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THE Psychological Review

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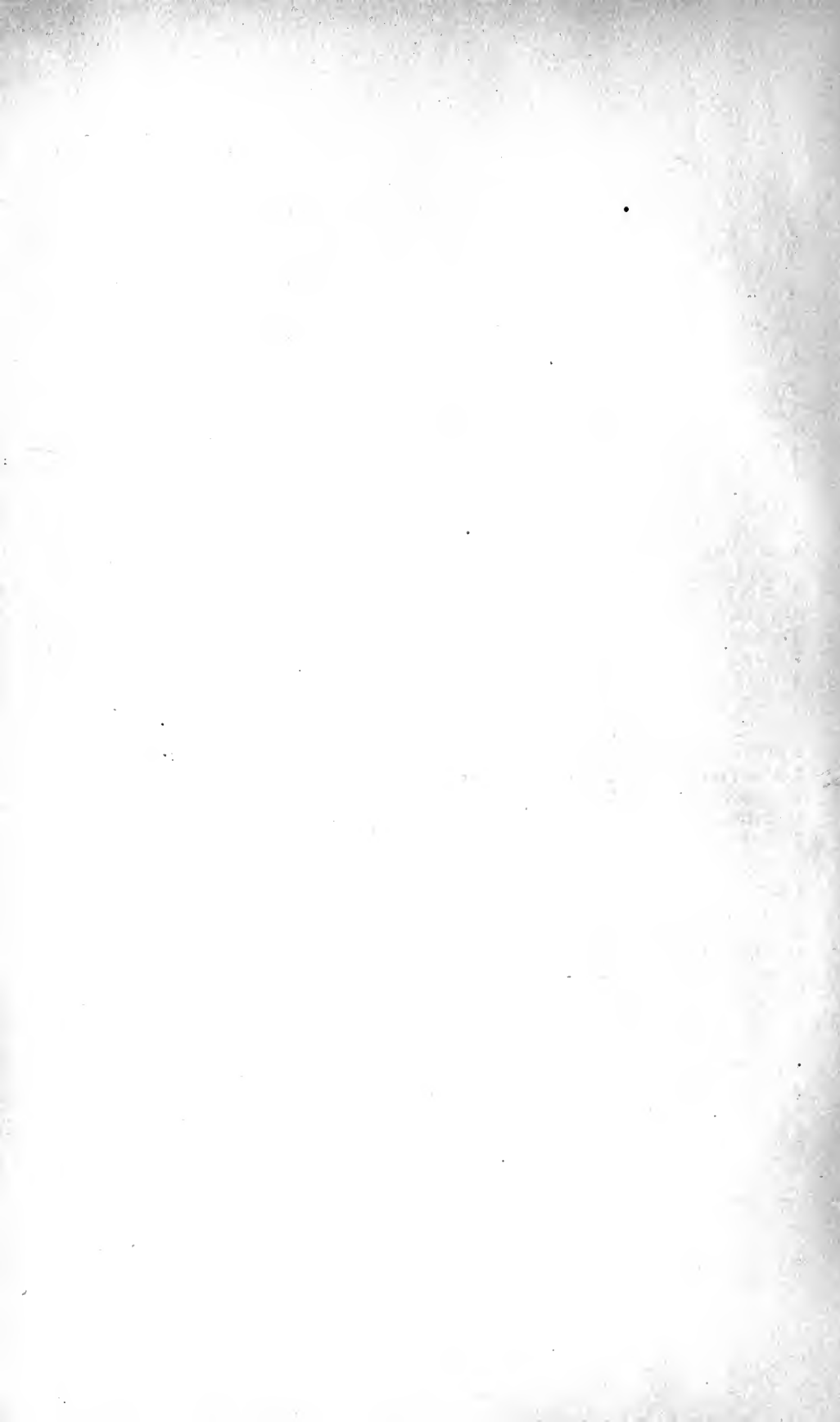
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THE PSYCHOLOGICAL REVIEW.

PRESIDENT'S ADDRESS, AMERICAN PSYCHOLOGICAL ASSOCIATION, CHICAGO MEETING,
DECEMBER, 1907.

THE METHODS OF THE NATURALIST AND
PSYCHOLOGIST.

BY HENRY RUTGERS MARSHALL,
New York.

I.

Section 1.—Attention has often been called to the mutual advantage that accrues to apparently diverse sciences when they come into close touch, and this has been illustrated lately by one of our members by reference to the contact of psychology and medicine. What such Doctors of Medicine as Lotze, and Müller, and Wundt, and our own James, have done for psychology, when they turned their attention to it, is patent. And that an equally momentous counter-influence upon medical science has resulted from its contact with psychology is evident in our modern psycho-pathological methods.

The modern correlation of natural science and psychology must in like manner be of advantage to each. That the work of the naturalists has served to broaden our psychological conceptions we are all indeed ready to acknowledge. How far their contact with the psychologists has benefited, or is to benefit, the naturalists we may modestly decline to consider, awaiting however with confidence the acknowledgments which will properly come from them.

