of anxiety to the poor metaphysician who, at times, harbors the suspicion that he is pitied by this one of his household as a grey dotard. Be that as it may, the rejuvenation of logic which promises so much, in the way of a clarifying of our categories, appears to be the result of the stimulus of social intercourse with psychology and scientific methodology. (Cf. Baldwin's *Thought and Things* which Angell describes as 'a striking example of functional psychology evolving into logic.' The *Studies in Logical Theory* might be spoken of in similar terms.)

With this as a sort of philosophical palinode, giving due notice of my peaceful intentions, may I advance a criticism of some recent tendencies by way of orientation? I shall put it in the form of a question. May not function win out at the expense of structure through the erection of a false antithesis between them? Reconstruction, change, experimentation, all these are of great importance and deserve the recognition they are receiving, at last, but organization is just as real. "Our experience is constantly undergoing modification; there are no final truths." Yes, certainly; but our experience is not a flux. We build up vast constructs whose complexity only the scientist (taking science in the sense of *Wissenschaft*) can realize. Of

course, I would protest against the imputation to myself of a radical misunderstanding of pragmatism, such as witnessed to in Joachim's essay on the *Nature of Truth*. Yet, must not the functionalist and, with him, the pragmatist widen the scope of their outlook to history and sociology and behold the slowness of this reconstruction in many important phases of human life? I am inclined to maintain that each individual's experience is a microcosm in the making (at least, this is its transcendental idea, as Kant would phrase it) and that advance is not linear but a complex process of development, working through organization. (Cf. Stout, *Analytic Psychology*, Vol. II.) That this is not contrary to functional views is evident from the following. "Functions, on the other hand, persist as well in mental as in physical life. We may never have twice exactly the same idea viewed from the side of sensuous structure and composition. But there seems nothing whatever to prevent our having, as often as we will, contents of consciousness which *mean* the same thing." (Angell, this REVIEW, March, 1907.)

Howbeit it is not my intention to engage in general criticisms or commendations, which would be as valueless as uncalled for, but to re-analyze a problem which lies on the border between psychology and metaphysics and which, therefore, is of peculiar interest to both. To attack this Gordian knot may argue to some undue temerity or the breezy rashness of the novice but, perchance, it may keep the World-Mephistophiles engaged while a wiser spirit outflanks him. My earnest conviction is that here is the point where reality is exposed, as it were. Were I to need further defense, a recent utterance of a leading psychologist would suffice. "No courageous psychology of volition is possible which does not squarely face the mind-body problem and in point of fact every important description of mental life contains doctrine of one kind or another upon this matter." (Professor Angell, *ibid.*)

In his brief reference to the problem, Professor Angell makes such a good analysis of the manner of approach adopted by recent writers that I cannot do better than quote. "The position to which I refer regards the mind-body relation as capable of treatment in psychology as a methodological distinction rather

than a metaphysically existential one. Certain of its expounders arrive at their view by means of an analysis of the genetic conditions under which the mind-body differentiation first makes itself felt in the experience of the individual (Baldwin). This procedure clearly involves a direct frontal attack on the problem. Others attain the position by flank movement emphasizing, to begin with, the insoluble contradictions with which one is met when the distinction is treated as resting on existential differences in the primordial elements in the Cosmos." Thus, considerable unanimity has been developing of late years in regard to the methodological character of the theories of physiology and psychology in respect to this relation. "Our task in discussing their relation is not to transcend a given dualism, but to get rid of one which we have manufactured for ourselves by the manipulation of experience in the interest of certain special scientific problems. Hence, as Münsterberg well puts it, we have not to find the connection which subsists as an actual fact, between body and soul, but to *invent* a connection in keeping with the general scheme of our artificial physical and psychological hypotheses." (Taylor, *Elements of Metaphysics*, p. 315.) Wundt gives an admirable statement of his own position in his *Ethics* and, since it is to defend himself against misunderstanding, may be regarded as authoritative. "Mechanical causality is thus a subordinate form of psychical causality. But in the case of all empirical relations, where psychical processes may be regarded from an external point of view, these processes may either be assigned to the complex of psychical events by virtue of their immediate characteristics or may be ranked within the causal nexus of mechanical processes by virtue of their external sensible aspect." (Wundt, *Ethics*, Vol. III., pp. 44, note, and 51.) "The psychical and the physical are incompatible only because we have made them so in the development of our scientific description of the universe. The distinction is a functional one, instrumental to the practical ends represented in their methodological demands." (H. Heath Bawden, *Philosophical Review*, 1903, pp. 315-16.) With such agreement, one is, at first, inclined to wonder why the problem still remains. Why do some thinkers hold still to interaction, while others vow allegiance to parallelism? Angell de-

cidedly hankers after some kind of interaction as he must, perforce, since he holds that the mind mediates between the environment and the needs of the organism. As he expresses it: "This is the psychology of the fundamental utilities of consciousness." (Cf. also, his *Psychology*, Ch. III.) On the other hand, Professor Baldwin advocates parallelism, yet insists on a psycho-physical evolution since he, too, holds consciousness to be no negligible factor. (Cf. *Development and Evolution*, Ch. I.) There must be some ghost here which will not down and, since metaphysicians are supposed to prowl about in weird and unseemly realms and delight in unsolvable problems, this must furnish a situation peculiarly inviting. My endeavor will be, then, to consider Baldwin's presentation in the light of recent definitions of the physical and psychical. I hope to give reasons for a fourth progression and to deduce some interesting conclusions therefrom.

According to Baldwin (this journal, 1903), there are three 'progressions': (1) the 'projective progression' which reads projects become personal-pr. and thing-pr.; (2) the 'subjective progression' which reads personal-pr. become subject-self and object-self; and (3) the 'ejective progression' which reads object-self become mind and body—the last alone representing complete dualism of body and mind. "We find that to think of body as presentation is in accordance with progression (3) to think other minds with it as presentation and this involves by progression (2) thinking of one's own mind as presentation. In other words, it is impossible on this hypothesis to take any other than a purely *phenomenalistic* or *presentational* view of both sorts of objects, body and mind. The procedure which involves treating other minds as objective phenomena and, at the same time, maintaining the psychic point of view with reference to one's own mind is illegitimate." (*Ibid.*, p. 230.) "It is only in the one case of the relation of *one mind to one body* and *that its own* that such a point of view is still held. In the theory of interaction the attempt is made to justify this remaining case." (P. 239. Read context.) Here is where Baldwin is untrue to the genetic position he otherwise so well sustains. He does not go far enough. On the other hand, the psychologist when holding to some form of interaction is seeking



to adopt a fourth progression which he sees only vaguely. He is really trying to escape from the *physical world considered as a closed universe*, a construction which as Wundt among others has pointed out is untenable. "In consequence, our experience of the constancy of objects has crystallized into the notion of matter as an absolutely permanent substrate of phenomena. It is a concept purely hypothetical in character, but it has proved very useful in the establishment of further principles; and it is, in particular, the foundation of all those laws of constancy referred to above as giving to natural causality its peculiar feature." (*Ethics*, p. 45.) The very nature of the postulates involves, a closed system. But, if the physical and the psychical are merely instrumental distinctions in experience, as modern logic seems to show, this cosmic character of the physical cannot be accepted. To resume: in the third progression, the object-self is looked upon as  $M'/B$ . This is read back into ourselves "because the theory requires that the view reached should cover the case of the relation of another person's mind to his body and that would mean his *mind presented as object to an onlooker in the same sense that his body is presented as object.*" (*Ibid.*, p. 232.) Baldwin's analysis here is excellent.

Now, what occurs when we move from the psychological point of view, as this undoubtedly is, to the psychic? (Cf. Baldwin's *Dict. of Philos.*, sub verbo.) Do we advance to a higher point of view, genetically speaking, or retrogress? I am strongly inclined to maintain that a new progression is the consequence of such a changed standpoint, and I would designate it the progression of 'duplication.' Each individual is now put on the same basis and regarded as having a unique psychic life. "The only states of consciousness that we naturally deal with are found in personal consciousnesses, minds, selves, concrete particular I's and You's. Each of these minds keeps its own thoughts to itself. There is no giving or bartering between them. No thought even comes into direct *sight* of a thought in another personal consciousness than its own. Absolute insulation, irreducible pluralism, is the law. It seems as if the elementary psychic fact were not *thought* or *this thought* or *that thought* but *my thought*, every thought being *owned*. \* \* \* The

breaches between such thoughts are the most absolute breaches in nature." (James, *Principles of Psychology*, Vol. I., p. 226.) I advise careful study of these pages. We hear too much of experience-in-general without mention of the owner. If this be the change that overtakes *M'* of progression (3) how must *B* be affected by it *since the terms must be on the same level*. In the third 'progression' *B* is *my* presentation, a part of my psychic experience, just as *M'* is. With the advance to this new progression, *B* must be reinterpreted. If *M'* becomes unique, must not the other also? To many ears, to advocate the assumption of what corresponds to a psychic point of view with regard to the body, may sound strange, but, before a too hasty decision is reached, let us ask what it implies. Philosophers have so long resided in a world of unincarnated sensations and thoughts, acknowledging, only in their uninspired moments, the facts of death and birth, that the mere suggestion of such an attitude may be looked upon as sub-dignitate. The conventional horror raised by the term 'thing-in-itself' has prevented a thorough reinterpretation of it in the light of recent biological and neurological facts. It is, however, noteworthy, that here, as elsewhere, the heretic is to be found preventing stagnation. Professor Strong has argued at considerable length that other consciousnesses are 'things-in-themselves' and James, in the passage quoted, seems to support similar views; at least, his pluralism has, here, its *raison d'être*. "Another man's mind, then, is in the strict sense of the term, a non-empirical existence; something real yet inaccessible to my immediate knowledge; as much so as material or mental substance and differing from them only in the nature of that which is inferred." (Strong, *Why Mind Has a Body*, p. 216.) The criticism one is inclined to pass upon Strong is that he did not approach his subject genetically and logically. Genetic social psychology would have prevented his famous theory of instinctive belief in other minds, and logic, his panpsychism. There has been, as a consequence, an unfortunate neglect of this valuable emphasis on the isolation of minds. To return. Must not *B* (organism) drop out of my experience in the same way that *M'* (mind) does? At present, there seems to me no possibility of avoiding this conclusion if

our genetic postulate is not to be violated, that *the two terms must be on the same level*. Let us cast about, nevertheless, for corroboration.

It is not difficult to discover. That every individual's experiencing is dependent on what we call his organism is a common-place of neurology and of pathology to-day. I could refer to the researches of Kraepelin, Ellis, Flechsig and others, but it would be a work of supererogation. Neurology not only has proved cerebral localization, but has discovered that consciousness arises only in a circuit of at least five neurones involving the Golgi cell type II. (Cf. an article, *Journal of Philosophy, Psychology and Scientific Methods*, where the present argument was given in outline, Vol. IV., No. 1.) Now, it would be absurd to assert that another individual's consciousness is dependent on *B*, my presentation; at least, we do not usually credit ourselves with creative power of this kind. From this side, also, we are, accordingly, forced to admit that *B* passes out of my experience, just as *M'* did. Moreover, *B* does not, then, become part of the second individual's experience, else would his experiencing depend on a presentation in his experience. Strongest of all is, I think, an appeal to death. Upon the individual's demise, the body remains. These are trite facts but their full significance has not, it seems to me, been recognized.

If these arguments are correct, a *peculiar form of Agnosticism* results which no one, to my knowledge, has developed. It will be the further task of the remainder of the article to accomplish this, and, in so doing, I hope to indicate the possible solution to two very important problems: What is the individual? How can two minds know the same thing?

I stated that this position leads to a form of agnosticism; I might better have said it results in a reinterpretation of the word, 'know,' and I wish to develop this to avoid misunderstanding. As is easily discernible, the thesis is purely naturalistic in its implications and outlook and has no place for an unknowable of the Mansel-Spencer variety. We are limited to our experience? Certainly; but who would wish to transcend it? To those who have understood Hegel the very question is meaningless. The real and vital question is what sort of ex-

perience have we? In the first place, if my argument holds, 'reality' becomes a more inclusive term than 'experience,' existentially speaking. Once prove that the organism is *more than* the individual's experience and you can't stop short of the other objects in relation to the body. All metaphysicians seem to admit this. The organism is in the same complex evolving world the rocks and trees and air and waters are. The individual's experience agrees with reality in the sense that it mediates the individual's activity in relation to reality. It is as a lamp unto his feet. It is adaptive. Of course, the accommodation must not be limited to the so-called physical world; the environment is also social, but the social is sustained by the physical, without it, the social could not be made perfect. And here I may include pragmatism, giving it its due place in a metaphysics. Thus Professor Dewey's view of agreement as equalizing success must be interpreted by subsumption under the category of 'accommodation.' Our universe is a process including organizations of various grades seeking adaptation. "You cannot get a fixed and definite color sensation, for example, without keeping perfectly constant the external and internal conditions in which it appears. The particular sense quality is, in short, functionally determined by the necessities of the existing situation which it emerges to meet." (Angell, this REVIEW, March, 1907, p. 17.)

This doctrine, if granted, does, of course, give the death-blow to naïve realism. I do not know how Professor Angell will relish the deduction of agnosticism from his thesis of the utility of consciousness, but that it points in this direction seems undeniable, though the word 'know' must be reinterpreted in the light of the teleological nature of consciousness. We must not demand a sort of knowledge that is impossible, even unthinkable, and then cry out about an 'unknowable.' There is, first, the selective character of our sense-organs to be reckoned with. "To begin at the bottom, what are our very senses themselves but organs of selection? But of the infinite chaos of movements, of which physics teaches us that the outer world consists, each sense-organ picks out those which fall within certain limits of velocity. To these it responds, but ignores the

rest as completely as if they did not exist. \* \* \* Attention, on the other hand, out of all the sensations yielded, picks out certain ones as worthy of notice and suppresses all the rest. \* \* \* The mind selects again. It chooses certain of the sensations to represent the thing most *truly*, and considers the rest as its appearances, modified by the conditions of the moment." (James, *Psychology*, Vol. I., pp. 284-5.) Thus, to know how things act and function is all that is necessary. You don't want to intuit some mysterious essence. Naturally enough, as soon as the absurdity of the old idea of 'knowing' is realized, one will not need to use the term 'agnostic.' To know about an ionized solution is not to intuit some mysterious reality or have a true idea of it, but to know how the ions behave. In short, we can *handle* things-in-themselves; we can tear them apart, synthesize them, manipulate them in all sorts of ways, but can't *be* them. Stout has well brought out the importance of this for our knowledge of the world. "He may ideally analyze and combine in a mechanical way what he cannot actually take to pieces and put together again. He may even assume constituent elements which are beyond the reach of actual perception. \* \* \* Modern theories of atoms and molecules and of the motions of the particles of ether are examples of the highest development attained in this direction." (Stout, *Manual of Psychology*, pp. 505 ff.) Electricity, which is becoming so omnipresent, playing an important rôle in electro-chemistry, physical chemistry and biology, is not something to be copied. We desire only to know how it acts under certain definite conditions. It is only in the case of other individuals of like nature with ourselves that we can speak of knowing, in the sense of *content*, for we are in the same stage of evolutionary organization. Our agnosticism in comparative psychology in regard to the experience of the ant or fish should be instructive. As I said in a former article, 'epistemology must reckon with evolution, for, only thus, can it explain common knowledge by similarity of organization and relationships.'

We have answered, then, tentatively at least, and, by implication, the first question, What is an individual? Our conclusion is *naturalistic*, but not materialistic, since matter has

disappeared and left process. Everything points to the belief that conscious-experience is a functional part and expression of this individual in its selective relations to other individuals of various degrees of organization. Of course, when the grade of organization is very low we do not use the term 'individual.' We confine it to molar masses usually, though science has a perfect right to extend its application. This position agrees with the results of evolutionary science, satisfying its prime postulate, continuity, and is monistic. *This monism grants, however, James' pluralism.* As I said in the former article, 'different individuals cannot have experiences, in any sense, numerically identical.' Moreover, I do not perceive the need of any world soul or absolute to bind them together. The connection which makes this a *universe* comes through the organism and its responsibility to its surroundings, and, here again, it is a relation of functioning, a dynamic unity, with free interplay of parts. The higher the grade of organization the greater the independence; it is, thus, a freedom which is natural to the universe, and which is lawful. This will give a hint of the bearing of this hypothesis on ethics.

There is reason, moreover, to believe that the mind-body difficulty in methodology will gradually solve itself as biology and psychology determine more the categories of our thinking. Body and mind will grow into one another. Habit seems to offer, at present, some prospect of a mediating factor, for has it not been called, rightly enough, the pragmatist's thing-in-itself? Consciousness was looked upon as mysterious under the tyrannic reign of the exact sciences, with their impersonal and dualistic outlook, but it will secure its rights under a broader and truer naturalism. *Organization is the scientist's substitute for secondary qualities* and is coming to its own. This offers a way of escape from the merely quantitative. This may be seen, in chemistry, in the study of color compounds, in the so-called stereochemistry, in recent physics, in the examination of radium, uranium and actinium. Physics is, thus, becoming evolutionary and cannot escape quality in some form or other.

The answer to the second question follows logically. The identity involved in the common object must be interpreted

functionally, *i. e.*, 'similar organizations in similar relations will have like experiences' and will gradually come to recognize this likeness. *This likeness can only be relative* since individuals differ and cannot get into exactly the same relations. Genetic psychology will trace out the process. This is a very simple solution, I may be told, but that is a merit.