And in this connection it may be remarked that no little significance is to be attached to the fact that the American Psychological Association has chosen this year to meet here in affiliation

with the American Association of Naturalists rather than with the American Philosophical Association at Cornell. No one will deny that the relation between psychology and philosophy is properly held to be a very close one; and the choice made by this association therefore indicates a marked eagerness on our part to strengthen the bond of alliance which already exists between ourselves and the naturalists. An outsider might well say that we are off with our old love and on with a new; and might furthermore observe that we have appeared as the suitors in this alliance, and that the naturalists have been somewhat hesitant in reaching the opinion that we are worthy of their regard; which has finally been compelled, I take it, by the evident scientific ability of certain of our members, and by an assurance that we have become devoted to the experimental method.

Section 2.—This promise of devotion to experiment, I am inclined to believe, has been interpreted to carry with it by implication a further determination to abjure the method of introspection which the naturalists as a body have held in contempt; and I am wondering whether they will not repent of their acceptance of us as suitors when they note that you have elected as your president this year a man who has never been influential in the foundation of a psychological laboratory, and who has never published statistical records of experiments involving the use of mechanical apparatus. I thus find myself impelled at the outset to assume the rôle of the apologist, lest the affection of the naturalists be cooled by the fact that I am called upon to represent the psychologists upon this occasion.

With this end in view I would ask the naturalists to note that we are not without claims to their recognition other than those just mentioned. It is true that our eagerness to have our names coupled with theirs has been due to our recognition of the illumination we have gained from the study of their work; but on the other hand I am inclined to believe that they themselves have been led to accept us as suitors partly because they dimly realize that many of their number are in the habit of using psychological data constantly as aids in the interpretations of many of the facts with which they are called upon to deal.

It is clear for instance that no merely objective study of the

retina could have led a student of optics to surmise that its tissues, in which the rod and cone arrangement is most prominent, could have such functions as are attributed to them by modern optical theorists. Only because introspective observation shows us that light waves produce in us an enormous differentiation of shades and qualities of color have our students of optical physiology been led to look for corresponding differentiations of functioning in the retina and its connected parts.

But I wish to go beyond this, and with some boldness to ask the naturalists whether they have ever had just ground for their all but contemptuous attitude towards the psychology of pure introspection. I would ask them if they realize that each step they and all other devotees of science take in their work is in the end based upon this introspection. When the chemist arranges a crucial experiment, and when he devises his mode of procedure, is he not concerned altogether with processes of thought? And thought processes cannot be developed apart from introspection. And when he notes the reactions resulting from his experiment is he not dependent upon the observation of the color of the product or of its weight perhaps; and is not his judgment finally determined by a discrimination of his color sensations, and by the accuracy of his perception of the movements of the scales in which he weighs; and are not these sensational and perceptual discriminations well marked cases of pure introspection?

My illustration has been taken from one of the physical sciences but I think we must grant it to be true of all the naturalists', as indeed of all scientific experiments, that introspection is their final determinant; and therefore that the attitude of the naturalist towards those who devote themselves to the analysis of the laws of this introspection should be one bordering upon humility rather than one of condescension and self-confidence.

What can be more important to science at the present moment than the determination of the basis of certitude—of our conviction that certain facts are real. Yet this problem relates to the appreciation of realness with which is inextricably bound up our experience of belief: and surely it must be

agreed that we can only study this problem profitably by a purely introspective examination of the relation of the sense of realness to the rest of conscious experience.

But I hear some naturalist say "Well suppose we grant that introspection has an indirect relation to our work, or follow you further and grant that it is the final instrument of service of all scientists, the question we raise is whether it has any practical value unless you adopt in connection with it the special methods of experiment which have been devised by scientific workers apart from all thought of psychology?" And this question leads me to ask you to turn for a moment to enquire as to the nature of this method of experiment, and as to its value.

II.

Section 3. — I take it that the method of experiment consists in nothing more recondite than the attempt to determine whether observed objects are really of the nature usually ascribed to them; this being accomplished by tests which enable us to discriminate the appearance from the reality.

And here I would ask our naturalist to note that the objects which he observes are of many and various types, and that his 'objects in the outer world' are not the only form of objects. In his description of them as objects 'in the outer world' he implicitly acknowledges, what we psychologists explicitly claim, the existence of other objects than these natural objects, viz., objects of attention. And then I would ask him to note further that all his 'objects in the outer world' are also objects of attention, so that it would appear that his material objects are but a special class of those objects which the introspective psychologist studies.

And then we are led to ask what ground there is for the assumption that the method of experiment is applicable only to objects in the outer world — whether we are not nearer the truth if we hold that this method is equally applicable to all objects of attention, in which case it must be applicable within those fields of pure introspection which involve no consideration of outer world objects.