But, I shall be asked with some indignation, do you assume space to be actual apart from the individual's experience? Not space as an entity or as a form, I reply; still, I believe things to be mutually exclusive and in dynamic relation to one another. If, perchance, Kant's old dilemma be brought forward, as veterans usually are, *viz.*,— if space is real how can mathematics hold? Hence, space must be transcendently ideal though empirically real—I shall reply, it may be *both transcendently real and empirically real*. Let me explain what I mean indirectly. In a recent article, Stout advances the thesis that primary qualities are actually more real than secondary. He is rather vague and does not succeed in proving his point. Incidentally, however, he makes a statement that fits in with the position I have advanced, that we can handle things-in-themselves and tear them apart. "Finally, how can the internal content of a solid be resolved into any possible series of sensory presentations. Slice it as you will, you only disclose surfaces, not solid content but only the boundaries of solid content." (Aristotelian Society's *Proceedings*, 1903-4, p. 156.) Now, if the organism is, in the sense defined, a thing-in-itself and consciousness adapts it in its relations, we would expect some mechanism to enable consciousness to *shadow forth* these relations. I suggest that Flechsig's theory of the two great silent areas, frontal and parietal, which are whirlpools of association, the theory of local signs and cerebral localization for the parts of the body will solve this problem. There appears to be a sort of correspondence between the nervous system and the organism and its environment by means of the distance-receptors which tallies with the correspondence between consciousness and reality. The dominance of the distance-receptors of the head is very important in this connection. (Cf. Sherrington, *Integrative Action of the Nervous System*, Ch. IX.) The

experience of the individual is, accordingly, a 'microcosm in idea' focalizing itself in special situations to meet the exigencies of the organism in relation to the macrocosm of reality. Reality bends back upon itself by means of the brain whose terrific complexity few realize.

If this mirroring in consciousness by space of the dynamic relations of reality is a valid conclusion, we must not forget that our space is usually of two dimensions. We are seldom concerned with space above our heads or below our feet. The universe *as a process* must not, however, be interpreted in this fashion as a going forward as we go forward. That would be too anthropomorphic. It is a stereometrical process in which various organizations and systems of organizations beyond our conception are equilibrated, or are mutually conflicting and adapting. As a consequence, the dynamic relations of reality which stereometry shadows forth in a too passive way, because conceptual, appear to me more universal than time relations. Time strikes one as more personal than space. We always tend to look upon time as a linear process, a stream with a direction, the past-present-future flow. Accordingly, the statement that the universe is a process involves, for many minds, the flux-view or else some 'far off divine event. Hold to this dynamic, stereometrical view of process as primary and all that is avoided. But, if space has an infinite number of dimensions, may it not have an infinite number of directions also? At least two possibilities, therefore, seem to be open. Time must be interpreted stereometrically, or it cannot be applied to the universe as a process. Without developing this into its intricacies, this much can be said, that each *irreversible* 'process-system' has a time. Our solar system is an example of this. Each conscious individual, also, has his time series which he fits into the larger series. We have, then, perceptual, conceptual and common time.

It would be impossible in an exposition of this nature to justify my thesis in detail, nor shall I attempt it. Contrast and comparison with some current teachings may serve, however, to give its general trend. "What, then, is needed, I think, is a complete renovation of our ontological conceptions of mind



and matter in terms of a functional psychology of experience." (H. Heath Bawden, *Philosophical Review*, 1903, p. 311.) This seems clear enough and most of us, I presume, would second the statement but when we find the term 'experience' used continually in a vaguely impersonal way, we are disposed to ask—Whose experience? Must not 'experience' be conscious experience and, if we throw some hypothetical world-soul out of the reckoning, somebody's experience? If this were accepted, I would modify Dewey's doctrine of 'Immediate Empiricism,' in accordance with it. "Immediate empiricism postulates that things — anything, everything, in the ordinary or non-technical use of the term 'thing'—are what they are experienced as." (*Journal of Philosophy, etc.*, Vol. II., p. 393.) I would restate this after the following fashion — In an individual's experience things are what they are experienced as. This would save the position from the strange *reductio ad absurdum* of 'Reality as Experience.' For me, truth, experience, and reality are terms with different meanings, although, of course, experience is real.

A recent movement, seeking to reinstate realism, seems to confuse logic and metaphysics. Personally, I do not understand how a functional psychologist, or one acquainted with Berkeley and Kant, could be a naïve realist. The view presented here, is of the critical sort. "I shall, accordingly, use the word consciousness, to mean experience that is essentially the private and unsharable experience of one person and I shall conceive such experience which for each one of us is a certain streaming of objects of the private type as contrasted with objects that are public and directly observable by anyone so far as their own nature is concerned. \* \* \*" (Bush, *Journal of Philosophy, etc.*, Vol. II., p. 567.) Now this is, to me, a logical distinction more clearly worked out by Baldwin in his *Genetic Logic*. (See pp. 146–8.) We are here engaged with distinctions in the social-individual's experience and, thus, the *soi-disant* realists are working out the side of organization neglected by the pragmatists.

I have confined myself as closely as possible to psychology and logic. If the progression of duplication holds good, certain hypotheses might be propounded which would lead us farther

into metaphysics and science. We are in a world greater than ourselves and each must say, 'De Profundis.'

"Out of the deep, my child, out of the deep,  
When all that was to be, in all that was,  
Whirled for a million æons, thro' the vast  
Waste dawn of multitudinous eddying light—"

Yet, the reverse is, also, to be pondered — "Does Charidas in truth sleep beneath thee? If thou meanest the son of Aremmas of Cyrene, beneath me. O, Charidas, what of the underworld? Great darkness. And what of the resurrection? A lie. And Pluto? A fable, we perish utterly." (By Callemachus, *Anthologia Palatina*, 7, 524.)<sup>1</sup>

<sup>1</sup>The MS. of this article was received May 26, 1907. — ED.

## SENSORY AFFECTION AND EMOTION.

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So influential a voice as that of Stumpf raised in favor of what has been long considered a lost cause in the psychological world, encourages me to make the admission that for a number of years I too have regarded the cause as far from lost, and to add my mite to the discussion. I feel different about doing so because I am writing in a remote corner of the earth where I have no library facilities, and only a few of the leading current periodicals, which reach me irregularly and whose files extend back but a year or two. If, therefore, even my mite of a contribution proves to be no contribution at all, but a mere repetition, I must beg for leniency. In any case I am well aware that I have nothing startlingly new to add. My only expectation was to bring together some of the recent discussions of the problem of affective processes in a somewhat new way.

The paper which prompted this one is entitled 'Ueber Gemüthsempfindungen,' and appeared in the *Zeitschrift für Psychologie*, I. Abt., Bd. 44, s. I. For the benefit of those who may not have Stumpf's discussion freshly in mind, I will give a brief summary of it. I wish to make it a starting point for what I have to say.

Stumpf's thesis is in general that the sensory affections are themselves another class of sensations, coördinate with those already recognized. There are two other views which have been held, one that sensory affections are mere attributes of sensation, and the other that they are elements of consciousness of a different order from sensations. The first view he considers sufficiently refuted by Külpe's well-known arguments on the subject. The second rests chiefly on three distinctions between sensation and affection, (*a*) that sensory affections seem to belong in the same class with emotions in that both are pleasurable or painful, and since emotions are not sensations therefore no

member of the same class can be; (*b*) that affections are subjective whereas sensations are objective; and (*c*) that affections lack the spatial extension and localization which many sensations possess. As Stumpf points out, (*a*) has no force for a follower of the James-Lange theory of the emotions, but he is not an adherent of the theory. For him, too, however, the argument is invalid because he believes that the classification of sensory affections and emotions in the same category is not justified. The emotions proper are, in his opinion, distinguished by a peculiar "kernel" which is distinct from the muscular and organic accompaniments, and which is entirely lacking in pure sensory affection. The distinction on the basis of subjectivity, (*b*) Stumpf considers unsatisfactory because not verified by ordinary introspection. The 'plain man' does not regard pain as subjective in any other sense than some other sensations. He is entirely ready to admit that the sweetness of an object consists merely in the way it tastes to him, just as the painfulness of another object consists in the way it affects him. Furthermore, it is not always true that sensations give information about the external world. There is a whole class of well recognized sensations, muscular sensations from the internal organs, which tell us only of the condition of the body itself. Finally, the distinction between the ego and the external world rests upon a complex mass of experience and cannot logically be made the basis for a distinction between classes of elements of conscious experience. The third argument, (*c*) is easily disposed of since it contradicts verifiable facts. Pain and certain kinds of pleasantness and unpleasantness undoubtedly have both volume and localization as definite as that of many well recognized sensations. Since, then, none of the arguments in favor of making affective experiences a separate class of elements holds, Stumpf regards it as logical to consider them sensations.

The remainder of the paper is divided into three portions, a discussion of (1) pain sensations and the pleasure sensations arising in the skin and vegetative organs; (2) the affective tone of the higher senses, and (3) applications.

1. Stumpf of course discards the view that the sense quality

of pain is a pricking sensation to which is united an affective element of intense disagreeableness. It seems to him that only a theoretical prejudice in favor of separate affective elements has led to this view. The painfulness of a pain sensation is itself its sense quality. "Pain is simply painful. The most discriminative psychology cannot change that." If one talks of agreeable pain sensations, he can only mean a state in which pain and pleasure sensations coexist. Although Stumpf does not stop to call attention to the fact, this statement reveals his opinion of another of the distinctions frequently drawn between sensation and affection—that there can be but one affection at a time in consciousness whereas there may be many sensations. Stumpf, like Royce and Calkins, evidently does not think the statement introspectively correct. Of course if pleasure and pain are sensations, there is no more reason why they should not coexist than there is why one's face should not be warm and his hands cold at the same time. Very conclusive evidence for the fact that pain is a separate sensation has recently been furnished by the experiments of Von Frey, who succeeded in isolating pain sensations by peripheral stimulation. The existence of delayed pain, both under pathological conditions, and normally after certain stimuli such as a needle prick, has long been known and is additional evidence of its sensory nature.

Though we have made no approach to a similar isolation of pleasure sensations, Stumpf believes that we have examples of them in the tickling and itching sensations of the skin, and in the sense of bodily well-being. Whether these sensations are due to the stimulation of pleasure nerves, corresponding to the pain nerves, he leaves an open question. Their assumption he does not regard as necessary to the theory. Certain pleasant and unpleasant experiences must be conditioned by purely central activities, and it is possible that all pleasure is so conditioned.

The algedonic sensations leave behind them memory images which bear the same relation to the original sensation as in the other senses. Külpe believes that the important difference between sensation and affection is that sensations can be represented in consciousness whereas affections can only be reinstated. As we have seen, Stumpf questions the fact. He thinks it pos-

sible to have a memory of a pain in the same sense that one has of an odor, though the power to call up memory images is not universal in either case, and images of algedonic sensations easily pass over into hallucinations.

2. The feeling tone of the so-called higher senses he considers under two headings, the case of excessive stimulation, and that of moderate stimulation. The former is easily dealt with. Excessive stimulation affects both the specific nerves and the pain nerves. The fact is most evident in pressure and temperature stimulations. It is in accounting for the feeling tone of moderate stimulations, especially in the case of tones and colors, that the difficulty comes in, a difficulty increased by the very slight intensity of the affective experience. The theoretical reasons for regarding the faint agreeable and disagreeable experiences as accessory sensations are the same as in the case of the more intense experiences. The greater difficulty in accepting the theory is that it is hard for us to so much as imagine the agreeableness of a tone or color in isolation from the given sensation. If it is merely an accessory sensation, it should be possible with effort to form a separate image of it. Although Stumpf does not feel sure that such an isolated image has ever been formed, he thinks it not impossible that it should be. In the case of the more intense algedonic tone which comes with color and tone combinations, and with tastes and odors, some observers assert that it is possible to form an image of the affective tone, quite independently of the sensation to which it belongs.

3. Stumpf believes that this view of affection has the advantage of offering a natural explanation of many facts which caused difficulty to the old theory. The complete and partial analgesias and hyperalgesias become cases of anesthesia or hyperesthesia. The delayed pain sensations cease to be an anomaly. The indifferent states cause no difficulty, and the independence of affective tone from sense quality is easily accounted for. Furthermore the facts known about sensation and the methods elaborated for its investigation may now become applicable to sensory affection. This formulation he also considers more helpful in the attempt to give an account of the genesis, both individual and racial, of sensory affection.

While I have long felt that regarding pleasure and pain in their simplest terms as themselves sensations, leads to the most satisfactory view of consciousness as a whole, I still think with Stumpf that there are introspective difficulties in the way. To my mind the greatest of them is in finding any experience of pleasure which at all corresponds in definiteness and simplicity with its supposed opposite pain. Stumpf suggests tickling and itching sensations as the typical pleasurable experiences from the skin, but itching is to most people a distinctly painful experience, and tickling easily becomes so. The traditional view of the two is that both are complexes of sensations. The nearest approach to simple pleasurable experience from the skin which I can find in my own case is the sensation arising from a gentle rubbing with some soft surface. There is something akin to a faint itching in this sensation, and it is perhaps what Stumpf has in mind as the typical pleasurable skin sensation.

While granting the introspective difficulties, I still consider the reasons for Stumpf's view as of far greater weight than those against. The point at which I find myself at variance with Stumpf, which is of course the one I wish to discuss further, is that of the relation between the simple sensory affections and the emotions. The question is one which Stumpf distinctly shuts out from the present discussion, but he states his belief that the emotions are quite a different type of experience from the simple sensory affections, and that a sharp line should be drawn between them. The grounds for this belief he has published more in detail in a previous paper to which he refers, and to which unfortunately I have no access here. However, he does in this paper state the point at which my view of the emotions, and consequently of their relation to simple sensory affections differs from his own. Stumpf does not believe that the James-Lange theory of the emotions furnishes a correct analysis of them. He holds that stripped of the various accompanying muscular and organic sensations, an emotion still remains an emotion. There is in the emotion of fear a 'kernel' of fearsomeness which is not destroyed when all the muscular and organic sensations have been dissected away from it. To me, and to all the adherents of the theory it seems equally

plain that the emotional aspect of the experience does indeed consist in the mass of muscular and organic sensations. They seem to be an integral part of the emotion without which it would cease to be an emotion at all. In such a deadlock of introspective analysis, argument seems to be of little avail. What I wish to do is first to state a little more fully the view of the relation between emotion and simple sensory affection which seems rational to one who holds that Stumpf has established his thesis with regard to simple sensory affection, but who also holds to the James-Lange account of the emotions; and second to point out the general conclusion with regard to the nature of consciousness as a whole which seems to follow.

To one who combines these two points of view the relation between sensory affection and emotion is merely that between a simple and a complex state of the same type. As I understand Stumpf's analysis, the composition of a simple sensory affection, such as a pleasant sweetness, is the two sensations sweet and pleasant. The total state of consciousness may be, and probably is, much more complex than this, but none of the other simultaneous constituents are to be considered as integral parts of the simple sensory affection. Just how he conceives the emotional 'kernel' I do not know, but evidently the stuff of which it is made up is something other than sensation. He would, I suppose, analyze an emotion into a central cognitive content, the emotional kernel, and as an adjunct, a mass of muscular and organic sensations. To which of these constituents he would assign the pleasantness or unpleasantness of an emotion, I do not know. If it belongs to the emotional kernel, and is accordingly non-sensational, it is hard to account for the common factor between this class of algedonic experiences and the simple sensory affections. If it is one of the accompanying sensations, it is non-essential to the emotion itself — a view quite opposed to all accepted doctrines.

But pointing out the difficulties in a theory which I do not myself thoroughly understand is probably only displaying my ignorance. Let me turn to the aspect of the question in which I feel more confident, the advantages of the alternative view. According to that view there is no sharp dividing line between



simple sensory affections and emotions. The simplest conceivable case of a sensory affection, in the usual acceptation of the term, is a pain sensation without organic or muscular accompaniments. It possesses but one quality and that is painfulness. The next simplest case is a state consisting of some other sensation, for instance, temperature, accompanied by an algedonic sensation as secondary. Beyond this there seems to be an unbroken series of increasing complexity occasioned by the addition of various organic and muscular sensations as secondary, and by increasing complexity in the central perceptual or ideational content, which ends only with the most complex emotion. If then we analyze any simple sensory affect or emotion, leaving aside those simplest limiting cases which exist rather as logical limits than as actual states, we find the same constituents — a presentational or representational central content with an accompanying mass of sensations in which pleasantness or unpleasantness and muscular and organic sensations are prominent. When the central content is largely representational, and the accompanying mass of sensations is complex and intense, we call the experience an emotion; when the central content is presentational, and the mass of accompanying sensations not very complex, we call the experience a sensory affection. The decreased complexity is usually due to the lesser number of muscular and organic sensations.

Within this series of experiences there are many on the border line between sensory affection and emotion which might equally well be classed with either one. Consider, for instance, the state occasioned by a sudden, unexpected, loud sound. As a very unpleasant sensory experience one would feel inclined to call it a sensory affection, but in this case there are present a sufficient number of muscular and organic sensations to give it an emotional tone. A friend who is peculiarly susceptible to colors can never describe the experiences they give her without telling of the cold shivers that run up and down her back. In such cases shall we call the state an intense sensory affection or a slight emotion? To me it seems immaterial. In fact, in most cases of sensory affection, careful observation reveals the presence of muscular and organic sensations which seem to me

to play their part in determining what we call the affective tone of the experience.

The question is closely bound up with that of the number of distinguishable affective qualities — a question which is of course not decided by regarding pleasure and pain as sensations. The algedonic sense may be, like the temperature sense, one which possesses but two opposed qualities, or it may possess two opposed classes of qualities, though the latter conception offers logical difficulties which I shall not stop to discuss further.