And this I take it must be conceded to be true. We may

take as an instance of such use of the experimental method Professor Woodworth's very valuable studies in relation to imageless thought. It being generally assumed that thoughts are always made up of 'image stuff,' if we may so speak, he as you will recall has devised tests, of a purely introspective type, which seem to show conclusively that this common view is untenable. I do not see how any one can deny that he has employed the method of experiment; yet he has dealt altogether with introspective data.

It is perhaps to be granted that we have neglected in the past the method of experiment in introspective psychology, but it seems to me to be the greatest of mistakes to hold that this method is inapplicable except where laboratory machinery can be used, and an equally grievous error to assume that introspective psychology is in itself relatively unimportant.

And in this connection I would especially make a plea for a return to the careful analysis of pure introspection. We must grant that psychology made its most important advances before the thinking man was at all cognizant of the nature of the nervous system, and of the correspondence between its activities and changes in the nature of consciousness with which our psychophysicists concern themselves. And these advances were due to introspective study which I believe will still yield to us precious fruit if we are guided by our conviction that this analysis to be of final value must be tested by experimental procedure.

Section 4.—I thus oppose the view, which I fear we must say is not uncommonly held to-day, that psychology is of little importance unless it makes use of methods which involve the use of laboratory machinery. And with especial relation to the modes of work in these laboratories I wish to turn for a moment to the consideration of certain points in relation to the acknowledged value of the experimental method.

In the first place I may speak of a value of lesser importance; I refer to the value of the experimental method as a discipline, as a mode of training which enables us to acquire the habit of dealing, if we may so speak, not with things as they appear but with things as they are. It is this value that is of the highest importance pedagogically.

In this connection I must run the risk of being thought to undervalue the work that is being done in our psychophysical laboratories when I confess that I think we tend to overestimate its importance to the student as a mode of discipline in observational accuracy, and that oftentimes more valuable results to the student in this same direction would be obtained by careful work in physical or chemical or physiological laboratories; and this without leading him to gain false conceptions as to the real nature of psychology to which I shall presently refer.

And here I would ask you to note that a large part of the work done in our psychophysical laboratories consists really of experiments in neurophysiology in which the tests are so clearly of an introspective nature that the fact cannot be masked; and that from our point of view they differ from what are known as strictly physiological or neurological experiments mainly in the fact that in these latter the final dependence upon introspection is overlooked and unacknowledged. I am indeed sometimes inclined to think it a misfortune that we have come to speak of such work as experimental psychology at all, and have not rather described it as a special branch of neuro-physiology. For I am convinced that we often give the immature student an utterly false view of the nature of psychology by our modern emphasis of this so-called 'new psychology'; for he is in my experience very often thus led to believe that the only really valuable psychological work is that done in the psychophysical laboratory. And if once he gains this impression he is easily led to think of his mental life in terms of mere mechanical formula, and as the result of this to gain materialistic conceptions which are entirely unwarranted.

Section 5.—Clearly the main value of the experimental method lies in the fact that it occasionally enables the investigator to discover the hidden nature of the objects with which he experiments.

But we become so interested in the methods and machinery used in these experiments that we are too prone to forget that they are but means to an end. As a bit of evidence in this connection let me quote from a late number of the *Journal of Philosophy* where an important writer uses these words: "At the

physiological congress only two papers of special interest to experimental psychologists were presented. *These are papers dealing with methods rather than results, and are therefore more valuable.*"¹ I may add that one of the papers thus referred to described a newly constructed room for sound experiments; the other the use of an instrument for testing retinal excitability.

In this connection I may be frank again in another direction in saying that I am inclined to think we have allowed ourselves, and have encouraged the young student, to give too much attention to the mere collection of observational data as though there were some special value in this collecting for its own sake. Certainly there is no virtue in the gathering together and tabulation of such observational data unless we are led thereby to throw new light upon the psychological problems presented to us, and I submit that such collection and tabulation is usually valueless unless it is undertaken with the definite purpose of testing some specific problem or hypothesis which we have in mind.

If the criticisms to which you have listened have seemed to some of you to be too sweeping I shall ask you to believe that I have spoken purposely of things at their worst, and that I do not fail to appreciate the full value of the conscientious and valuable effort of the laboratory workers numbered among our members; who perhaps may find their feelings of enmity toward me somewhat softened if I open fire especially upon the introspective psychologists; and I shall therefore ask you to consider for a moment what seems to me to be a very fundamental defect of method in their procedure.

III.

Section 6.—If we look back at the history of any science we discover that in its crude beginnings those interested in it were content to deal with the striking facts related to their subject that naturally attracted their attention; and devoted themselves to attempts to coördinate all facts of less prominence with those which were thus most emphasized. On the other hand each science as it has developed has taken a second step which has led to immensely important advances; it has deliberately turned

¹ Italics mine.

its attention away from these most prominent characteristics, and has concerned itself with the discovery of what is fundamental, treating all noticeable characteristics, whether prominent or not, as exemplification of laws of deeper significance.

In botany for instance the classification of plants was first made by reference to their most easily noticeable characteristics. They were classed by reference to the forms of fruits by Andrea Cæsalpinus in the sixteenth century, by reference to their woody or herbaceous nature by Morison in the seventeenth century, by reference to the forms of the flowers by Rivinus and his followers in the eighteenth century, by reference mainly to sexual characteristics by the great Linnæus. These classifications are in our time looked upon as of minor importance, the botanists of our day giving themselves to the study of affinities based upon fundamental morphological, structural, and physiological characteristics.

So the histories of the olden times were records of startling events — the crowning of kings and emperors, the battles lost and won, the treaties made. But in our day history is laying aside its narrative and its didactic forms, and is becoming a study of what Freeman called continuity, and what Robinson is calling a continuity of process, which brings the past into direct relation with our own life of the present.

Section 7.— Now it seems to me that introspective psychology can scarcely claim to have taken many steps in its development beyond this first crude stage above referred to, in which it has taken cognizance of the most emphatic types of experience and has attempted to arrange all else of experience in relation to these emphatic forms.

Our sensations are clearly the most marked forms of experience, and the sensationalists of old, and of our day, have aimed, and are still aiming, to explain all mental phenomena upon the presupposition that they are sensational in their nature. Even the associationists, who concerned themselves with the study of images and their relations, began by treating them as sensational combinations which are merely so ‘washed out’ that their vividness and liveliness is lacking. And in passing I may remark that I know of no better example of an attempt to base a sci-

ence upon an unverified and, in my view, utterly unwarranted assumption.

And in our own day I cannot but feel that we are in danger of giving valuable time to a similar crude scientific method in the attempt to make our motor presentations a basis of the explanation of other mental phenomena.

I might illustrate this point again by the attention given in the past to the bipartite and the more modern tripartite divisions of mental phenomena. I cannot stop however to enlarge upon this point, for I am here concerned to urge that the moment has arrived when we should lay aside these modes of procedure, and should search for more fundamental characteristics which shall serve to coördinate all the more or less emphatic types of experience; and the firm conviction that I have in the future development of psychology is based upon the fact that a distinct movement in the direction of this higher mode of procedure is evidenced in parts of the work of many of our modern masters.

IV.

Section 8. — In the remainder of this address I wish to present briefly one mode of procedure which seems to me to promise good results in the direction in which true advance is to be made; a mode which I have adopted in my studies, and which I hope some day to present in a more systematic form than I have found possible thus far.

The data which we find ourselves called upon to examine are what we commonly call presentations. These presentations seem on their face to be of very diverse types, some of them being more emphatic and pervasive than others; and as I have already noted we have in the past allowed our attention to be too fully fixed upon the most emphatic form of these types, viz., our sensations.

But these very diverse presentations must display certain characteristics which are common to them all, otherwise we would not thus group them together. It would seem that in the interests of a higher development of psychology we may well look beyond the fact that some presentations are more marked than others, and make it our aim to discover the nature of the

characteristics which always belong in common to all forms of presentations; and then to coördinate these common characteristics, trusting that we may be able to discover fundamental laws which will be found to be exemplified in all of the diverse forms in which presentations are given.

Section 9. — A careful examination of this question in my view must lead us to hold that each presentation in human consciousness must display some measure of intensity, of manifoldness, of stability or realness; must be either pleasant, indifferent, or painful; and must display one of the three time phases, either pastness, or presentness, or futureness.

It is true of course that we do not always note the existence of these qualities in our consideration of presentations, but I think it clear that if we study any specific presentation we will always find in it the characteristics which enable us to say that it is more or less intense; more or less manifold; more or less real; that it is either pleasant, indifferent or painful; and that as a presentation it is one which may be described either as a presentation that is placed in the past, or a presentation that is placed in the future, or as a presentation that is placed in the present.

Intensity, manifoldness, realness, the algedonic quality, and the time quality are thus what I would call the five general qualities of all presentations; and of them I would say a few words.

1. If we agree that what we call vividness is a type of intensity, as I think can easily be shown, it is clear that all presentations display intensity in some measure.

2. It will be generally agreed also that all presentations that are observable in reflection are found upon examination to be more or less complex; *i. e.*, that they display more or less of manifoldness.

3. That psychic stability or realness is a general quality more or less of which must appear in connection with each of our specific presentations is a fact that is not so generally noted.

Each of the presentations which we study in our serious moments of reflection is found to be made up of many minor

presentations, as we may call them, some of which appear as new, and some of which are due to revivals of presentations that are past and gone. In our presentations of reflection, in which we consider the nature of a more or less broken series of what I would speak of as our noetic patterns, certain minor presentations appear in more than one, and some appear in many, of the successive noetic patterns. Each special minor presentation thus displays more or less of stability when it is considered in relation to the successive noetic patterns in which it appears, when these are considered as a group.