Stumpf recognizes the possibility that the apparent differences between the various kinds of sensory pains may be constituted by differences in the groups of organic and muscular sensations accompanying them, together with variations in the intensity and extensity of the pain sensations themselves, but he finds this explanation unsatisfactory in the case of the higher senses. It seems to him impossible to regard the unpleasantness of a bad odor or of a discord as having the same quality as a pure pain sensation. Most psychologists admit that even in the states usually classified as simple sensory affection there are present a certain number of muscular and organic sensations as well as the characteristic quality, and the algedonic factor. Many go even further and admit that this group of sensations plays an important part in determining the general tone of the state of consciousness. Angell in his new psychology (p. 331) says, 'All consciousness, to be sure, seems to be toned more or less by the sensory reactions which arise from the constant overflow of neural excitement into the muscles, and in so far every psychosis has an element of emotion in it.' But they are all unwilling to admit that this mass of sensations plays a part in determining the *affective* tone of consciousness. That they regard as a pleasantness or unpleasantness which must be a single simple factor. To make the case concrete — an intense sour sensation is usually unpleasant and is usually accompanied by distinct sensations of muscular contraction from the muscles and glands behind the jaws. The question is, would what we ordinarily call the unpleasantness of a sour taste be the same unpleasantness without these muscular sensations? To me it seems not. In other words the affective tone in this case seems

to me not simple but complex. The feat of isolating the mere unpleasant sensation from the invariable muscular portion of the experience is a very difficult piece of introspection and one which we are not often called upon to perform. The unpleasantness and the muscular sensations form a unified group, and it seems to me clear that it is this group which we mean in ordinary language when we talk about the unpleasantness of a sour taste and insist that it is different from other kinds of unpleasantness. This is merely to apply the James-Lange theory of the emotions to sensory affections as well. The affective tone, then, of a sensory affection is usually not a totally unanalyzable portion of consciousness, just as the emotional tone of an emotion is not. In the cases where there is least complexity there seems to be no difficulty in identifying the unpleasantness with the quality of a pain sensation. For instance, an intense but localized temperature sensation is accompanied by an unpleasantness which is readily recognized as of the same quality as isolated pain. In such an experience as a discord or an unpleasant color combination the unpleasantness is much less intense and the muscular sensations much more prominent. The unpleasant odor nauseates us and the discord sets our teeth on edge and makes our flesh creep. Here the identification is very difficult and to many seems impossible. The final appeal is to introspection and an introspection which is most difficult. One is in danger of being unduly influenced by the alluring simplicity of the view which recognizes but a single quality of pain or pleasure. Now I do not pretend to be able to analyze completely that which we call the affective tone of an experience. Moreover, as I shall explain later, I believe this disability to be inherent in the nature of the case. Nor am I able to isolate introspectively the mere unpleasant factor of a bad odor and of a discord and assert that they are of the same quality as pain. But it does seem to me quite evident that what we ordinarily call the unpleasantness of these two experiences is in both cases a complex, and that it is at least very possible that if we could isolate the mere sensation of unpleasantness from the more or less vague group in which it always occurs, we should find it the same in both cases. The logical difficulty of accounting

for the fact that such varied experiences are all classed as pleasant or unpleasant would then disappear. The case would be one of similarity on the ground of partial identity.

In discussing the number of qualities to be recognized in the algedonic aspect of experience, it seems worth while to add a word of comment on the experimental method which has been employed to gain evidence on the subject—that of recording the modifications of circulation and respiration coincident with affective states. The work has been done under the assumption that pleasure and pain were an independent order of elements, but it would have the same application on the theory that they are sensations. The assumption underlying the experiments seems to be that if it could be shown that a given supposed element of consciousness were accompanied by a constant set of physiological changes in breathing and circulation, it would establish the claim of that content to be an element. In contesting this view I may perhaps be fighting a man of straw. It is difficult to find an explicit statement of it in the literature, and some of the more recent work, such as that of Shepard, is clearly exonerated from any suspicion of it. Nevertheless, much of the earlier experimentation seems implicitly based upon it. A few years ago I took the trouble to make a comparative study of the series of investigations in question, summarizing the results in tables. The manuscript has never seen the light of publication, but is still in my possession, and by reference to it I can make some detailed statements of results. One series of experimenters, Féré, Lehman, Mentz, Meuman and Zoneff, Brahn, Gent, and Boggs, find antithetical physiological processes in the breathing, vasomotor, or pulse activities, one or all, which are correlated with pleasantness and unpleasantness. Another set, Angell and his co-workers, Shields, Binet and Courtier, Bonser, and recently Shepard and Kelchner, failed to find such a correlation.<sup>1</sup> Recently Wundt and his students have attempted to furnish evidence for his tridimensional theory by the same method. Brahn and Gent both carried out elab-

<sup>1</sup> A bibliography for the earlier part of this series of papers may be found in an article by Angell and Thompson, *PSY. REV.*, VI., 32, 1899; and for the later part in one by John F. Shepard, *Am. J. of Psych.*, XVII., 522, 1906.

orate and careful experiments. Each one found a set of results consistent with itself, and in accord with the theory — three pairs of antithetical physiological processes corresponding to the three pairs of affective qualities — but they failed to agree with regard to the exact nature of the physiological change characterizing each of the three affective pairs. Before discussing the theoretical interpretation of these results, I would like to point out one more fact which is significant, the fact that those workers who failed to find the correspondence in question were those who used the greatest variety of stimuli, and that Wundt's students who failed to agree about the physiological changes characterizing the pairs strain-relaxation and excitement-depression, used very different stimuli to incite these states. For instance, for stimulating excitement Brahn used certain odors, high tones, and noises, while Gent used the suggestion that the subject should try to increase voluntarily the volume of one arm. Boggs, who repeated Brahn's work, using the same stimuli, obtained the same results.

Now in the discussion of these results carried on between Titchener and his pupils, and the Leipzig school, there has been no question of the fundamental validity of the method. The mutual criticisms have been directed merely against methods of experimentation and of dealing with the curves obtained. But what can be the basis of the assumption that a constant set of physiological processes means an elementary conscious state? To be sure, we have a general doctrine that two closely similar conscious states will have similar physiological accompaniments. It is further true that relatively simple states are more easily reproduced at will than complex ones. But the question of an element of consciousness is a question of absolute, not of relative simplicity. It is more than possible that there are in consciousness certain relatively constant groups of sensations which are readily reproduced, and if so they would have relatively stable physiological accompaniments. For instance, suppose that Wundt establishes his thesis that strain is always accompanied by a given set of changes in pulse and breathing — does that prove that strain is an *elementary* conscious state? Certainly not. It would merely prove that it is a relatively stable

and easily reproduced state of consciousness. In the experiments in which the writer participated some years ago, the most constant set of results obtained was that for mental application to simple arithmetical problems, but that was not considered evidence that mental application is an element of consciousness. Just how similar two states need to be in order to have the same sort of physiological accompaniments, we do not know, but it is fairly certain that they do not need to be elementary. I must repeat, therefore, that it seems to me impossible that the method in question should furnish any positive evidence on the question of the content elements of consciousness.

If one adopts the view which has been presented here, a certain remodeling of the general formulations of psychology becomes necessary. Stated from the point of view of content — the aspect of consciousness in terms of which the discussion has been carried out — it means that the ultimate product of any and every analysis of the content of consciousness must be sensations. To put the matter a little more accurately — when the final discriminations possible to analysis have been made, the discriminated contents are all sensations. The affective elements seem to have met the fate which long ago overtook the conative elements.

Whether or not the term *element* is one which can properly be applied to these simplest discriminable contents of consciousness is a further question which I should answer in the negative. The point has been ably argued by Miss Gordon.<sup>1</sup> The logic of her contention seems to me irrefutable. An element is, as she says, a content which is completely homogeneous and not further analyzable. "There can logically, of course, be only one final element, since opposites always have a common ground." Now each sensation can be distinguished from some thousands of others, and must therefore have many grounds of distinction within it. I also agree with Miss Gordon in her view that the discriminated portions of consciousness do not exhaust its content. There is always present an undiscriminated background of which we can, of course, say but little. The usage Miss Gordon seems to favor is to apply the term affection to this

<sup>1</sup> *Jour. of Phil., Psych. and Sci. Meth.*, 1905, II., 617-622.

undiscriminated background of consciousness. With certain concessions which, I take it, Miss Gordon really makes herself, the usage strikes me as most happy. I should wish to extend the term affection, or affective tone, to cover not only the undiscriminated background of consciousness, but the relatively undiscriminated portion which is with difficulty distinguished from it, as well. In so far as we have succeeded in making discriminations within this affective realm, the sensations revealed are those of pleasure and pain, muscular, and organic sensations. Miss Gordon seems to have such an interpretation in mind when she tells us that 'feeling is the relatively simple,' that 'there are many different feeling qualities,' and that 'an emotion is largely made up of muscular stimulations.'

If this usage be adopted, a distinction must be made between the affective tone of an experience and its algedonic tone. The latter depends upon the intensity of the algedonic sensations, the former upon the total organic reaction of the organism to the stimulus. This reaction frequently involves sensations of pleasure or pain, but need not necessarily do so. The distinction does away with one of the difficulties in the older formulation which always seemed to me very great. If the affective tone of an experience consists merely in its pleasurable or painful quality, then it must follow that every experience which is strongly affective—such as a strong emotion—must be either intensely pleasurable or intensely painful, whatever else it may be. To my introspection, nothing could be a more evident distortion of fact to fit theory. The question as to whether a given emotion is pleasant or unpleasant is often very difficult to answer. It was experimental work on the affective processes which first called my attention to this fact. When left for some time in a state of reverie while the plethysmographic and respiratory records were being taken, emotional memories or ideas which caused marked modifications of the curve sometimes occurred. The experimenter always demanded to know whether the emotions were pleasant or unpleasant. Somewhat to my own surprise I often found the question most baffling. Anger is, in my own case, the emotion par excellence in which the algedonic tone is slight, if present at all. Nor is the diffi-

culty disposed of by the admission that pleasure and pain may coexist in consciousness. Many emotions, as Royce points out, are characterized by their simultaneous presence. In fact in my own experience, pleasant emotions, if at all violent, have an unpleasant element in the very fact of their intensity. Feeling myself given over to any violent emotion, even though I recognize that it is a desired experience, is in so far unpleasant. But there are other cases, notably anger, which are intense without being either pleasant or unpleasant, or both, to any marked extent. In other words, the emotionality of an experience does not at all run parallel with its algedonic tone, as the accepted theory requires.

The classical division of psychological phenomena into the cognitive, conative and affective realms cannot, on the view advocated, be regarded as based on the kind of content into which they can be analyzed. They are distinguished on the side of content merely by the grouping of their constituent sensations, presentative or representative. Roughly we may say that in states which we call affective, algedonic sensations, and vaguely recognized sensations of an involuntary muscular or organic type are prominent. In those called conative, sensations either presenting or standing for voluntary movements are most important, while the cognitive states are distinguished by the predominance of the various sensations which mediate a knowledge of the external world. But though these differences hold roughly and for many states, the fact remains that no thoroughgoing distinction between these kinds of consciousness can be made on the basis of content alone. The function of the state in question must always be taken into consideration.

Though the discussion has been carried out on the basis of content analysis, the whole matter may gain in clearness by being restated from a functional and genetic point of view such as that taken in Angell's *Psychology*. The condition for the appearance of primitive consciousness in the individual is a lack of ready-made adjustment to environment, requiring a readjustment on the part of the organism. At first this readjustment involves a general discharge of nervous energy throughout the body, bringing about a more or less aimless response of the whole organism. On the conscious side, since this is a first ex-



perience it is of course an unanalyzed experience. It is James' 'big blooming buzzing confusion,' which is nevertheless not recognized as a confusion; it is an 'original continuum,' homogeneous to the experiencer. If we are to name it in terms of subsequent analysis, it must of course be called an affective state. It is in fact the only conceivable state which is pure affection. As experience progresses, responses to frequently repeated stimuli become organized in definite channels of discharge, while discrimination of content gradually breaks up the homogeneity. To the extent to which responses become organized and adapted to the stimuli which occasion them, they cease to involve the whole organism, gradually lose the organic and muscular factors, and consequently their affective tone disappears. They may finally become reduced to mere perceptions with little or no affective tone. But there always remain other situations for which there is no ready-made response and which do therefore cause a vague stirring up of the entire organism, *i. e.*, a strongly affective state.

Thus it comes about that within any developed consciousness we can trace a series of states from slight affective tone to intense emotion, corresponding to the extent to which responses to stimuli have become reduced to habitual reactions. In so far as responses are unorganized by habit, they belong on the conscious side to the unanalyzed background of consciousness out of which definite experience is constantly emerging. Discrimination within consciousness means the presence of organized response on the side of habit. The process of the development of intelligence is a gradual differentiation of the cognitive from the matrix of the affective, coincident with a progressive development of habitual activities. The primitive man is a man of feeling in that he is a man of few discriminations and simple habits.

From the functional standpoint, one or two more of the distinctions often quoted to prove the disparateness of sensation and affection lose their force. It is often stated that whereas sensations become more distinct and fixed in consciousness with repetition, affections fade and eventually disappear. The fact that affections fade and eventually disappear with repetition is exactly what we must expect if our account of conscious proc-

esses has been at all correct. As we have shown, responses which were at first vague and general, and consequently strongly affective, become organized in definite habitual channels of discharge, and therefore lose their affective tone. To deal with the matter completely, I should have to add that I do not believe the truth of the statement with regard to the cognitive contents of consciousness. But that would take me too far afield.

A point closely related to the one just discussed, though not identical with it, is that the cognitive and affective contents of experience are asserted to behave differently when attention is turned toward them. If attention is fixed upon a cognitive content, it develops and grows richer, whereas an affective content attended to, fades and disappears. The classic example is that as soon as one begins to analyze an emotion, the emotion is destroyed. This again is what must be expected if an affective content is due to the reflex response of the whole organism to a given stimulus. As long as attention remains fixed on the characteristic stimulus, for instance, the thing that is making us angry, the reflex response continues and we remain angry. But suppose attention to be turned to the emotion itself. We begin to try to analyze the various sensations involved. Now organic or muscular sensations are not the normal stimulus for anger and therefore when attention is turned toward them, anger ceases. The anomaly which met the old theory in the case of physical pain, becomes additional evidence for the correctness of this view. Pain is not due to a reflex response of the organism, but to the direct stimulation of a sensory nerve. So long as attention remains fixed on it, it behaves like other cognitive contents — remains distinct and often increases in intensity. The way to get rid of physical pain is to turn attention away from it, and get it absorbed in something else.

Since writing the above, I have come upon a review of a monograph by Rolf Lagerborg, Leipzig, 1905, which leads me to think that he has taken the same ground that I have here, and has gone much further in physiological explanations. I have, of course, not seen the original.<sup>1</sup>

<sup>1</sup>The MS. of this paper was received May 31, '07. — ED.

## DISCUSSION.

### AN EXPERIMENTAL COURSE IN ESTHETICS.<sup>1</sup>

I wish to give a brief sketch of a course in esthetics for which — it seems to me — there is a real demand. I have given this course repeatedly and am under the impression that the students who took it derived more benefit from it than they would have derived from a course following the old-fashioned lines, defining the 'beautiful' and the 'sublime' and informing the student on the historic development of esthetic theory from Plato and Aristotle up to the year 1907. I present this sketch of a course in order to call forth criticism and discussion.

By an experimental course I do not mean a technical course in which the student is taught how to perform experiments and take measurements, but a course in which theoretical knowledge is conveyed by the help of experimental demonstrations in class.

A student who specializes in philosophical studies wants, of course, information on the history of esthetic theory. Such information, however, can be obtained as well from reading books as from listening to a lecturer. The number of students who want such a course is small compared with the number who find themselves again and again puzzled by questions like the following :

Why does Mr. *X* enjoy this piece of sculpture which is to me little more than a piece of stone? Why does Mr. *Z* say that he does not care for that picture with which I decorated my study? Why are some people able to spend delightful hours in the galleries of a museum, while to me the most delightful moment during a visit to a gallery is the one when I discover that I am approaching the exit?

Answers to such questions cannot easily be found in books. The student who seeks these answers needs the guidance of an instructor. And the course which I wish to describe attempts to help the student to find them experimentally, to derive them from his own observations made in class.

It is plain that in a course of this kind one cannot require the student to have any knowledge of the history of art, or any familiarity

<sup>1</sup> Read before the joint meeting of the Western Philosophical Association and the North-Central section of the American Psychological Association, Chicago, March, 1907.

with the technic of drawing, painting, modeling; or carving. The very students who do not possess such knowledge and have but little time to acquire it, are most likely to ask questions like the above and seek for answers. I do require, however, that the student shall previously have taken a year's course in general psychology covering the whole field, from sense perceptions to emotions, from the ordinary activities of daily life to the unusual actions of a temporarily or chronically abnormal human being. Otherwise the course might assume the features of a kindergarten course instead of those of a college course; and only thus can time enough be found to obtain experimentally, within a single semester, answers to the questions of practical esthetics, answers which are to be of permanent benefit to the student in his conduct of life.

Such words as 'beautiful, sublime, ugly' are scarcely ever used during the course; and their use is discouraged. The use of such words would unavoidably narrow down, from the start, the field of esthetic inquiry to the limited area covered by the meaning accidentally associated with them in the student's mind. To illustrate this, let me mention the case of a student who — at the end of the course in question — says that he has never applied and will never apply the word 'beautiful' to a statue in the nude, but that the course has made him comprehend why perfectly decent people will place such statues in a museum or use them to decorate their homes. Another student says that he can never call a Verestchagin war scene anything but disgusting, but that he has come to understand why such a painting may properly find its place in a public or private museum or library.

The most serious mistake which can be made in an experimental course of instruction in any science consists in overemphasizing those experimental methods and results which are predominant in the recent research literature of that science or which have been particularly investigated by the individual instructor giving the course. Much harm has been done to psychology in general by this mistake having been made by some men in charge of psychological courses. The result has been the still wide-spread belief of the public that an experimental course in psychology consists in discussing and performing all manner of experiments in order to test the validity of the Weber-Fechner law — a law which is of but little more concern to the psychologist than to the representative of many another science. I have tried to avoid this mistake, to have in mind the interest of the student rather than that of a few investigators who happen to be his contemporaries.

Instead of beginning the course with a definition of 'the beautiful,' or of 'the esthetic' or 'art,' I begin with a practical problem by showing the student two lantern slides, representing actual scenery, and asking him to answer the following question: If you found yourself momentarily free of all mental occupation and had nothing else to do in order to while away your time but to inspect either the one or the other of these pictures, which one would you select for this purpose? This is a question which every student immediately comprehends and feels entirely competent to answer. The pictures used for this purpose are not reproductions of works of art. I do not wish to give the student from the start the impression that the esthetic experience is restricted to the perception of artistic creations. The pictures are lantern slides from a collection intended to serve the purpose of instruction in geography, representing scenery from all parts of the globe, some by chance ranking rather high esthetically, some ranking exceedingly low. But this variety of degree is an advantage rather than a disadvantage. I have divided these slides into two groups, according as they contain water in the shape of ocean, lake, river, brook, or no water. The reason for this division will become clear later. Each group contains about twelve or fifteen slides.