It seems to me clear that it is because a presentation displays a marked degree of this noetic stability that we come to describe it as real, and it is for this reason that I have come to speak of this general quality of all presentations as realness.

The recognition of realness as a general quality of presentations is surely in the air. It is implicit in much of Dr. James's work, especially in his studies of belief and what he calls the 'perception of reality'; it is tacitly recognized by Baldwin in distinguishing belief from what he calls 'reality feeling'; and our late President, Miss Calkins, has described it as a distinctive quality of presentations, calling it as she does the 'feeling of realness.' In describing this realness as a *general* quality of all presentations I perhaps take a step further than others have explicitly done.

4. That pain and pleasure are phases of the general quality which I have called the algedonic quality, indifference being a mere transition phase between these two, was my main contention in my *Pain, Pleasure and Æsthetics* published some thirteen years ago; and since its writing I have seen no criticism which has led me to doubt the correctness of this view.

The only formidable opposition to its acceptance is based upon the fact that what we call physical pains are so clearly always painful and always sensational. But, as I have pointed out in the work above referred to there are enormous difficulties connected with the acceptance of the view that pain is itself a sensation, and no difficulty in interpreting the facts discovered in relation to physical pains if we assume that in the cases relied upon to prove the sensational theory we are dealing with special

sensations which are always aroused in painful phase under the conditions which we are able to govern in our experiments.

A theory cannot be held to be satisfactory if it explains merely one set of experiences, but fails altogether to explain others of an equally definite character; and those who hold to the sensational nature of pain can do so only by blinding themselves to the fact that their theory not only fails altogether to take cognizance of a large body of experiences relating to pain and pleasure but actually presents an hypothesis which is incompatible with many of these experiences.¹

5. That what I call the time quality is a general three-phased quality of all presentations, closely allied in form with the algedonic quality, is a view that I have held for many years, but which I have only lately found myself prepared to state in form worthy of the criticism of my fellow psychologists in my article published in the January issue of *Mind* of 1907; where however a large amount of corroborative evidence has been omitted in consequence of the necessary limits of a Journal article. Even if the hypothesis there presented should prove to be invalid it does not seem to me that we can fail to acknowledge that each presentation in itself displays either pastness, or presentness, or futureness, and that the time quality may therefore be described as a three-phased general quality of all presentations.

Section 10. — It is interesting to note that these general psychic qualities seem to correspond with certain general characteristics which must in some measure appear in connection with each special nervous activity, in the complex system of systems of neural elements which constitute the nervous system of man.

1. Each elementary nervous part must display a greater or less degree of activity, and this when considered in itself constitutes a general characteristic of nervous activity. Now we are agreed that sensational intensity at least changes, broadly speaking, as the degree of special nervous activities changes: and if we extend this observation to cover all other forms of

¹ Confer my *Pain, Pleasure and Æsthetics*, pp. 23 ff. Also article in *Philosophical Review*, Vol. 1, No. 6, entitled 'Pleasure, Pain and Sensation.'

presentation, we are led to see why it is that intensity, as inclusive of vividness, is a general psychic characteristic.

2. When we consider the nature of the nervous system with its highly complex systems of minor systems which are differently integrated as we say, in connection with the great diversities of kind and degree found in the stimuli reaching the system, it appears that no emphasis of activity in any neural element can stand alone, but that it must be related with other emphases of activity of greater or less degree in other elements. Hence we see that each major emphasis of neural activity within the system constituted as it is must display a greater or less complexity of minor emphases of activity, and this when considered in itself constitutes a general characteristic of nervous activity, corresponding altogether with the greater or less manifoldness which is observable in connection with all our presentations.

3. Each special emphasis of neural activity of any importance appears in successive moments, during which the configurations of the complex activities in the nervous system as a whole must alter. It appears therefore that each special emphasis of neural activity must have a greater or less degree of stability in relation to what I have spoken of as successive neururgic patterns if these are considered in relation to one another. And this greater or less stability when considered in itself constitutes a general characteristic of nervous activity. It is with this greater or less of neururgic stability that realness appears to correspond.

That each specific presentation displays more or less of noetic stability when we consider the development of successive noetic patterns seems to me clear: and I think that we are warranted in holding that the experience which leads us to describe presentations as more or less real is determined solely by the stability of specific presentations within successive contexts as these are considered in retrospect.

4. It is impossible to deny that the nature of each elementary neural activity must be differentiated by the relation existing between the stimulus reaching it and its capacity to react to this stimulus; and that in any given moment the neural element must display either hypernormal, or normal, or subnormal efficiency.

That is to say; the energy developed in the reaction must be greater than that given in the stimulus; or else it must be less than that given in the stimulus; or else the stimulus and the reaction must display an equivalence of energy.

It is clear therefore that if we consider this relation in itself we are dealing with a general characteristic of all nervous activity.

That some close relation exists between our pleasures and efficient activities on the one hand, and between our pains and our inefficient activities on the other hand, has been recognized from the earliest times, and was made the basis of theoretical consideration by the early Greek philosophers. I have attempted to show, in the work already referred to, that a satisfactory statement of this relation is possible if we hold on the one hand that the efficiency-inefficiency characteristic is one that applies to neural elements, and that on the other hand, the pleasure-pain quality is one that correspondingly applies to psychic elements.

Differences of neural efficiency must surely involve differentiations in the form of action of neural elements, and if we believe in the validity of the theory of neururgic and noetic correspondences we are surely bound to look for some psychic differentiations corresponding with these differences of neural efficiency. Such we do find in pleasantness and unpleasantness; and those who reject this theory because they are impressed by their physical-pain experiences surely should not rest content until they have shown us some differentiations of consciousness, other than pleasure and pain, which correspond with the differentiations of neural efficiency here considered.

5. It is clear also that each specific emphasis of neural activity, when considered in relation to emphases of like nature in the immediate past, must display either an increasing, or a stationary, or a decreasing, complexity; and when this fact is recognized, and considered in itself, we are evidently dealing with a general characteristic of nervous activity.

In the *Mind* article above referred to I have sketched in outline the basis of my conviction that the diverse temporal phases are closely related with changes in complexity. Whether this hypothesis is valid, or of value, cannot be determined until it

has been subjected to such criticism as I hope it may receive ; nor until it is corroborated by indirect evidence such as I find in abundance, and which I hope some day to present for the study of those who think it worth considering at all.

Section 11. — These general qualities of presentations then may be grouped as follows in correspondence with the general characteristics of nervous activity.

GENERAL NEURURGIC CHARACTER-
ISTICS.

GENERAL QUALITIES OF PRESENTA-
TIONS.

Group I.

Involving the relation
of more or less.

Each elementary nervous part must display a greater or less degree of activity.

When we consider the complex nature of the nervous system we see that each neururgic emphasis must display more or less of complexity.

Each specific neururgic emphasis must display more or less of stability in our consideration of successive 'neururgic patterns.'

1. *Intensity.*

Each elementary presentation must display more or less of intensity.

2. *Manifoldness.*

Each presentation as appreciated in reflection must display more or less of manifoldness.

3. *Realness.*

Each specific presentation appears in relation to a context, broader than itself, which is determined by revivals of past presentations ; and in relation to this broad context the specific presentation must display more or less of psychic stability or realness.

Group II.

Involving three phases, one of which appears as a transition mode, from which the other two depart in opposite directions.

Each elementary neural activity must display hypernormal, or subnormal, efficiency; or else normal efficiency: this efficiency being determined by the relation of its grade of activity to its capacity for reaction.

Each specific neururgic emphasis, when considered in relation to past emphases of like nature, must display either an increasing complexity, or a stationary complexity, or a decreasing complexity.

4. *The Algedonic Quality.*

Each elementary presentation must display either agreeableness or disagreeableness, or else indifference which is a mode of transition between the other two.

5. *The Time Quality.*

Each specific presentation must display either pastness, or futureness; or else presentness which is a mode of transition between the other two. Each specific presentation appearing as it does in relation to a context, broader than itself, which is determined by revivals of past presentations, must display either an increasing, or a decreasing complexity, or else a stationary complexity.

The hypothesis suggested is that:

The increasing complexity involves futureness.

The stationary complexity involves presentness.

The decreasing complexity involves pastness.

Section 12.—I have spoken somewhat at length of these general qualities of presentations because, if we find ourselves convinced that they exist and are of the nature ascribed to them, we are led to look for certain consequences of no little psychological importance. Of some of these I shall speak briefly in the next division of our subject, but before doing so I shall ask you to consider two examples of the value I find in this mode of approach.

In the first place it may be noted that the conditions of neural activity to which manifoldness, realness and the time quality are supposed to correspond could not appear in an isolated neural element, but only in a complex system of such elements.

On the other hand it appears that if we could isolate a neural element we would find it displaying the condition of greater or less degree of activity to which intensity is supposed to correspond; and also the characteristic relation between degrees of activity and capacity to which the algedonic quality is supposed to correspond.

We are thus led to see that if we could isolate psychic elements, and could observe them in reflection as thus isolated, we would discover in connection with them elemental qualities of the nature of intensity, and of the nature of pain and pleasure, which we may speak of respectively as elemental intensity, and elemental pain and pleasure.

But as consciousness is systemic and not atomic these elemental qualities as appreciated must be transformed; and in the laws governing this transformation much of interest is discovered.