I then show the class the pictures of one of the above groups in pairs, presenting each pair long enough for each member of the class to answer the question as to which he would select for looking at if that was his only possibility of whiling away his time. The number of votes of the class are then recorded in a list containing as many columns as there are pictures. Picture No. 1 is first presented together with No. 2, and the votes are recorded in the proper columns. No. 1 is then presented with No. 3, and so on until No. 1 has been shown together with all the other pictures of the group. Now No. 2 is shown together with No. 3, with No. 4, etc. This takes of course several hours. The votes recorded in each column are then added together. The sums thus obtained, of which the largest are many times multiples of the smallest, can be regarded as representing a measure of the relative esthetic value of the pictures for the group of human beings making up the class.

In order to enable the class to discuss the pictures, they must be given names. I do not tell the class the actual names, because these would inevitably influence the judgment, a fact which agrees with a statement recently made by Professor Lillien Martin who found that even knowledge of the artist's name influences the esthetic judgment concerning a painting. Being told that of two river views one rep-

resents the Rhine valley, the other an unknown region in Canada, the subject feels constrained to prefer the Rhine. I therefore ask the class to propose themselves suitable names by which to refer to the pictures.

While it is very important to obtain esthetic measurements valid for the class as a whole, the individual differences must not be obliterated. I therefore have each student—in particular those who cast their votes with the minority—write down in his note book a statement of the fact that he belongs to the majority or minority and also of the reasons—if he is conscious of any—why he would select this picture rather than the other.

Having thus collected material for discussion, it is our task to explain the relative values recorded by analyzing out of the pictures the esthetic factors influencing the judgment. For this analysis we need, of course, some guidance. What could guide us better than a brief description of the mental processes going on in an artist when he creates a work of art which is to exert esthetic influence over others? I therefore study with the class a description of these mental processes, and I use the description given by the distinguished German sculptor Hildebrand in his book *The Problem of Form in Painting and Sculpture*. Unfortunately, there is, as yet, no English version of the book, and the German edition is written in a style so difficult to read that the book cannot be given into the students' hands. I therefore present its contents in lectures. When I give the course again, an English edition of the book will be out.

I shall give here a brief outline of Hildebrand's book in order to make clear its contents and to show how these contents can help the student to analyze the esthetic experiences above referred to. There has been a good deal of discussion among writers on esthetics as to the question what Hildebrand's esthetic theory is and how it is related to other theories. As a matter of fact the book contains no esthetic theory at all. Hildebrand is the last person in the world who would claim to be a scientist, the promoter of a scientific theory, even in a science so closely related to art as esthetics. To comprehend his book, to use it to the best advantage, we must regard it, not as a theory of esthetics. but as the confessions of an artist with respect to his mode of thought when he is engaged in productive work. And this very fact that it is not a theory, but a confession of thought, makes the booklet extremely valuable in an experimental course on esthetics.

Hildebrand is chiefly a sculptor; but he asks us to regard him not merely as a sculptor; but as a painter and architect as well, when

reading his confessions. He tells us that when he creates a work of art he is conscious of one predominant aim, and this is: *to make the work of art clear and impressive as a visual percept*. All his varying thoughts during the process of artistic production are governed by this universal aim. The aim has three main aspects: (1) The perception must be a *visual* perception; (2) the perception must be *clear*; (3) the perception must be *impressive*.

That the purpose of painting, of sculpture, or of architecture is visual perception, would be a superfluous statement were it not that writers who are not — as Hildebrand is — productive in art, had actually tried to convince us otherwise. *E. g.*, A. Schmarsow tells us that 'the aim of the painter's art is the representation of the interrelations existing between the things of the world, *i. e.*, of the unity of nature,' which obviously is the aim of the scientist, but not at all of the artist.

Hildebrand tells us that he cannot create the clearest and most impressive percepts in works of art unless the creative imagination is visual too; and the psychologist will readily understand this, for it is no less true in psychology than elsewhere that like begets like. Not that other kinds of imagery are to be excluded: they are as important here as elsewhere in human activities. But they have to be translated into visual imagery before they influence the artist's productive hands. And when the artist tests his own work for its esthetic value, he tests it by the eye, as a visual percept, without any aid on the part of other sense organs. No matter whether his work is a painting or a statue or a building, its esthetic value is based exclusively on the characteristics which it presents as a visual percept.

What, then, are the requirements to be fulfilled in order to have a visual percept which is both clear and impressive? The artist tells us that, to have the highest possible degree of clearness, the external nervous stimulation must be as homogeneous as possible. The psychologist will be ready to understand this. It is but natural that, the more heterogeneous the external stimulations, the greater the possibilities for distraction of the attention, the less, therefore, the probability of that unity of mental activity which we refer to by the word clearness. Now, everybody knows that even in applying no other sense organs to a given situation than our eyes, the external stimulations are not exclusively those of retinal sensory elements, but also — as a rule — certain stimulations belonging to the sensory region usually referred to by the term kinesthetic. This is the case because, in ordinary vision, our eyes move, and some of these movements, those of convergence

and those of accommodation, resulting from the muscle fibers without and within the eyeball, furnish sensory stimulations of much importance for the interpretation of the retinal image. But these same kinesthetic stimulations, being heterogeneous with the purely visual impressions, are a possible and probable source of distraction to the artist's mind. He does not test, therefore, the esthetic value of his work by looking at it from close by, but by inspecting it from a sufficient distance, where convergence or accommodation no longer play their rôles in the process of perception. And, likewise, the imagination, which controls his hand, always consists in visual imagery representing things as seen from a distance. For the artist, then, all the esthetic values of visual perception are to be analyzed out of the percept of a distance picture, of a pure *visual projection*, as we may term it.

Another source of distraction to the artist's mind, interfering with the requirement of the highest possible degree of mental clearness, is the fact that in ordinary vision our consciousness does not directly correspond to our retinal image, but is manufactured out of two different images having their details more or less displaced relative to each other. Again the psychologist will readily understand the artist's feeling of a lack of unity, of a deficiency in the mental clearness to be desired, when his consciousness corresponds, not to the direct sensory stimulation, but to an indirectly stimulated nervous process, made up for the occasion according to nervous habits well suited to the practical demands in the struggle for life, but not adapted to the purpose of a playful activity of the mind. This lack of clearness is eliminated by the artist in the same manner as the one just mentioned, simply by making the visual projection, the distance picture, which is identical for both eyes, the exclusive material of both his productive and receptive mental activities.

Further conditions, however, have to be fulfilled in order to give the visual percept the highest possible degree of mental clearness. The artist requires that the act of forming a percept, a unitary group, out of the innumerable sensation elements presented be made as easy as possible so that no effort may be experienced, but the playful attitude of the mind be preserved. For this purpose the horizontal and vertical directions in the visual field must be clearly indicated by familiar objects such as a tree standing on level ground and throwing a shadow upon it. Other means may be used, of which the artist makes no direct mention, but which psychologists have begun to study in recent years, actual symmetry of form, or, more frequently, a quasi-



symmetry of attention values. Hildebrand, since he does not pretend to offer a scientific theory, makes no effort to obtain a complete list of the various factors which can be pressed into service. He is satisfied with emphasizing the mere necessity of clearness in the two dimensions of the visual field, by whatever means this clearness may be brought about.

More important yet than the manner in which the objects are arranged in two dimensions is their arrangement with respect to their ability to arouse in us — in spite of our being limited to the visual projection — an absolutely clear and effortless perception of depth relations. Here we have a large field of esthetic investigation in which practically nothing has been done thus far by psychologists. Hildebrand tells us that he obtains his end chiefly by two means, by arranging the various objects in a comparatively small number of successive planes, and by choosing the objects for representation in the various planes in such a manner that the observer cannot help reading off their depth values from the front of the picture into its depth.

It is but natural that the clearness, the so-called repose or unity, of the perception must be greatly enhanced by the objects not being scattered all over the three-dimensional space but being found in a small number of planes, meaning by 'planes,' of course, layers of a certain thickness. If they are arranged within these planes in such ways that each plane offers a perfectly clear two-dimensional percept, there is but one problem left, that of uniting these planes in one act of perception, in order to obtain a perfectly clear percept of the total space with all its contents.

For the purpose of uniting the planes Hildebrand's chief requirement is that the observer be made to read off the distance values of the planes in a serial order, beginning from the front. Again there is no difficulty in understanding this requirement on psychological grounds. Whenever our eyes in actual life sweep along a line in the direction of the third dimension, as when we look over our writing desk, or over the lawn in front of our house, we practically without exception fixate a near object first and farther and farther points of interest in succession until we have reached the most distant point visible. Having acquired a strong habit of this kind, it is plain that the ease of perception would suffer if, in inspecting a picture, the imaginary eye movement would proceed otherwise, *i. e.*, if any plane other than the front plane of the picture (in painting; and no less in sculpture or architecture) would attract our attention first, and the less distant plane or planes later. Here again Hildebrand does not

attempt to solve the psychological problem, what the conditions of visual sensation or perception are which favor and which are opposed to this direction of our reading off movement. He is satisfied with emphasizing the fact as being of the greatest importance in his own creative thought and with illustrating it by a few examples.

The third requirement is that of impressiveness. Clearness obtained by emptiness of the situation would have little, if any, esthetic value. The spatial contents presented to the eye must have a meaning, must represent life. The artist tells us that life does not invariably mean to him actual movement; it may mean merely possible movement. The spatial contents presented arouse in the artist feelings of activity or of character by which activity is governed. And these feelings can be strong, the impressiveness of the visual percept can be great only when the spatial contents consist of objects which possess typical spatial forms, which are types of activity or character, for example a sinewy hand, or a strong jaw, and when the spatial arrangement itself fulfills the requirements of clearness so that there is mental energy enough available to perceive the life of the spatial contents, subtracting the energy necessary to perceive the total space. Life must be represented in the picture, but the question what kind of activity, what kind of character this life consists in, is regarded by Hildebrand as a question which does not concern the artist as artist, which concerns only the individual as individual.

Having made the students acquainted with the artist's mode of thought as confessed by himself and just given in outline, and, indeed, *while* making them acquainted with these thoughts, I ask the students to analyze out some of the esthetic factors effective in our experiments by trying to apply the artist's mode of thought to the pictures which we arranged in a series according to their esthetic effectiveness. The students now easily separate the individual factor from factors which are of universal application. One of them is much interested in a picture because a group of human beings apparently resting after a day of labor are visible in the foreground and arouse a strong emotional response. Another one prefers a picture because it contains a hilly pasture reminding him of childhood days. Aside from such individually effective factors there are now discovered features which are of more universal application, which exert a determining influence on the esthetic judgment of all the members of the class. And it is at once admitted that the latter factors are those which should be studied here, by this class, for that we have our individual preferences can scarcely be regarded as a fact to be studied in a course on esthetics,

but, perhaps, in a course on individual psychology. It is also admitted that thoughts of human toilers, of a playground of our childhood days, of a Madonna and Child, so far as they are subjects of esthetic inquiry, are not exclusively based on *visual* perception, but may be conveyed by poetry or prose, and must therefore be studied in a further branch of esthetics, separate from the problems which have come thus far to constitute our center of interest.

Why, then, is a certain picture clearer and more impressive than another picture and receives thus a majority of the votes? Some of the instances illustrating the rules of two- and three-dimensional arrangement are noticed by the students directly, others by the help of an indirect method to be mentioned farther on. Such facts as real symmetry, or quasi-symmetry may be observed directly. The effect of the presence of water, referred to above, may also largely be grasped by direct inspection. Not that water in itself is particularly pleasing to look at. Not everyone has pleasant associations derived from swimming or boating or other water sports or from the pleasant experience of washing down his food. But water nearly always conveys a clear idea of the horizontal plane and thus aids in the perception of the spatial relations of other things.

The indirect method referred to is particularly useful in the study of the spatial structure in the direction of the third dimension, although it is entirely applicable and useful also for the study of two-dimensional arrangement. The method consists in cutting off from above or below, from the right or the left, larger or smaller pieces of the picture and studying the new picture with respect to the same question with which we started the experiments. This cutting off is easily done with lantern slides by means of strips of card board. We observe that frequently the resulting picture seems preferable to the original. And we have little difficulty in observing that this is the case because of the removal of an object which does not obey the rules of arrangement in planes and of reading off the successive planes from the front to the back. We observe that a picture which was given a rather low rank in our experiments can thus often be raised to an equal rank with pictures which previously appeared superior. Nevertheless, the life and character of the piece of nature represented may have remained practically the same as before. We can use these observations as illustrating the fact that in esthetics—if not in general, at least in esthetics as applied to art—the formal principles are of more fundamental importance than those concerning content, that the mere fact that a piece of nature, because of some accidentally acquired associations, pleases

someone is no excuse for representing it in art, unless its form makes it worthy to be represented. I do not mean, of course, that without this method of cutting off pieces of the picture we could not get along. Indeed, to some pictures it cannot be successfully applied. We use then the direct method for the study of the esthetic effectiveness of the architectonic of the picture. And here we observe another, indeed the chief effect of the presence of water in a landscape. A water surface easily breaks up the infinite number of details into readily perceptible groups. And if these groups happen to arrange themselves into larger groups, into a few successive planes, and if nothing counteracts, if everything aids our tendency to read off these planes from the front to the back, the esthetic effect is great.

It is impossible to enumerate here all the detail questions which can be asked and discussed by students and instructor. I wish to mention only one kind of such questions, those with respect to the means by which our tendency to read off the spatial values from the front to the back can be aided, and with respect to the opposite effect which must be avoided. Hildebrand in his book gives a few instances answering this question. But many more may be found if we study pictures as my students do this in class. *E. g.*, if one of the objects of the first plane is conspicuous by mere size, or color, or light contrast, but otherwise uninteresting, it will serve to attract our attention at once to the first plane without unduly keeping it there. Facts like the one just stated appear cut and dried when stated in abstract form, but readily become a valuable addition to the student's store of knowledge if he derives them himself from immediate observation, applying the scientific laws which he has previously acquired in a course in general psychology.

Studying what I called the impressiveness of a visual percept by analyzing landscapes, the student easily discovers that the impressiveness of a visual percept is something different from what the ordinary man happens to call 'beauty.' The life and character of a landscape consist in the amount of spatial elements arranged for ease of perception. We may apply here the traditional esthetic term of unity in variety. The larger the number of spatial elements, in other words: the greater the spatial richness of the picture, the more intense is its life, the more pronounced its character. Whether the landscape stretches out for many miles or only a few yards, however, is irrelevant, for the absolute size of the spatial elements is a matter of arbitrary choice.

Turning now to sculpture, first to relief, then to sculpture in the

round, the student readily comprehends that the esthetic laws of visual perception are essentially the same here as in drawing and painting. He observes that all his previous observations can be repeated here, and he convinces himself of the absurdity of attributing to sculpture *objective* beauty, since sculpture is a thing to be *seen*, and not to be seen while we are wandering around it, but to be seen from a single point of view, that point of view from which the artist conceived his visual image of the picture. I need not describe in detail how I proceed in class with regard to these questions since I follow rather closely the lines of discussion chosen by Hildebrand in his book.

Thus far, no particular mention has been made in this course of the law of association upon which so much stress has been laid by Fechner. I now give my students some lectures on Fechner's principles of esthetics and let the students discuss them. It is found then that these principles are of much less esthetic importance than the formal laws of visual perception previously studied. Much esthetic effectiveness that seems to be due to association is really due to its influence on form perception. For example, what Fechner says about the associations based on color, is doubtless true, but practically rather insignificant. Saying this, I do not wish to give the impression of believing in color-harmony or in any other speculative principle of color esthetics. I do not believe that colors can be said to harmonize at all, and I give my students here the results of the psychological investigations of recent years, which clearly show that color-harmony is a meaningless term. But it does not follow that all the esthetic effectiveness of color must then be based on Fechner's principle of association. On the contrary, the great importance of color is to be found in its unifying and separating effects by means of which it aids us immensely in perceiving the spatial contents of a spatial whole.

There is no need of belittling the great accomplishment of Fechner in esthetics. His work is invaluable as a welcome reaction from purely speculative esthetics which was derived from metaphysical principles instead of being based on a study of the laws of the mind in esthetic perception. But it would be a regrettable illusion if psychologists thought that beyond the problems stated by Fechner none were left which offered themselves for an experimental investigation. I am inclined to believe that the problems of form (in all three dimensions), which are barely hinted at by Fechner, are those which promise the most satisfactory results to the experimental investigator.

The student is now well prepared to discuss critically the esthetic value of the discoveries made by artists of recent times, particularly

those of the impressionistic school. I give the class a brief outline of the theories in which the artistic tendencies of this school are usually described; and by the help of a few typical examples, I let them conclude themselves to what extent these new tendencies can really be regarded as new discoveries, to what extent merely as further elaborations of principles well known and employed by much earlier artists. Especially the color theories as applied to their technic by the impressionists are discussed here by the class. And this takes but little time if the members of the class are familiar with the physiological theories of color vision.

I finally give my students a survey of the general esthetic theories as proposed by recent writers. It is easy to show that—in spite of all divergence—they agree in regarding the esthetic experience essentially as a playful attitude towards a situation. The more adapted the situation is to be responded to in play, the higher its esthetic value. Such general theories can be discussed with a class more advantageously after the esthetic experience itself, in many variations, has become a perfectly familiar phenomenon to the student, than they can be taught while the student still has to guess what experience the instructor means when talking of the beautiful or the esthetic. If we apply the modern esthetic theories to the arts of painting, sculpture, and architecture, we can summarize in a few words by saying: An esthetic experience is a mental process of playing with a visual percept. And to make this clear to the student I have regarded as the aim of this course.<sup>1</sup>

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# THE PSYCHOLOGICAL REVIEW.

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## APPARENT CONTROL OF THE POSITION OF THE VISUAL FIELD.

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One of my students reported that she possessed the ability of moving upwards the entire visual field. This translocation first occurred involuntarily and after noticing the phenomenon the subject found by trial that it could be repeated at will.

During several conferences and tests the following account was obtained, giving the essential facts as to the nature of the phenomenon and the circumstances of its occurrence so far as the subject had been able to notice them: The subject is afflicted with hysteria. A rather severe attack occurred seven years ago from which she is slowly recovering. The involuntary translocations were first noted shortly after this time and they have occurred rather infrequently ever since. Fatigue and a prolonged fixation seem to be the conditions under which they occur involuntarily. The phenomenon can be produced voluntarily at any time and under any circumstances. The subject has refrained from much experimentation for fear of aggravating her mental condition. An object is momentarily fixated and then slowly raised upwards. The duration of fixation necessary before movement can be effected varies from one to ten seconds. The rapidity of the movement varies. The translocation is sometimes slow and gradual and is effected only by continuous effort; at other times the movement is more rapid and comes easily. Fatigue and brightness of the visual field decrease the time of necessary fixation and increase the rapidity and ease of the translocation. The extent and duration

of the displacement is under complete control. The extent of the movement may be anywhere from one to forty degrees. The field may be held stationary at any desired position, and then be moved on upwards or be brought back to its original position. The displacement has been maintained in one position for five minutes, though the continuous strain necessary is very fatiguing. The exhaustion due to continuous effort seems to be the only limitation of the possible duration of the phenomenon. Objects do not become double during the translocation; they are perceived only in their elevated position, although the subject is conscious of their original location, for she can at any time point accurately in that direction. The entire visual field participates in the movement, and all visual objects keep their relative positions to each other. The only noticeable change in the character of the visual objects is a slight decrease in their intensity, though they remain distinct and substantial in appearance. When the field is lowered to its original position, the visual objects receive an added snap of reality the moment they reach their real position. It is by this means that the subject knows when the objects reach their true positions. Both the upward and the return movements are consciously real; objects do not merely appear now in one place and now in another, but they appear to move as well. The objects do not move relatively to the line of sight. The object originally fixated remains at the point of fixation throughout the displacement; in other words the point of fixation participates in the translocatory movement. The visual field remains perpendicular to the line of sight, as if it were undergoing a vertical rotation about the head as a center. If a person is in the visual field his voice participates in the illusion. In the preliminary tests, the subject was requested to attempt other directions of movement but she was unsuccessful. Moreover, she was successful only with binocular vision, and when the eyes were in relatively unconstrained positions in the socket during the original fixation. With monocular vision or when the eyes were rotated far to the periphery, only a very slight and momentary displacement could be effected.

At first it was supposed that the phenomenon could be explained on the basis of one of three theories: (1) The trans-

location is effected by some ocular innervation which does not involve eye movement, but which shifts the space reference of the retinae. The phenomenon would thus be similar to the well-known illusion due to the paralysis of the external rectus. This theory was put out of consideration immediately by the very obvious fact that the eyes do not remain stationary, but rotate in the direction of, and in proportion to, the visual illusion. If the illusion were slight in extent one could not be certain of this fact, but a movement of thirty degrees that may be maintained for five minutes is too obvious for the most sceptical observer. The subject was asked to point out the apparent location of the fixated object, and it always coincided with the directional position of her eyes. (2) The second theory supposes that the eyes rotate with the illusion, the space reference of the retinae remains normal, but that a refractive change, a lateral or rotary movement of the lens, occurs whereby the rays from the real positions of the objects are kept focused upon the same points of the retinae in spite of the bulbular or retinal rotation. Such a conception is conceivable though its truth is not probable according to current views of ocular physiology. There is some factual support for such a theory, because the point of fixation, that portion of the field corresponding to foveal activity, is displaced and the image of the object originally fixated is still located at the point of fixation. Foveal positive and negative after-images were induced and developed before the translocation. These after-images representing foveal activity participated in the movement and were still located at the point of fixation. Although the eye has rotated upwards forty degrees away from the object primarily fixated, yet the image of that object must be due to the foveal activity of the retinae, for it is located at the fixation point and also at the same position in space as a foveal after-image. This theory was tested by making a phakoscopic examination of the behavior of the refractive surfaces. No unusual movements were detected. The lenticular images behaved in reference to the corneal image exactly as they did during a similar normal rotation. No refractive changes were in evidence. Ophthalmoscopic tests were planned but a more satisfactory theory was evolved before they were carried out.

(3) It may be supposed that the illusion is due to some disturbance in the sense of bodily position, which illusory disturbance is projected upon, or interpreted as belonging to, the objective field, the inverse of the haunted swing illusion, etc. There is no evidence in favor of this theory. The subject does not feel dizzy in the least. Her conceptual, or ideational, space is not affected; she can point out the vertical and cardinal positions, and the real location of the displaced objects although she may not see anything in that direction. Furthermore, if the theory were true, it would be necessary to assume some secondary principle, as a refractive change, in order to compensate for the effects of the eye rotation.

The next conception evolved to be experimentally tested may be roughly stated as follows: During the entire period of the displacement, the retinae are insensitive to all objective stimulations, and that which the subject sees is a hallucinatory positive after-image of the objects primarily perceived. This theory was suggested by two facts: (1) The subject is an hysteric, a temporary visual anæsthesia being one of the symptoms; (2) In the preliminary tests I noted that she was extraordinarily susceptible to positive after-images. A momentary glance at an electric light in daylight is sufficient to induce a positive after-image with a duration of seven to eight minutes. This conception proved to be true in the main. The tests were made at various times of the day with different conditions of illumination. Two series were made at night in a room illumined by a shaded Welsbach lamp. The remaining tests were made on bright clear days in a well-lighted room where the brightness of the background could be varied. The various experiments will be grouped around a series of propositions.

A. *The translocations may be in any direction and may be initiated and sustained by a movement of either the eyes, head, or body.*

At first the movements had occurred in but the one direction; at my suggestion the subject attempted other directions of movement but was unsuccessful. If the translocated visual field is a positive after-image, it would seem that any direction of movement should be possible. With this idea in mind, the subject

was directed to rotate her head slowly sidewise during an upward displacement. She did so and the displaced field moved likewise. The field could now be moved in any direction by either a head or eye movement. After this experience, the subject was able to start the displacement in any direction, the preliminary upward movement not being necessary. By turning the head and body, the field may be rotated to such an extent that the objects originally perceived no longer stimulate the retina. This result did not occur with the first displacements of forty degrees. The field may be rotated the full 360 degrees if desired.

During the preliminary tests, displacements could not be effected with monocular vision, nor when the eyes were in constrained positions. After several months of experimentation, the attempt to secure displacements under these conditions was repeated with successful results. The translocation was effected, but not readily, and the period of necessary fixation was longer than in the case of binocular vision with a normal position of the eyes.

*B. All new objects introduced into the field of vision during the displacement are not perceived.*

This statement does not mean that the stimulations do not affect vision at all; it means that these objects are not perceived as objects with their proper form, color and position so as to be recognized and located in space. At first the subject was kept in ignorance of the nature of the tests, and while she occasionally knew that something had happened to the visual field, she did not have the least idea as to what had caused the perceived changes. After being informed as to the nature of the experiments, she generally knew that some object had been introduced into the visual field but she had no idea as to its nature or location.

At night, she fixated a lighted candle near the wall some eight feet distant. After a displacement of fifteen degrees, a large bright yellow paper was thrust in front of the candle; it was not perceived. The paper was now put eight inches in front of each eye in succession, and then held at the same distance in front of both eyes for a couple of minutes. The paper

was large enough (16 in. square) to intercept the entire visual field, and a Welsbach light was so situated as to shine directly upon it. In neither case was the paper seen. A long series of similar tests was performed in bright daylight, the objects being introduced at different distances from the eye and in various positions in the visual field. A few typical cases will be described: After a twenty degree displacement, a book and a lighted candle were placed at the original fixation position. The lighted candle was moved back and forth a foot in front of her eyes. A bright paper screen was placed a foot in front of both eyes so as to intercept the entire visual field. The screen was kept in this position for two minutes. Again, the field was displaced so that the subject's eyes were directed at an electric light some eight feet distant. This light consisted of three sixteen-candle incandescents. While the eyes were held in this position, the light was turned on for fifteen seconds. This test was repeated a dozen times. In one of the tests the light was kept on for a full three minutes. In none of these cases were the objects perceived. When the visual field is moved more than ninety degrees, it is projected against an entirely new background of objects and these always remain invisible.

*C. Objects introduced into the visual field during the displacement, although not perceived, may affect the brightness, color tone and distance location of the displaced images.*

The effect varies with the brightness of the field originally fixated, and the intensity, extent, and duration of the stimulation introduced. If the objects displaced be very bright, while the stimulation introduced be of small extent or of weak intensity, no effect is noticeable. If the field be weak in intensity, and the stimulation introduced be intense, large and prolonged, a maximum effect results.

When the window was displaced in bright daylight and a book or lighted candle was placed at the original fixation position at a distance of ten feet from the subject, no effect was noticed. When the screen of bright yellow paper was passed close in front of her eyes so as to intercept the vision of one or of both eyes, a very dim shadow appeared to pass over the distant displaced field. When the lighted candle was thrust close

in front of her eyes, a marked pupillary reflex was evident, and a very dim pale yellow light was suffused over the distant field. The bright window and a dull yellow wall were successively displaced in the direction of the electric lights; this stimulation produced a pale yellow glare over the field, but the effect was much more pronounced in the latter case, *i. e.*, with the less intense field. When the image of the window was displaced against the electric light, no effect was noticeable at first; after a few moments the yellow light tinged the field and gradually became more intense as the stimulation was prolonged. After a few minutes the yellow glare contracted from the periphery and became concentrated in the center of the field. Probably in time the lights would have been perceived in this case, but the subject was not able to prolong the test over three minutes. A dull wall was displaced against a blackboard as a background at the distance of three feet from the observer. A lighted candle was held near the blackboard and directly in front of her eyes. At first there appeared a dim flare of yellow light which gradually contracted in size and increased in intensity. After four minutes the image of this candle broke through the displaced field and was perceived as a candle. This was the only case in all of the tests where a distinct perception of the object occurred, and even here the percept of the candle was described as being strange, hazy, and unreal in appearance, and much less intense than in ordinary vision. Furthermore, in this test the field had been rotated more than ninety degrees, so that the objects primarily fixated no longer stimulated the retinae, and, as shall be noted later, the stimulation from the real objects is effective in maintaining their displaced images in consciousness.

When the screen was placed close before both eyes so as to intercept the entire visual field, some of the displaced visual objects, after some time, appeared located at the distance of the screen as though projected upon it. The screen remained invisible and the subject was ignorant as to the nature of the experiment. In the first test the subject suddenly reached out her hand in order to point out the location of the image, and was greatly surprised when her hand came in contact with a

real object in that position. Only those images foveally perceived were affected in this manner, and their size was always increased in proportion to the nearness of their location. This fact is directly contrary to the usual results as to the size of after-images when projected on backgrounds of different distances from the observer. However, in the above case it must be borne in mind that the eyes remained adapted for the distant position, instead of becoming converged upon the invisible screen.

The retinal effectiveness of these new stimulations is genuine. The pupillary reflex is indubitable proof. The screen though not perceived influences the distance of the displaced images. The diffused yellow glare is undoubtedly due to the stimulation of the lights. The subject was ignorant of the tests in the majority of the cases so that the results probably cannot be due to conscious suggestion. The absence of retinal effectiveness might be shammed by the subject, but there could be no deception when retinal effects are present, unless she had knowledge of the nature of the experiments to be performed.

D. *The objects primarily fixated, though not perceived at their real positions, effectively influence in various ways their displaced images so long as their stimulations can reach the retina.*

This influence may be tested by displacing the field more than ninety degrees, by covering one of the objects with a screen, by moving an object in the field, or by removing an object entirely from the range of possible vision.

1. A removal of an object from the range of vision was finally effective in all of the experiments. A few cases will illustrate the general nature of the results. The electric lights were fixated and displaced about twenty degrees. Shortly afterwards they were turned off. The displaced image of the light immediately exhibited a marked decrease in brightness but remained visible during the continuance of the test. The writer stood in front of the window and was fixated by the subject. After the displacement, he suddenly dropped down out of the range of vision. After a half minute his displaced image disappeared entirely from sight, though the images of the other



objects in the field remained in distinct view. The place of image was not filled in by the surrounding visual content, *i. e.*, the bright light of the window. Neither was the window back of his body now perceived. The space was filled in by a homogeneous light gray content, a light shadow silhouette effect. Upon rising up again to the original position, a rather hazy image appeared to view but still in its displaced position. The subject was ignorant of the nature of the test. A book was held before the window and fixated. After the displacement it was removed, and in a short time its image disappeared. The book was now brought back into the field of vision, but it was placed a foot below its original position. Its displaced image reappeared, but at a position a foot below that from which it had disappeared. The test was repeated a number of times, the object being introduced into the field at various positions relative to its original location. The same results obtained; the reappearing image was always displaced from the true position of the object and bore the same spatial relation to its position of disappearance as the new location of the real object did to its primary position. The object was never perceived simultaneously in the two positions. The first image always disappeared before the second image was seen in the new position. The reappearing images were much dimmer than their originals and were always perceived with some difficulty. The objects were easier to perceive when brought back to their original position than in the case where they were introduced in a new position.

Since the existence of the image of the removed object depends upon the presence or absence of that object in the field, although the other images in the displaced field remain visible, it follows that the objective stimulations must be effective in maintaining the vision of their translocated images. Ignorance of the tests disposes of the possibility of any sham or suggestion.

The removal of an intensive stimulation from the original field thus produces a decrease of brightness in its displaced image. If the stimulation is weak, its displaced image finally disappears. If the object is returned to the field, perception occurs with difficulty and the new image is much dimmer than

the original one. The new image occupies the same relative position in the displaced field as the new location of the object does in the primary field.

2. Movement of an object in the primary field may produce a change of location on the part of its image. If the movement is slow, a perception of motion may result.

At night the writer stood in the field of view. During the displacement, the arm was lifted up slowly to a horizontal position. No movement was perceived at first. After the arm had moved about half the distance, the subject noted its new position and then perceived it in motion for the remainder of the distance. The perception was very vague and difficult. The arm seemed to be a mere transparent shadow, for the subject could look through it and see the visual objects past which it moved. The experiment was repeated while standing before a bright window. No movement was perceived; the arm was finally seen in its extended position, presenting a very shadowy and unsubstantial appearance, markedly different from the remaining part of the body. The electric lights were fixated and displaced ten degrees against a dull yellow wall. The light was then set swinging, pendular fashion, quite rapidly. The arc of movement was two feet in extent. The displaced image of the light was described as quivering in a vibratory fashion as though it were rigid and had been violently jarred. In a similar test, the light was slowly moved backwards and forwards through an arc of three feet. A similar motion on the part of its displaced image was perceived, but its extent was judged to be only six inches in length. This decrease in length was not due to the subject's ignorance of linear values, for the extent of movement was represented graphically after the test. Whether the perceived motion was synchronous with the motion of the light, or lagged behind it an appreciable time, I do not know, though the latter condition probably obtained. The image of the moving object was never seen in two positions simultaneously; the image in the first position disappeared before the moving object was perceived in its second position.

These results are genuine, for I attempted to induce such movements by suggestion, often asserting that my arm was

being elevated and requesting the subject to perceive the movement if possible. Such attempts were invariably unsuccessful. When the field was displaced more than ninety degrees, the movement of an object produced no effect upon its image. In this case, the object no longer stimulated the retinae. Objects were also moved after being hidden behind a screen; this movement effected no results upon the displaced image. Consequently suggestion cannot explain the results.

3. The various results obtained by the interception of the original stimulus by the introduction of a screen are partly due to the new stimulation introduced as well as to the removal of the old one. The results due to the new object have been enumerated and described in a previous section (C, pp. 362 ff.). Certain other phenomena occur, however, which are due to the removal of the original stimulus from the retinae. In the tests at night a screen was interposed just in front of the candle originally fixated. The image of the candle did not disappear but flared out to a large size with an indeterminate contour and a marked decrease in luminosity. The image resumed its normal appearance when the screen was removed. The test was repeated several times in immediate succession with the same results. The screen was placed immediately in front of both eyes. All visual objects in the displaced field disappeared almost at once, but the subject continued to see the space between the screen and the distant wall as though nothing had happened; this space appeared light and transparent as in normal vision. The background, *i. e.*, the image of the wall, merely faded away into nothingness; the further limit of the perceived empty space was thus not blackness but a mere void. After a short time the image of the candle reappeared at the distance of the screen, though all other objects in the field remained invisible. When this image of the candle reappeared to view, vision of the empty space beyond the screen was lost. With strong illumination (fixating the window on a bright day), a screen interposed just in front of the object of fixation produced no noticeable results on the character or continuance of its image. When the screen was placed immediately before both eyes so as to intercept the entire field, certain objects in

the far distance which were perceived through the window disappeared from vision at once, but the images of the window and surrounding walls as well as of the intervening space remained visible for nearly a minute. After this period the small part of the window foveally perceived became located at the distance of the screen. The subject's attention was now attracted to this, and she did not notice whether the remaining part of the field continued to be visible at its distant position. However, the empty space beyond the screen was still perceived until the end of the experiment.

The apparent results of these tests may be stated as follows: When the original stimulation is intense and a small portion of the field is intercepted, no effect upon the duration of the displaced image is noticeable. When the stimulation is weak and the whole field is intercepted, the displaced images disappear almost immediately. Intermediary results can be obtained with mean conditions.

4. The influence of the original stimulations may be inferred from certain results obtained by a displacement of more than ninety degrees. The introduction of the electric lights before the eyes produced more marked results in case the field was displaced to such an extent that the original objects perceived no longer stimulated the retinae. Moreover, the results occurred more quickly with such extreme rotations than they did with a small displacement. The object introduced into the field was perceived as an object only in the case of such an extreme rotation.

The displaced images thus possess a greater resistance to the influence of new stimuli so long as the primary field continues to stimulate the retinae.

*E. The effect of an old stimulation is much greater than, and far different from, that of any new stimulus introduced during the displacement.*

1. An old object introduced into any part of the field after its removal is perceived as an object under conditions where the introduction of a new object would produce no visual effect whatsoever.