In relation to intensity these laws of transformation furnish a broad explanation of the facts which are related to those grouped together under the formula known as Weber's Law. For it is clear that when we speak of the 'threshold of consciousness' we refer not to a threshold of psychic existence, but to a threshold of awareness, or to use Dr. Stout's phrase a threshold of discernment. And with this fact in mind, it becomes clear that the discernment of any elemental intensity must be dependent upon the relation between its degree and the degree of intensity of the vastly complex systematized mass of psychic elements with which the element whose intensity is examined is correlated and with which it is contrasted.

In relation to the algedonic quality these laws of transformation, as I have attempted to show elsewhere, furnish us with data which serve to explain the indirect and variable relations between pain and organic inefficiency, and between pleasure and organic efficiency respectively; and throw much light upon the nature of our æsthetic experiences.

Section 13. — Turning to my second example, I shall ask

you to consider one implication of the thesis that realness is a general quality more or less of which must attach to all presentations.

Under such a view it would appear that all presentations must have at least some measure of this experienced realness, although this at times may not be appreciated as such: that is to say, they must maintain a momentary stability if they are to appear as presentations at all.

But beyond this; when revived in a later context some presentations will be found to display a greater stability than others, and some so little that they may be described as intrinsically unstable. Or in other words a presentation as such may not maintain this realness—it may almost at once appear to be so lacking in realness that we come to speak of it as unreal, as a mere ‘appearance’; while on the other hand its realness may be so persistently maintained that we do not hesitate at any time to speak of it as real. And between this minimum of realness which we call unrealness, and this maximum of realness, presentations may display all manner of grades of this psychic stability.

Thus there appear diverse realms of realness, which yield what Dr. James calls diverse ‘worlds of reality.’ A given presentation may be very unreal in one of the noetic patterns which we experience, while in another it may be very real. For instance the rising and setting of the sun are presentations that are very real from the standpoint of every-day life, but very unreal when one takes the attitude of the astronomer.

If then realness is such a general quality it must attach to concepts, which are a special form of our presentations: and these concepts must appear as more or less real according to the nature of the contexts in which they appear.

But what we speak of as reality when we are concerned with metaphysical considerations is a concept; and it therefore follows that special forms of the reality concept must have more or less of realness, more for you perhaps than for me. Bradley’s absolute for instance is a concept which is practically of the same nature for all who study it carefully. We are bound to assume that it is very real for him; but it is surely less real for Professor Royce, and thoroughly unreal for Dr. James and Dr. Schiller.

This leads us to see that it is necessary to draw a sharp line of distinction between the objective concept reality, and realness which is a subjective characteristic; a distinction which is often overlooked by psychologists who not infrequently use the phrase 'perception of reality' when they refer to what may more properly be described as 'the appreciation of realness.'

A study of this point also brings out clearly the fact that what we call belief is a subjective state which is determined not by the nature of any conceptual reality, but by our reaction upon it in giving this concept an established realness. It thus appears that we should also make a sharp distinction between reality and the belief that relates to this reality; and in my view a careful consideration of this distinction serves to throw much light upon the troublesome problems related to belief.

But these distinctions are not commonly maintained either in thought or language; and I am inclined to think that the current somewhat acrimonious debate between the absolutist and the pragmatist is largely due to the fact that the two parties to the controversy too often deal with altogether different problems; the contestants being led astray by the very common everyday ambiguous use of the terms truth and true, reality and real.

We commonly and carelessly speak of that as a truth which we appreciate as having realness for us, and which we are wont to speak of as true. But we are here dealing with the record of a concrete case of our appreciation of realness, and not with the nature and meaning of the metaphysical concept which we designate the truth.

So again commonly and carelessly we speak of that as a reality which we appreciate as having realness for us, and which we are wont to describe as real. But here again we are dealing with a concrete case of our appreciation of realness, and not with the nature and meaning of the metaphysical concept which we also designate by the word reality where we do not call it the real.

The ontologist is concerned to examine the nature and meaning of the concepts the true, or truth; the real or reality; part of the connotation of which is that they remain unaltered whatever be the vicissitudes of human experience. Any one of

which concepts, be it noted, may display more or less of realness, and may be more or less acceptable as stable, thus in greater or less degree determining belief. And as such it may be spoken of according to current usage as real or true, these words being employed to designate our experience of noetic stability.

But it is not clear that the pragmatist is properly concerned to examine the nature and meaning of the concepts the true, or truth; the real or reality. He is concerned rather with a problem which the ontologist may choose to ignore; viz., with the consideration of the process by which the realness of any presentation whatever becomes established, and with the possibility of the restatement of this process in terms of workableness for human purposes, and of consequent values for men.

VI.

Section 14. — We may now turn in closing to a brief consideration of some of the consequences which follow from the mode of study I am here advocating.

It will be clear upon consideration, as I have already noted, that while some phase of each of the general qualities above considered must attach to all of our presentations, it is not at all necessary that their existence should always be appreciated, for they may not be at all emphasized: and it is apparent when we turn to introspection that such is the case.