This general statement is derived from a comparison of the

results of the tests described in sections B, C, and D. The following test was performed to illustrate the proposition. Under conditions of weak illumination, I stood in the field of view holding an unlighted candle in my hand. The hand was fixated and a ten degree displacement of the field was secured. I now moved out of the range of possible vision and lighted the candle. After my displaced image had disappeared from view, I came back to the original position. The image of myself and candle now reappeared, but the light was not perceived save for the dim and vague luminosity suffusing the field. It would be possible to choose conditions under which even this dim luminosity would not occur.

2. The effect of a new object tends to be diffused over the visual field, while the effect of an old object tends to be definite and localized.

The first case is illustrated by the diffused luminosity of the candle and electric lights. The second statement is illustrated by a number of facts. The displaced image of the electric lights decreased in intensity the moment the light was turned off, although no effect was noted on the remaining part of the field. The removal or movement of an object in the primary field produced visual effects which were confined entirely to the displaced image of that object. When an old object was brought back into any part of the field, it was perceived as an object, *i. e.*, its visual effects were definitely localized in space.

3. The visual effects of a new object are projected in accordance with the normal laws of retinal space reference. The image of an old object re-introduced into any part of the field is perceived in a displaced position.

As illustrations of the first statement we may cite the following tests: In the case where the candle introduced into the field after a displacement was perceived as a candle, it was correctly localized. It was placed directly in front of the subject's eyes and it was perceived in that position. In the case where the eyes were directed at the electric lights for three minutes during a displacement, the diffused luminosity became concentrated in a large circle in the center of the field of vision. If this ring of light represents the stimulation of the lights, as has been

assumed, it was correctly localized. The second of the above statements represents the results given in section D, (1) and (2).

F. *This peculiar and abnormal functional condition of the eyes obtaining during the displacements may be maintained, destroyed and reinstated at will. The condition is maintained or reinstated by a mental fiat accompanied by an orbital strain, while the condition is discontinued at any time by a mental fiat and a relaxation of the orbital strain.*

1. Maintenance of the displacement. During the various tests, a careful observation was made of the subject's motor attitudes and expression in initiating and maintaining the displacements. The body generally remained quiet but exhibited a suppressed tenseness as though the whole energy of the body was being concentrated upon the task in hand. The breathing was slow, quiet and regular, but much deeper than usual. The subject appeared slightly enrapt or entranced as one does with extreme absorption in some observation involving steady fixation. The extreme concentration was due to the facts that the tests were generally of some duration, the subject's attention was directed to the observation of all changes occurring in the visual field, while many of the phenomena were novel in character. It was found on trial that the field could be displaced and maintained in a given position with a relaxed condition of the body and with normal breathing. No expression was noted other than that occurring in a case of ordinary fixation. Introspectively, the only necessary conditions for the maintenance of the displacement were a marked strain located in the head directly back of the eyeballs, and the focusing of the attention upon the images.

2. The discontinuance of the state. We found that it was not necessary to move the field back to its original position in order to discontinue the state. The subject generally shook her head, moved her eyes, blinked several times and relaxed her bodily tension. The subject was asked to give an account of her method of discontinuing the state at will, but was unable to do so with the exception that she had noted that it was not necessary to move the field back to its primary position. This method was made an object of study in a number of experi-

ments. It was found that a sudden head or eye movement generally caused the field to disappear momentarily during the movement. The movements, blinkings and the bodily relaxation were not necessary to discontinue the phenomenon though they were of some service. The only necessary concomitants of the mental decision were the release of the attention from the images, and a relaxation of the orbital strain mentioned above. The displaced field does not disappear immediately, but fades away gradually. The time necessary for the disappearance of the images seemed to vary slightly in the different tests. Probably, the time is proportional to the intensity of the original stimulations. The average duration necessary was from three to five seconds. The recovery of normal vision does not occur immediately after the disappearance of the displaced images. There is an intermediary period in which the visual field presents a uniform gray hazy appearance. The images of the real objects now before the eyes break through this hazy mist and gradually become distinct. The whole process involving the disappearance of the displaced field and the recovery of normal vision lasts from four to seven seconds.

3. The reinstatement of the displaced field after its disappearance. After normal vision has been recovered, the displaced field may be brought back to consciousness at will without the necessity of again subjecting the eyes to the original stimulations. A mental decision involving a thought of the objects and the reinstatement of the orbicular strain is the only condition necessary to effect this result. Merely thinking of the objects is not sufficient to produce the reinstatement. The displaced field does not come back gradually but *instantaneously*. The subject had not been aware of her ability to recall these positive after-images at will and first attempted it at my suggestion. The results were so immediate and pronounced as to startle her. The phenomenon is best described in the subject's own words: "No sooner had I willed than the displaced images burst upon me in full bloom as though they had been hidden behind a screen and this screen had been suddenly jerked away." With the return of the displaced images, the eyes were subjected to the various tests described above in order to deter-

mine their sensitivity. The eyes are now in exactly the same condition of sensitivity as they were during the original displacement. This voluntary alternation of the abnormal condition of the eyes and of normal vision may be successively produced in the same experiment apparently as many times as desired. In one experiment the field was displaced more than ninety degrees and projected against a background of new objects. The subject was directed to hold the eyes as motionless as possible, to allow the displaced field to disappear until distinct vision of the new background was secured, to call back the displaced field so as to hide all vision of the new background of objects and to alternate the two states as long as possible. The two conditions were alternated six times in succession, when the subject was compelled to stop through fatigue. Apparently, fatigue is the only limitation on the possible duration of the phenomenon. In every case normal vision was effected gradually while the abnormal condition was reinstated immediately.

G. *The visual field may be moved at will in a third dimensional direction. The backward movement is effected by an 'effortful feeling of expansion' within the eyeball, while a 'feeling of contraction and relaxation' in the same locality accompanies a forward direction of movement. During these movements the same abnormal condition of sensitivity obtains as in the case of the lateral displacements<sup>1</sup> already described.*

At the time when the lateral displacements were first noted (seven years ago), third dimensional movements of the field sometimes occurred involuntarily, especially under conditions of fatigue or of prolonged fixation. By trial, it was found that these movements were also subject to voluntary control. They can be produced voluntarily much more easily and after a shorter period of fixation than can the lateral displacements.

The field cannot be moved forward to a distance nearer than five feet from the subject, but it can be removed to the apparent distance of the horizon. Within these limits, the field can be

<sup>1</sup>The translocatory movements already described in the previous sections will be termed hereafter 'lateral displacements,' in order to distinguish them from these third dimensional movements.



moved and located at will. The images do not become double, but are blurred to some extent and are rather confused in outline. With the backward direction of movement, the images become slightly smaller, but the decrease in size does not seem to be proportionate to the increase of distance according to the laws of perspective. The decrease in size seems to be due to a 'melting away of the edges' of the various images. In the return movement, the field is judged to have reached its real position when the images attain to their maximum distinctness of outline.

The movement can be effected with monocular vision, but it occurs much more readily with the left eye than with the right. On the return movement with the right eye, the field does not move forward gradually but jumps back quickly in an involuntary manner. The images grow less distinct and a trifle smaller with the backward movements. The decrease in size seems to be due to a 'fading away of the edges.'

When the field is moved backward toward the horizon, the subject experiences a 'feeling of expansion' which is located inside of the eyeballs directly back of the cornea. The forward movements are accompanied by a 'feeling of contraction' in the same locality. The feeling of expansion is described as effortful, while the contractile feeling is accompanied by a sense of relaxation.

At first it was supposed that these depth movements were entirely distinct in nature from the displacement phenomenon, and that they were another instance of that voluntary control of the depth location of the visual field possessed by Miss Allen.<sup>1</sup> This inference was not wholly correct. During a depth displacement, the visual field may be displaced laterally, or it may be moved in a third dimensional direction during a lateral translocation. During the prolonged tests on the lateral displacements, the subject often lost control of the distance location of the displaced field and it would suddenly recede from five to ten feet. A series of experiments was performed in order to test the sensitivity of the eye during the depth movements. If anything, the eye is more insensitive during this phenomenon

<sup>2</sup> PSYCHOLOGICAL REVIEW, Vol. XIII., No. 4, pp. 258-275.

than it is with the lateral displacements. Various objects were introduced into the range of possible vision, but they were not perceived, nor did they affect the visual field in any way. A lighted candle held at a distance of three feet directly in front of the eyes did not even suffuse the distant field with a luminous glow. When objects were removed from the field, the period necessary for the disappearance of their images was longer than in the case of the previous phenomenon. The movement of an object in the field was not perceived, though the object was finally seen in its new position. Objects re-introduced into the field were perceived with extreme difficulty unless they were brought back to their original positions. In the latter case the image of the object is more intense and realistic, and it appears to view in less time after the introduction of the stimulus.

The fact, however, that the moving visual field is of the nature of a hallucinatory positive after-image, does not explain the mechanism of its distance location. The lateral displacements are due to head or eye movements, and the depth changes must likewise be attributed to some factors just as in the case of the distance location of any after-image, either positive or negative. Moreover, the changes must be due to factors over which the subject has direct voluntary control. While this phenomenon is essentially different from that exhibited by Miss Allen so far as the retinal sensitivity is concerned, yet it is possible that the two cases are similar in respect to the mechanism involved in this voluntary control over the depth location of the visual imagery. In the case of Miss Allen, the depth movements were conditioned by lenticular adjustments which involved no convergent changes of the eyes. With the present subject, no convergent movements occurred. This fact supports the proposition previously enunciated as to the retinal effectiveness of the stimulations from a primary field, for if the eyes were totally free from the influence of the objects primarily fixated, it is inconceivable that the convergence should remain unaltered while the visual images are subject to such marked changes in respect to depth location. As to the presence of lenticular adjustments, no confident assertions can be made. I was under the impression that lens changes occurred, but the

movements were so slight in extent that I could feel no absolute confidence in the validity of the observations. The movements were so small that it was impossible to detect whether a particular kind of adjustment was invariably correlated with each direction of image movement. The small extent of the movements present, in case the observed results are valid, is explainable from the fact that the possible extent of the third dimensional movements of the visual field was greatly diminished in the dim illumination necessary to a phakoscopic examination. The lack of clear-cut definite results, as in the case of Miss Allen, does not disprove the lenticular theory; neither do the observations furnish indubitable proof that the depth displacements are conditioned by appropriate adjustments of the lenses, though they do support that theory to some extent. During the displacements pupillary changes occur, but they are spasmodic and irregular in character, no definite change being invariably correlated with each direction of image movement. The fact that the displaced images become blurred and confused in outline in the third dimensional movements, but do not do so during the lateral displacements, indicates the presence of lenticular disturbances in the former case. The presence of muscular feelings inside the eyeballs in the region of the lens may likewise be interpreted in favor of the theory. On the whole the writer is disposed to believe that lenticular changes do occur and condition the movements to some extent, though they may not constitute the sole explanation of the phenomenon. The possibility of other conditioning factors is a matter of speculation and any such discussion is beyond the range of this paper.

The preceding account has purported to be as much as possible a factual statement of the various experimental results with little comment or theoretical digression. Some peculiar aspects of the case deserve further consideration.

Such visual anæsthesias, wherein objective stimulations are retinally effective and may indirectly influence consciousness, occur with hysteria and may be induced by suggestion. So far as the writer is aware, however, such anæsthetic retinal areas do not subserve any objectified visual consciousness, as

with the present subject, unless hallucinatory images are induced by suggestion. The hallucination and the insensitivity seem to be a single phenomenon rather than two independent events, for they invariably occur together. This is seen from the fact that there is no stage of a total lack of visual sense content intervening between normal vision and the abnormal condition. When the displaced field is caused to disappear, there is, it is true, an intermediary stage wherein the visual field presents a uniform undifferentiated appearance. But this is not a total blindness, for an objectified visual sense content is present. When objects were removed from the field and their displaced images were allowed to fade from view, no gap was left devoid of all sense content. This close relation between the presence of the hallucinatory field and the insensitivity, and their relation to volition are matters for discussion. Three theories may be conceived as to the relations involved :

1. The anæsthesia may be assumed to be directly subject to volitional control, while the hallucination is an effect of the anæsthesia. The first relation is conceivable for such anæsthesias can be induced by suggestion, but the second causal nexus is hard to conceive and some facts' contradict the assumption of any such invariable connection. An involuntary semi-trance, involving a visual anæsthesia and a complete aboulia has frequently occurred throughout the subject's life. This visual anæsthesia generally involved a complete loss of all sense content, *i. e.*, it did not produce an hallucination.

2. It may be supposed that the two phenomena are independent events and are controlled by separate volitional processes, but, since the two results cannot be separately initiated, it must be assumed that each event is due to a particular process within the whole volitional act, but that the two processes are so associated that they cannot be even consciously separated. This theory may be true for all that is known to the contrary, but it is needlessly complex.

3. We may assume that the hallucination is volitionally controlled, but that the presence of the hallucinatory images is the cause of the anæsthesia. The second relation may be illustrated by the following phenomenon: Let the light from a bright

window be reflected into the left eye by one's glasses. The image of the window is now projected against the wall of the room. If the right eye is closed, the wall back of the projected image remains invisible in spite of all efforts to perceive it. The stimulations from the wall enter the eye and reach the retina, but vision is so dominated by the image of the bright window that the stimulations from the wall fail to influence it effectively. Likewise, it may be conceived that the hallucinatory activities so dominate the visual centers that these latter are impervious to the objective stimulations. The phenomenon is thus a matter of visual rivalry. This conception is supported by the general result enunciated in section C that the visual effect of any new stimulation introduced varies with its intensity, extent, and duration, and also according to the brightness of the primary field, *i. e.*, the intensity of the hallucinatory field. In the volition her attention is positively directed toward the visual images in the reinstatement and maintenance of the hallucination, and it neglects them in order to discontinue the state. This fact supports the view that volition deals directly with the hallucination and that the insensitivity is a secondary by-product. The supposition may be further supported by the fact that the stimulation of an old object is more effective when it is brought back to its original location than when it is introduced into the field in some new position. In the former case the image is more vivid and realistic and is perceived in a shorter time after the object is returned to the field. This result may be conceived as due to the fact that the stimulation in any secondary position comes into rivalry with a hallucinatory image of some other object.

There is a real spatial translocation of the effects of retinal stimulation in certain cases. This is illustrated in Fig. 1. Suppose that the eye momentarily fixates the object  $F$ , while  $C$  is perceived in indirect vision. The points  $f$  and  $c$  are the retinal areas stimulated by these objects. The eye is now rotated upward until the optic axis is directed toward  $F'$ . The stimulations from the objects  $F$  and  $C$  now meet the retina at the points  $b$  and  $a$  respectively, while the images of those objects are perceived in the positions  $F'$  and  $C'$ . These periph-

eral stimulations at  $a$  and  $b$  influence the brightness, duration, location and existence of the visual images  $F'$  and  $C'$  which should normally correspond to the retinal activity of the areas  $f$  and  $c$  respectively. It is as if the effects of the stimulations of  $a$  and  $b$  were transferred to the points  $c$  and  $f$  respectively. What is true of these two stimulated areas is also true for all retinal points. Thus every retinal area,  $c$  for example, transfers the effects of its own stimulation to another area  $d$ , and in

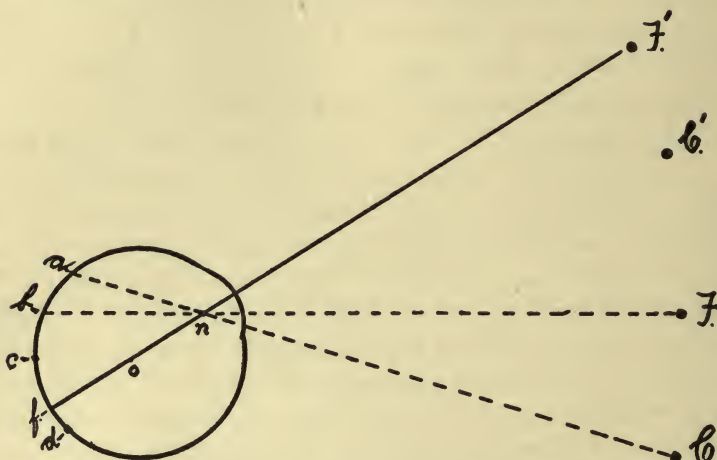


FIG. 1.  $F$  and  $C$ , objects in the field of vision;  $F'$  and  $C'$ , displaced images of the objects  $F$  and  $C$  after the eye rotation;  $n$ , nodal point;  $o$ , center of rotation;  $f$ , fovea;  $f-o-n-F'$ , optic axis after the rotation;  $a$ ,  $b$ ,  $c$ ,  $d$ , retinal points.

return it receives the effects of the stimulation of the area  $a$ . However this apparent 'transference' of the stimulation of one area to a second retinal area occurs only for 'primary stimulations,' *i. e.*, only for those objects occupying the original field of vision. In the case of 'secondary stimulations'—those resulting from new objects introduced into the field of vision after the displacement—there is at first an apparent retinal 'diffusion'; the results of the stimulation are diffused so as to tinge appropriately the entire visual field. This diffusion is minimized in extent in proportion to the duration and intensity of the secondary stimulation.

As to the nature and mechanism of this 'transference' and

'diffusion' several possibilities are open. It may be supposed that the retinal space reference has been altered. Ordinarily the image corresponding to the stimulation of a point  $b$  on the retina is localized along a line running through this point and the nodal point  $n$ , but this spatial reference of the retina may be altered in certain conditions, *e. g.*, the partial paralysis of an eye muscle. This conception is disproved by the fact that the retina localizes normally in the case of a prolonged and intensive secondary stimulation, although the transference of the primary stimulations still obtains. While the conception might explain the 'transference phenomenon,' yet it is inadequate to account for the 'diffusion of secondary stimulations.'

The phenomena may be supposed to be either retinal or central affairs. In fact, they have been couched above in retinal terms, but this was done merely for descriptive and not explanatory purposes. Analogous results have been obtained in experimental psychology. The irradiation phenomenon, simultaneous contrast, etc., indicate that in normal experiences the conscious effects of any retinal stimulation are not confined wholly to the corresponding part of the visual field, but it is not known whether this diffusion of results is centrally or retinally conditioned. The question is further involved with the general problem of the seat of hallucinatory activities, as to which there is no unanimity of opinion. Consequently, there is no positive evidence to be derived from other sources in favor of either conception. So far as anatomical possibilities are concerned a central location is preferable. The fact of voluntary control over the existence and duration of the transference is more explicable in central terms. A statement of the facts, however, in either retinal or central terms would do little but localize the phenomenon. The mechanism and *raison d'être* of the process would still remain unintelligible.

The conception which seems most satisfactory to the writer involves several propositions: (1) For all points  $a, b, c$  on the retina there are corresponding cortical areas  $A, B, C$ . The habitual pathway of a retinal impulse from any point is to its corresponding cortical area (Fig. 2). The course of any impulse may be varied under certain conditions. It is not neces-

sary to assume that the spatial arrangement of the cortical areas is in any way similar to that of their corresponding retinal points although they have been represented in that manner in the figure (2). The hallucinatory images of the displaced field are due

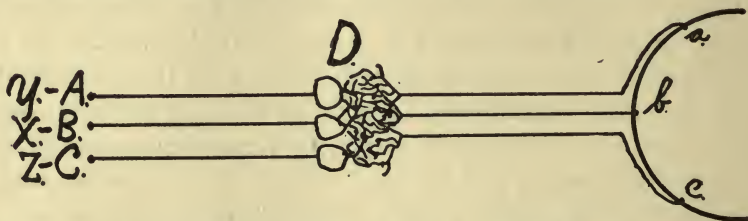


FIG. 2. *a, b, c*, retinal points; *A, B, C*, cortical areas corresponding respectively to *a, b, c*; *Y, X, Z*, displaced images due to activity of *A, B, C*, respectively; *D*, subcortical center.

mainly to cortical activities, and (3) these cortical activities are so intensive and dominating that they interfere with the habitual behavior of the incoming retinal impulses. These impulses become blocked at the subcortical center *D*.

We will suppose that the eye perceives three objects, *X, Y* and *Z*, corresponding to the three neural processes represented in the figure. The images of these objects are now displaced by an eye movement, and a new object, *V*, is introduced into the field so as to stimulate the retina at *b*. This retinal impulse is checked at *D*, and hence a diffusion of the impulse occurs. If the stimulation is weak, the effects are drafted off to lower centers without conscious effect. A greater intensity of stimulation gives a diffused effect over the entire visual areas. In case the stimulation is very intense and prolonged, the retinal impulse becomes strong enough to supplant some one of the cortical activities. The impulse will traverse the line of least resistance, and this will be along the habitual pathway *b-D-B*. The object *V* will thus be localized in a normal manner. The displacement of the images *Y* and *Z* and the correct localization of the new object *V* are thus possible.

As a result of the eye movement, the object *Y* now stimulates the retina at *c* instead of at *a*. This retinal impulse becomes blocked at *D* because of the cortical activity of *C* involved in the displaced image *Z*. This impulse will finally



break through the hallucinatory field at the point of least resistance. With primary stimulations this point of least resistance is not along the habitual pathway *D-C*, but it is at the cortical area *A* involved in the displaced image *Y*. This area *A*, being strongly excited centrally, forms an apperceptive center highly susceptible to an appropriate stimulation. The impulse from *c* is transferred to *A* by the subcortical center *D*. This theory assumes that a psycho-cortical activity will block an habitual path to impulses which would arouse qualitative dissimilar responses in that center, while it will markedly increase the susceptibility of that area to appropriate impulses. This conception involves no new doctrine, for the same principle is used to explain the selective character of apperceptive attention; central activities increase the mind's sensitivity to stimulations of an appropriate character but decrease its susceptibility to all other stimulations. Thus it is not necessary to posit the existence of a subconscious mind in order to explain the subject's ability to react differently to the two kinds of stimulations.

The volitional control over the existence and duration of the hallucinatory images is a noteworthy fact, for generally such experiences possess all of the involuntary characteristics of percepts. What causal relation the orbital strain bears to the existence of the abnormal state is a subject concerning which it is idle to speculate. It is also rather curious that this abnormal condition does not seem to be subject to suggestion in any way, although it is so susceptible to volitional influences.

The subject of these experiences was under the writer's observation for six months and the experimental work covered a period of three months. Owing to the subject's susceptibility to fatigue, it was impossible in this time to investigate the phenomenon as thoroughly as desired. The case deserves further study, as many interesting problems came up during the experiments whose solution would certainly give a more comprehensive insight into the phenomenon.

The subject comes of a well-to-do and cultured family. She is an only child and was reared in comparative isolation from those of her own age. She has been much addicted to day dreaming and she possesses an artistic, idealistic and sensitive

temperament. Her physical health has always been good. She is physically well-developed, and her appearance gives every indication of healthful bodily functioning. She has been subject all her life to short attacks involving visual anæsthesia and aboulia. These attacks are congenital on the mother's side of the family. She has often experienced other seizures involving faintness and extreme physical weakness, with the presence of only a dim vague consciousness. These attacks often leave the subject in a very weak condition for some hours. Shortly before the phenomenon described in this paper was first noticed, she experienced a more profound attack resulting in some permanent amnesias. The complete loss of auditory musical memory incapacitated her for her vocation as a music teacher. Her retentiveness for academic subjects was much impaired. She is now extremely susceptible to fatigue. Her case was diagnosed by a competent nervous specialist who found that she was unable to converge upon objects at a distance of less than eight feet. She has been using a set of prisms to strengthen the internal recti muscles and finds that their constant use has had a beneficial effect upon her mental ability.<sup>1</sup>

<sup>1</sup> The MS. of this article was received October 15, 1907.

## CONCERNING ANIMAL PERCEPTION.

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I wish to call attention to a phase of animal psychology which has received, it seems to me, but inadequate treatment. This inadequacy is evident not only in the general psychologies, but also in special experimental investigations of animal intelligence. The difficulty gathers about the doctrine of perception, and is due in part to the incomplete character of the theory of perception in human psychology, and in part to a failure to analyze sufficiently the conditions of possible perception in lower animal forms.

Can we draw a line between perception and higher cognitive processes, leaving below the line a cognition which is not rational though intelligent, such as characterizes the adaptations of a crab or a rat, and placing above the line all the consciousness of relation which makes human intelligence rational? Do our own predominately perceptive processes, such as those of rapidly climbing a steep, rocky cliff, or playing a game of tennis, where we are seemingly unconscious of anything except the physical environment and our reactions thereto, differ qualitatively from the more abstract processes in which we consciously deal in symbols and isolate the relations of things?

If these discursive processes are mere developments of contents which are implicitly present in perceptual consciousness, is there any definite line which can be drawn between the intelligence of man and that of the lower forms, unless we deny them the form of consciousness which we call perceptual in ourselves? Hobhouse,<sup>1</sup> for example, assumes that the cat, the dog and the monkey, which he observed, apprehend perceptual relations, which enabled them to learn by experience, without the ability to isolate the relations as elements in thought.

Stout<sup>2</sup> would grant to the chick that learns to reject a cin-

<sup>1</sup> *Mind in Evolution*, p. 117.

<sup>2</sup> *Manual of Psychology*, pp. 84 ff.

nabar caterpillar, an 'apprehension of meaning or significance, which would come to the same thing. On the other hand, Thorndyke<sup>1</sup> explains such learning by experience on the part of lower animals through the association of an 'impulse' with a stimulus, which seems to imply a qualitatively different state of consciousness from that which would ordinarily be called perceptual in human experience. He undertakes to illustrate this by phases of human consciousness in which even perception would be reduced to a minimum. This latter illustration indicates a possibility of discrimination which seems to me to have been but inadequately recognized. In learning to play billiards or tennis, we are moving in a perceptual world, but the process of improvement takes place largely below even the perceptual level. We make certain movements which are more successful than others, and these persist. We are largely conscious only of the selection which has already begun. We emphasize this and control to some extent the conditions under which the selection takes place, but the actual assumption of the better attitude, the actual selection of the stroke, lies below even this level of consciousness. Thorndyke calls this selection a process of stamping in by the pleasure coming with success. This explanation, however, calls for its own explanation and ascribes active control to states of pleasure and pain, which is by no means proved and opens up another field of dubious animal psychology. Thorndyke calls the process of improvement an association of an impulse and a stimulus, which lies quite outside of associations of ideas. The phrase is perhaps a vague one, that calls for further specification, but it answers to a large number of instances which are commonly conceived of as perceptions by the animal psychologists, although it is to be presumed that Thorndyke himself assumes that these animals move in a perceptual world. The instances to which I refer may be well illustrated by the action of the chick in rejecting the cinabar caterpillar or the orange-peel. Is there a revival of the past experiences which leads the chick to reject these disagreeable objects; or may we assume that the impulse to reject has become associated with this particular stimulus, without any intervening redintegrated psychoses?

<sup>1</sup> 'Animal Intelligence,' *PSY. REV. MON. SUPPL.*, Vol. II., No. 4, pp. 65 ff.

This question is closely allied to that which arises with reference to the plasticity of the young form and the manner in which it acquires the specific habits which are not found performed in its nervous system. A chick learns to make use of the impulse to hide when a hawk sails overhead. A young fox learns to run away from the odor of man. The process of hiding and running away are indeed performed in these young animals. It is the association of the instinctive action with determinate stimuli which is acquired. What seems to take place is this: The animal tastes a disagreeable morsel when it instinctively strikes at a moving object before it. The action of the flavor of the morsel upon the organs of taste sets free an equally instinctive reaction of rejecting the morsel. At the same time, the chick eyes the caterpillar under the excitement of the disagreeable experience. Now the caterpillar hereafter to be avoided must be different from a mere moving object such as would have called forth the reaction of pecking. It is fair to assume that the condition for this discrimination made by the chick lies in the different reaction which it has called forth. The mere reintegration of the experience would not protect the chick. Either the chick would peck again, since presumably the same bad taste and same rejection would follow, simply reinforced by the revival of the past experience, and this would bring about no improvement in adaptation; or else the past experience would be revived with the appearance of the old stimulus. This stimulus was not a caterpillar with certain markings, but a moving object within reach. The revival of the experience with this generalized stimulus to which, as Lloyd Morgan's experiments show, the chick reacts, would lead to the rejection, not of cinnabar caterpillars alone, but of all moving objects within reach. The ability to distinguish between stimuli which had been identical in their value before, arises together with the new reaction, that of rejection. The meaning of the plasticity of the young form seems to be that there exist in the form instinctive reactions which have not as yet determined external stimuli. Through the experience of the animal the appropriate stimuli are determined. One condition, at any rate, is found in the new visual or olfactory expe-

rience which arises when, for any reason, this new reaction takes place. A dog's shrinking from the sight of the whip involves not simply the revival of the painful experience of the flogging; it involves his reacting to characteristics in the sight of the whip which led to no reaction at first. It is not then so much the association of an old visual or olfactory experience with the impulse, as the arising of a new visual or olfactory experience which now becomes the stimulus for the particular impulse or reaction. If there be association of ideal contents, it is between this new visual or olfactory experience and the old experience which had not as yet been discriminated; of this association, Mr. Thorndyke remarks,<sup>1</sup> we have little or no evidence. What we must assume, in what is implied above, is that the animal gets the new visual or olfactory experience because it is carrying out a new reaction; that the ground for discrimination in sensation lies in the difference of reaction to that which is sensed, an assumption that is reinforced by the recognition that the process of sensing is controlled and directed by the reaction to the stimulus.

Now what is implied in perception is the association of the new sensory experience with the old. If the chick perceives a caterpillar as a 'thing,' he may associate the former experience of pecking at a thing with the new experience of rejecting the peculiarly marked thing. But evidence for such an association in the case of the chick certainly is lacking. What has appeared in its conduct is a new stimulus of a visual character for a performed reaction, which up to this and other like experiences had no determined visual stimulus.

The question then arises, what are the conditions for the appearance of this permanent core to which varying sensory elements may be associated? It is impossible to appeal directly to the introspective analysis of human perception. We cannot get inside the consciousness of the lower forms. It is, however, possible to find in our own experience of physical objects what constitutes this core which endows it with its Thinghood, and investigate the conduct and sensory equipment of these forms, with a view to determining whether their experience can also contain this identical core to which varying phases of the same

<sup>1</sup> *Loc. cit.*

object can be referred. Stout<sup>1</sup> finds this core in what he terms 'manipulation,' understanding by this any contact experiences which arise as the result of visual stimuli, such as the hearing, scratching, pulling, shoving, as well as our actual handling of what we see. This he illustrates by the visual experience of a hole to which an animal is fleeing and which answers to an experience of contact, that enables the animal to determine whether the opening is passable.

If this distinction be carried out somewhat further, we find that the sensory experiences of animal life may be divided into two categories: those that come through what may be called the distance sense organs, the visual, olfactory and auditory senses, and those that come through the contact sensations. The distinction suggested by Stout's use of the term 'manipulation' is that intelligent conduct, when it reaches the stage of perception, implies a reference of what comes through the distance sensations to contact sensation. There is perhaps nothing inherent in contact experiences which accounts for their being the substantial element in perception — that to which, so far as physical, *i. e.*, perceptual, experience goes, all other experience is referred. Visual discriminations are much finer and more accurate than those of manipulation. The auditory and olfactory experience are richer in emotional valuations. But it remains true that our perception of physical objects always refers color, sound, odor, to a possibly handled substrate, a fact which was of course long ago recognized in the distinction between the so-called primary and secondary senses.

The ground of this is readily found in the nature of animal conduct, which, in so far as it is overt can be resolved into movements, stimulated by the distance senses, ending up in the attainment or avoidance of certain contacts. Overt food, protective, reproductive, fighting processes, all are made up of such movements toward or away from possible contacts, and the success of the conduct depends upon the accuracy with which the distance stimulation leads up to appropriate contacts. Consciously intelligent conduct within the perceptual field lies in the estimate of the sort of contact to which distance sensory stimulates the animal form, that is the conscious reference of experience result-

<sup>1</sup> *Loc. cit.*, pp. 326 ff.

ing from the stimulation of the eye, the ear, the olfactory tracts, even the skin, by the movement of the air, etc., to the contacts which this stimulation tends to bring about.

The vast importance of the human hand for perception becomes evident when we recognize how it answers to the eye, especially among the distance senses. The development of space perception follow in normal individuals upon the interaction of the eye and the hand, and this interaction works a continual meeting of the discriminations of the eye by those of the skin, mediated through the manipulating hand. It is this contact experience which gives the identical core to which the contents coming from the distance senses are referred in the so-called process of complication. It is this core which answers to varying experiences while it remains the same. It is this core which is a *conditio sine qua non* of our perception of physical objects. Of course this content of contact experience is supplied by the process of association or complication out of past experience in most of our perceptions. The objects about us look hard or soft, large or small. But the reference is always there.

There are two respects in which the contact experiences of lower animal forms are inferior to those of man for the purposes of perception. The organs of manipulation are not as well adapted in form and function for manipulation itself, and, in the second place, the contact experiences of lower animals are, to a large extent, determined, not by the process of manipulation, but are so immediately a part of eating, fighting, repose, etc., that it is hard to believe that a consciousness of a 'thing' can be segregated from these instinctive activities.

To develop this second point a little further, we need only to recall what has been brought out by Dewey<sup>1</sup> and Stout<sup>2</sup> that perception involves a continued control of such an organ as that of vision by such an organ as that of the hand, and *vice versa*. We look because we handle, and we are able to handle because we look. Attention consists in this mutual relationship of control between the processes of stimulation and response, each directing the other. But while this control is essential to perception, perception itself is neither eating, fighting, nor any

<sup>1</sup> PSYCHOL. REVIEW, III., p. 359.

<sup>2</sup> *Loc. cit.*



other of the organic activities which commence overtly with stimulation and end with the response. On the contrary, perception lies within these activities, and represents a part of the mechanism by which these activities are carried out in highly organized forms. Perception is a process of mediation within the act; and that form of mediation by which the possible contact value of the distance stimulation appears with that stimulation, in other words, a mediation by which we are conscious of physical things. The actual eating, fighting or resting, etc., are not mediations within the act, but the culminations of the acts themselves. We could not perceive bread as a physical thing if that cognitive state grew out of the presentation of the mastication and taste which constitute eating. We perceive *what* we masticate, *what* we taste, etc., except in so far as we may perceive, through their movements, our various organs, as things.

The great importance of the human hand for perception lies in the fact that it is essentially mediatory within the organic acts out of which the physiological process of life is made up. The presentation of a physical thing which must be made up out of the contacts necessary to the actual processes of eating or those of locomotion cannot offer as fruitful a field for the growth of perception as those which are based upon the mediations of the hand within the act. And the contents of contact experience which a mouth or the paws can present must be very inadequate, for just that function of correspondence between the elements of the retinal and the tactual experience out of which the physical world of normal perception arises.

To assume that a chick can find in the contact of its bill together with those of its feet the materials that answer to the perception of a physical thing is almost inconceivable. Even the cat and the dog must find in their paws or mouths, fashioned seemingly for the purposes, not of 'feeling things,' but of locomotion or tearing and masticating, but a minimum of that material which goes into the structure of our perceptions. In the case of the monkey the question arises whether the function of locomotion is so dominant in use of the so-called hands that that of 'feeling' can be isolated out of the monkey's contact experiences to build up perception.

Finally, to recur to the difficulties inherent in the doctrine of perception referred to at the opening of this paper, the assumption of a perception of things, that is, of what is mediatory in experience, carries with it the essence certainly of reasoning, *i. e.*, the conscious use of something — a certain type of experience — for something else, another type of experience. Every perceived thing is in so far as perceived a recognized means to possible ends, and there can be no hard and fast line drawn between such perceptual consciousness and the more abstracted processes of so-called reasoning. Any form that perceives is in so far carrying on a process of conscious mediation within its act and conscious mediation is ratiocination.<sup>1</sup>

<sup>1</sup>The MS. of this article was received September 18, 1907. — ED.

## A STUDY IN VERTICAL SYMMETRY.

BY ELEANOR HARRIS ROWLAND.

It is obvious to anyone who looks at a series of pictures, landscapes especially, giving particular attention to the position of the horizon line, that he usually finds that line just above or just below the center, seldom at the extreme boundaries of the picture and almost never at the center itself. The question naturally arises, Is there any reason for this uniformity of choice and would the same conditions and demands hold good if reduced to the simplicity of an experiment? The following is an account of an inquiry into the choices made by eleven observers of divisions of a rectangular space, and an analysis of their methods of apperception.

To test the question the following apparatus was used: A black, rectangular picture-frame, with an opening 33 by 25 cm. had a black background placed behind, with light gray foregrounds of graded widths placed before it.

In the second series the background was gray and the foregrounds were black. These foregrounds were numbered from I. to XI. No. VI. measured 12  $\frac{1}{2}$  cm. filling exactly half the opening while the others graded both ways at intervals of 2 cm.

The method of procedure was to start with the widest gray foreground and to exhibit all the sizes down to the narrowest, and back again, against the black background. Then the observer was asked to tell where she liked to have the dividing line come, and, if possible, to tell why she liked it that way. The same question was asked with the second series.

Out of eleven observers in Series I., four preferred to see the dividing line just below the center, or the No. V. card; two wanted the division just above the center, or the No. VII. card; two chose IV., while VIII., IX. and III. were each chosen by one person. In Series II. three observers chose No. V., two preferred IV., two VII. and two IX., while III. and XI. had each one vote.

The largest group, then, preferred a division just below the central line; another group preferred varying points slightly above the central line, while choices of the extreme divisions of II. and III. or X. and XI. were rare and those for equal division entirely absent.

The attention of the observers was called to this fact, and they were asked why they did not choose the central division. The almost uniform answer was, that when it was divided evenly they did not 'see it as a picture,' it was 'too flat and uninteresting.'

This testimony brought several things to light: (1) That with no comment on the part of the experimenter they had been taking the empty cards 'as pictures'; (2) that the very unequal division resisted their efforts to see it as a picture and therefore it was not chosen; (3) that with the equally divided space it apparently did not occur to them to 'see it as a picture' at all. Just as the slightly unequal spaces had naturally become landscapes, snow-scenes or sea-views, so did the equally divided space simply look like two equal cards. This change of apperception for the equal division was uniform, although none could give a reason why she had changed except that the equal cards 'didn't look like anything.'

The next questions put to them were :

1. Can you see the equally divided space, and the very unequal divisions as pictures and those formerly seen as pictures, as cards — that is, can the apperception be varied at will?

2. Is there any difference between the two modes of perceiving, except the presence or absence of associations?

3. Does your feeling-tone vary with this change of apperception?

4. Do you find it more difficult to vary your perception one way than the other?

5. Exactly what do you consciously do to change your apperception?

The answers to some of the questions were uniform, but the introspection varied in others. All of the observers found that they could vary their apperception at will, and that such variation not only supplied or deprived the cards of associative value,

but made them look *deep* or *flat*. When seen as a picture the background retreated, more or less according to the division (their favorite division usually had the greatest depth of any) but when seen simply as cards, the background moved front or the foreground back, to make a plane surface.

Their feeling-tone varied with this change of view, so that three liked the equal division, if they forgot it was equal and saw it as something else.

Most of them had more difficulty in changing the apperception for the very unequal divisions, but with practice they could also modify these at will.

The most interesting introspection came however on the last question, where despite their difference in expression, there was some agreement as to their difference in fixation point in the two cases.

When looking at the cards as at a *picture*, the attention was more centered, either on the dividing horizontal line or exactly above or below it, but always on the median axis. They looked from this point to other parts of the surface, but always turned back to the same central point. When, however, they looked at the divided space simply as cardboards, it at once became flat and unaccented. One observer said that she saw it much more impartially, looking not only at the median axis or the division line, but also around the edges and the frame. Another, when seeing it without picture associations, described her attention as following several parallel lines across the space, the division line or the central axis being no more important than the others. Another looked up and down impartially along vertical lines, never resting at the center. Several observers spoke of seeing the *edges* of the cards in the flat apperception, which they had not noticed when seeing the cards as pictures. One observer felt that her fixation for the picture apperception was at a point in the middle of the division line, behind the card, as if she were looking at a distant point, but the simple card perception meant aimless travelling along the division line over the surface and edges.

It would seem from these introspections from eleven regular observers (and essentially similar results were obtained from a

class of forty all observing at once) that a rectangular space divided into equal halves by a horizontal line, tends to be taken as flat, as free from varied associations and without strong central accent, and it has thereby very little the 'picture' character. On the other hand, the slightly unequal division lends itself to apperception of depth, and consequently to associations and to being taken as a picture. Doubtless the observers were influenced in their association by the fact that most pictures have the latter type of division, but the question still remains — Why do they?

It is interesting in this connection, that two observers liked the equal division very much, but did not want it *framed*. That is, their attention not being bound to a central point, wandered at large over the surface, and felt cramped by the frame. This suggests a possible reason why we do not, as a matter of fact, frame geometrical designs, however satisfactory they may be in themselves. In geometric designs, which are usually strongly symmetrical, both bilaterally and vertically, however much a central point may be indicated, we do not take it as a center of *interest*. Our attention is more or less impartial, it extends with equal interest to the edges, and is better satisfied by a repetition of itself than by a frame. Its out-going activity demands continuance of its design, while the in-going tendency of the picture requires exactly the reverse.<sup>1</sup>

<sup>1</sup> The MS. of this article was received June 30, 1907.—ED.

## LOGICAL COMMUNITY AND THE DIFFERENCE OF DISCERNIBLES.

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In certain of our discussions<sup>1</sup> we have reached positions which involve the recognition of the intent of judgment to hold for more than one individual. We have given to this aspect of meaning the name of 'community.' We may now gather together the positions taken up in various connections, and show certain of their larger bearings.

1. In the first place, it appears that the process ordinarily known as generalization in logic is one in which a common meaning arises, that is, a meaning in community. The general meaning not only applies to each of the particulars under it, but it also holds for different individuals. The general-particular relationship remains the same whether the different cases that serve as particulars be observed by one individual or by many. This case is the one covered in logic by the theory of 'extension.' Certain variations upon it arise when we take explicitly the point of view of the community of the meaning.

2. Second, we find certain peculiarities attaching to the meaning rendered as 'singular.' When only one object is meant, such an object can be made subject-matter of judgment only from the point of view of community, not from the point of view of the extension of the objective class—although this is the construction given it by formal logic, which considers it a universal of a class of one! A single object can be generalized only from the point of view of the process that in some manner distinguishes in it different instances or particulars. This occurs in two ways, both of which show the absolute necessity of recognizing the character of community in logic.

<sup>1</sup>In *Thought and Things, or Genetic Logic*, Vol. II., "Experimental Logic," of which this article constitutes a section (in Chap. xiv.).

The first of these is that in which the *one single object is actually experienced by different persons*, as for instance, the 'falling' of a star. If we disregard those aspects of meaning wherein the single object may also be one of a class — then there is left over only that aspect wherein it is a single object to different persons. We have elsewhere shown how by processes of 'secondary conversion'<sup>1</sup> between different minds this meaning arises. The point to consider here is this: such a meaning can become logical — in the sense of having different cases to serve as basis of generalization — only if different experiences of one object can play the rôle of experiences of different objects: that is, only *if community of experience takes the place of extensive quantity*. The experiences of different minds furnish the differences which become particulars under a general. The identity of a singular — say, for example, the identity of the shooting star seen by different observers — can be rendered in a judgment only through the generalization of the appearances to these observers, whereby the event is pronounced the same for all of them. This is a movement *in community*, or in a mode that preserves the force of community.

We may say, therefore, at this point, that, but for the aspect of community attaching to judgment, *the logical rendering of a singular would be impossible*.

The other case of the rendering of a singular, seeing its great importance, may be placed under a separate heading.

3. A third case is that of the meaning attaching to a single object when experienced *by a single person only*; in what sense can such a meaning be rendered in terms of general and particular, and so become subject-matter of judgment?

Here also it is evident that there is no general meaning in extensive quantity. The meaning is a singular because of the mark or group of marks which prevent its generalization with other objects in a class. How then can we judge such an object the same, and expect others, if and when they do experience it, to agree with us? — or not experiencing it, still to accept our report of it?

Here again we have an evident resort to community. If we

<sup>1</sup> See *Thought and Things*, Vol. I., Chap. iv., § 5.



consider the generalization in the instance just discussed above — that of one object seen by different observers — to proceed upon differences in experiences, the object being found identical through the *differences of its appearances* to the different observers, then the recognition of community gives us the same result here. Judgment in community renders meaning as holding *for different personal acts of judgment*; and the requirements of the case are met as well, and in precisely the same way, *when recurrent experiences of one person* are substituted for different experiences of more than one. There arises what we may well call a ‘general of recurrence.’ In both cases, the generalization proceeds upon the commonness of the various constructions of the meaning, whether these be experiences in one mind or in many. The process whereby the meaning of ‘sameness’ attaches to an object is the same whether the recurrences of the meaning thus identified as the same be in one mind or in more; for there is either actual reference,<sup>1</sup> or the presupposition of it, from one experience to another in both cases alike. We reach, then, the striking result that a judgment of singular identity is one that may arise by the generalization of successive experiences in one mind, and this generalization is read in community as equally valid for other minds. That is, we again come to the conclusion that a judgment of singular identity is possible on the basis of a single person’s recurrent experience; and that it is a judgment in community, having the force of commonness for all thinkers alike. But for the character of community, however, such a judgment would be impossible; for there is no guarantee, apart from the intent of community, that the individual’s identification of the object through recurrent experiences is socially available.

The cases now interpreted show clearly just what the intent of community really is. It is the implication, in the rendering of an identical meaning by any one person, of other persons’ judgment whoever they may be. It rests upon the fact, which we have studied in detail, that such a judgment of identity is one of recurrent<sup>2</sup> experiences, whether the objects experienced

<sup>1</sup> Reference of the sort called ‘conversion’ in my Vol. I; see the last note above.

<sup>2</sup> ‘Recurrent,’ that is, in the general sense of duplicated or plural, not necessarily successive.

be one or many, and whether the observers is one or many. The intent of community therefore is essential to judgment and is independent of variations in the other characters, especially of variations in extension.

This result appears in an interesting light when we view the three cases mentioned in the reverse order. If we take a judgment of a single individual's recurrent experience of one object as given, we may ask what it involves besides his personal belief. The first additional element of the meaning is found to be that this person expects his judgment to be confirmed by any one else who may experience the object. That is, the community intent is one that allows the substitution of another's personal experiences for one's own, or the intercalation of that person's experience in the series of one's own as in all respects equivalent to one's own. This carries over the meaning to the case mentioned second above — that of an object experienced by different observers.

Another implication then appears. Whenever occasions arise in which a judgment of identity in recurrence fails to establish itself, the experiences are read *as different objects*; that is, a generalization in extension takes place, whether or no there actually be more objects than one. The individual remarks, 'I did not recognize you — I took you for a different man.' This is precisely the same result *as if different individuals had disagreed in their several reports of the one object*. The judgment such individuals would reach after conference is that there are two objects of the same class, and this is the result the one person reaches on the basis of recurrence. The step now taken is that whereby the single individual's treatment of recurrent experiences of one object is logically equivalent to the ordinary generalization by one or more persons of different particular objects. But this holds entirely and only within the mode of community, since objectively there is but the one object.

We here come upon a principle which may be formulated alongside a celebrated historical dictum, the 'identity, or sameness, of indiscernibles.' While usually associated with the name of Leibnitz, on account of his use of it in his theory of

'monads,' it has been formulated in somewhat different senses by various thinkers.<sup>1</sup> We might describe it in Hegelian terms as the principle of the 'oneness of the many,' and set over against it a principle to be called the 'difference of discernibles' or the 'manyness of the one.' In the terms of our present analysis, the 'identity of indiscernibles' means in principle that in the absence of discernible difference two or more objects are judged to be one and the same in recurrent experience. It is evident that we have here the process of individuating as one, objects which do not give experience of difference. This is, therefore, just the case we have pointed out as generalization in community and not in extension. The experiences may be anybody's or everybody's; they are rendered in a judgment of singular identity. The experiences of different objects are really equivalent to those resulting from the recurrence of one.

The same movement is capable, on our principles, of precisely the reverse reading—the reading formulated in the phrase 'difference of discernibles.' A single object is rendered, by reason of differences discerned in its several appearances, as more than one. The experience passes from that form in which a single object is found to recur to one mind, and also from that in which it appears as one to different minds, to that in which its several cases have marks of difference which forbid the individuation as one object.

The principle of 'identity of indiscernibles,' when psychologically interpreted, expresses the movement in community whereby like experiences of more than one object may yield an object identified as one; while that of the 'difference of discernibles' expresses the movement also in community whereby unlike experiences of one object may lead to its determination as more than one.<sup>2</sup>

<sup>1</sup> Leibnitz, *Monadologie*, 9, and *Nouveaux essais*, II., chap. 27, § 1 ff. For citations from other authors see Eisler, *Wörterbuch d. philos. Begriffe*, Art. *Identitatis indiscernibilium*.

<sup>2</sup> The epistemological bearings of these principles are reserved for treatment in the later volume. Here it may be suggested, however, that all generalization illustrates the 'identity of indiscernibles' and all singularization illustrates the 'difference of discernibles.' For generalization summarizes the

In brief, any judgment, by reason of its community of intent, may be read in any one of three ways: as meaning (1) more than one object, appearing to one person or many; (2) one object only, appearing to one person or many; or (3) one object only, appearing to one person only. The process of generalization as such, considered as a summarizing of likenesses in recurrent experience, can in nowise determine which of these three the actual meaning is to be. A paranoiac declares that everybody is persecuting him, because he generalizes recurrent experiences as all fit to excite his fear of others; he is working under the principle of 'identity of indiscernibles.' At the other extreme we may cite the individual we call 'subjective,' who sees always in our conduct, however uniformly kind, new and varied signs of change. He in turn is magnifying the 'difference of discernibles.' The actual force in any case of normal judgment is determined by the control factor, the coefficients of fact which limit the meaning. The paranoiac's constructions do not allow the control that the actual differences in his attendants' action should secure; the uniform tide of his fear obliterates these differences. Nor are those of the 'subjective' man controlled in the larger meaning of kindness that pervades the variety of our acts. In his case, the pebbles of variety choke the tide of sameness. Both are abnormal in that the actual facts do not get in their proper work.<sup>1</sup>

aspects of meaning in which objects are indistinguishable or identical, and singularization fixes those aspects in which each object is discernibly different from all others. We now see that this latter process, the logical rendering of the singular, explicitly requires the intent of community, a result which shows the radical rôle played by the common or social factor in all the processes of thought.

<sup>1</sup> It is interesting to note that there are forms of speech in which meanings based on the recurrent appearances of objects are recognized, whether such appearances are to one person or many. Propositions in which the predicate is modified by the words 'sometimes,' 'often,' 'always,' etc., may embody this meaning. 'This woman is always vain' is a universal in appearance; it is quantified in community; just as 'women are always vain,' equivalent to 'all women are vain,' has universal quantity in extension. Propositions in 'sometimes' are particular in community (as 'this woman is sometimes vain') or in extension (as 'women are sometimes vain'), or in both (as 'some women are sometimes vain'). This sort of proposition rendering variety of appearances, which change with time and circumstance, has been said by certain logicians to have multiple quantification (see Johnson in *Mind*, 1902, on 'The Logical Calculus,' and Keynes, *Formal Logic*, sect. 70). The name is a good one, since the two aspects of

I have also found reason, in the detailed discussions from which this statement is extracted, to distinguish two modes within the meaning of community. Community 'for whom' — the intent of a judgment to hold for many individuals as for one — is correlated with community 'by whom' — the further intent to suggest that the meaning may not be universally prevalent or catholic as a fact, but may be actually held by a certain number only. It is evident that what has been said in the discussion above about generalization in community, holds, in the first instance, of community 'for whom.' The question may be asked whether the other sort of community, that of catholicity, the relative commonness of the content as actually held in different minds, has any logical rôle.

There are meanings, and of course forms of speech fitted to express them, which not only recognize the recurrence of appearances, as basis of the predication made, but also the limitation of these appearances to a restricted number of persons. For example, the propositions 'there are observations that indicate that Mars is inhabited,' and 'Mr. Lowell holds that Mars is inhabited,' have both these shades of meaning. The reference to a plurality of observers may indeed be the more emphatic element as in the proposition, 'as to the truth of evolution there is wide agreement among biologists.' Of course, every one would admit that such meanings can be expressed, it is a very different thing to say that such an intent is always present in the judgment. But if we are right in holding that a problematical shading of meaning attaches to all judgments when they are actually current; that all judgment intends personal belief, which is expressed in order to silence doubt or extend conviction; in short, that all judgment has an experimental and instrumental force — then here in this mode of community we should find its variations. Probably, as a matter of fact, the

meaning do both render quantity; but it is hard to see how the quantification due to recurrent appearances of one object can be brought under the ordinary logical doctrine of quantity in extension. If we recognize, however, the recurrent appearances of one object to one mind or more as psychologically equivalent to the recognition of a plurality of different objects, for the purposes of generalization, then in this movement which gives what I call 'community' the additional mode of quantity arises.

majority of cultivated people, if asked whether evolution is true, would say in effect, 'yes, most of the best biologists accept it.' The ground of personal acceptance here seems to be relative prevalence and the explicit recognition of this in such a judgment as that last cited, brings out the presupposition of the mode of community 'by whom' in the simple judgment of truth. Often the conditions of the appearance of the object or event to which the proposition refers require a meaning in catholicity. 'Shooting stars are often red,' 'sea-serpents have no fins,' 'the moon is made of green cheese,' are propositions that require this presupposition. They mean to report a certain degree of prevalence of the opinion, observation, or belief, which the proposition renders, as well as to cite a number of illustrative cases or appearances. These variations in prevalence or relative catholicity constitute a further sort of quantification.

The implication made in respect to prevalence varies from the singularity of the opinion or judgment rendered as private, to the universality of an appeal, let us say, to the catholicity of 'common sense.' Between these lies the particular quantity of a proposition which renders the common judgment of a limited group.

The three modes of quantity therefore that may attach to judgments are (1) quantity in extension (as in 'men are sometimes irritable'), (2) quantity in community 'for whom' or 'community of appearance' (as in 'John is sometimes irritable') and (3) quantity in community 'by whom' or in catholicity (as in 'we all find John irritable').



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