And this leads us to note that the appreciation of the existence of each of these general qualities is determined by the appearance in consciousness of a special form of presentation, each of which is *sui generis*, and is one of those 'senses of relation' which Dr. James has taught us are so innumerable.

Having gone thus far we are led to note that if some phase of each of these general qualities is given in connection with each presentation, then all of them are in some measure given together in connection with each presentation, although not all are likely to be equally prominent.

This leads us to see that where certain of the phases of these general qualities are coincidently emphatic we should expect to observe the appearance of new and distinctive *combinational* 'senses of relation,' as we may call them, which might well appear to be important.

And if we enter into an investigation suggested by this thought we are led to results of great general interest.

If for instance we imagine a case in which there is an appreciation of a marked intensity of a partial presentation within a whole presentational complex, and at the same time an appreciation of the whole complex itself as manifold; then we might expect to note the appearance of a new combinational 'sense of relation' determined by the relation of the two phases of the two general qualities intensity and manifoldness as thus appreciated.

And when we ask ourselves whether such a combinational sense of relation is ever observed we note that the general neururgic conditions determining its appearance would be very similar to those constantly observed in one special limited part of the nervous system, *i. e.*, to the retinal conditions where the eye is powerfully stimulated, for there we have an activity of high degree in a limited part in relation with a broad but less active retinal field.

We see thus that we would be likely to describe the broader conscious experience involving the recognition of the relation of intensity to manifoldness in terms of the narrower but more vivid and usual ocular presentation. When therefore we note that we commonly describe the experience of attention in ocular terms as displaying a focus within a broader field we are at once led to see that when we appreciate the existence of attention we do so because we experience a presentation of a special form—a combinational sense of relation—in which we grasp the relation existing between a marked intensity within a given presentational complex, and the manifold nature of the presentational complex apart from the intense element.

In a similar way, if we imagine a case in which there is an appreciation of a marked realness of a partial presentation within a whole presentational complex, and at the same time an appreciation of the whole complex itself as manifold, then again we might expect to note the appearance of a new combinational 'sense of relation' determined by the relation of the two phases of the two general qualities realness and manifoldness as thus appreciated. And when we look for such a new

combinational sense of relation we find it in my view in the object-subject relation.

In looking for similar 'senses of relation' due to the coincident emphasis of realness and the time phases we find them: in relation to pastness in familiarity, and its development in memory; in relation to futureness in anticipation, and its development in expectation.

Section 15. — Turning again to the development of the method with which we are here concerned we may note that after we have considered in detail the general qualities of all presentations in all their bearings; and after we have studied those resultant combinational 'senses of relation' due to the coincident emphasis of two or more phases of these general qualities in connection with a given presentation; then we may properly consider the nature of, and the conditions of appearance of certain qualities which are not general qualities in the sense that they are appreciable in connection with all presentations, but which nevertheless are of such general occurrence that they may well be mistaken for such general qualities.

It is to be noted that the existence of each of these special qualities will be due to the appearance of a special 'sense of relation' presentation.

The most important of these frequently occurring special qualities is that which I would call the spatial quality.

The spatial quality cannot be called a general quality of all presentations; for it cannot be shown that all presentations are spatially qualified, as the philosopher and the common man implicitly agree when they describe the mind as non-extended and immaterial. Such presentations for instance as 'theory of consciousness,' 'virtue,' 'algebraic functions,' taken in themselves as presentations, do not appear to display any spatial qualifications whatever; they cannot be said to be here or there in space.

But on the other hand as it is clear that a very large proportion of our experiences are spatially qualified, although we should not treat of the spatial quality as of primary importance, we nevertheless should give special attention to the nature of the situations which induce the appearance of this special spatial quality which Professor Judd will agree with me in describing

as a quality of relation, and which can only be appreciated because of the appearance of a special 'sense of relation' presentation.

Section 16. — Finally when we have studied thus the nature of the general, and of the broadly occurring special, qualities of presentations we are in position to consider in detail the nature of specific presentations which seem to be clearly differentiated from one another—our sensations, our percepts, our concepts, our instinct experiences and emotions, our acts of will; which appear from such a point of view as special psychic emphases which are differentiated because of their divergent psychic *loci*, if we may so speak; just as the special nervous activities with which they correspond may be described as special neururgic emphases within certain limited parts of the nervous system all parts of which are in some measure active at all times.

Section 17. — Through the whole course of such a study we are compelled to take cognizance of the fact that the presentations given in reflection are only part of the whole of the state of consciousness considered, and that in any given instant the part of consciousness which we call the Self is existent although it is not presented and in fact is non-presentable.

Considering then that, if consciousness is a system, all parts of it must be fundamentally of the same nature, and all parts reciprocally efficient, it appears that the non-presentable Self, and the presentations to this Self, must always affect each other; and the appreciation of this fact in connection with the mode of approach suggested serves to throw much light upon many questions of current interest. It leads us to see for instance that no valid distinction can be made between voluntary and involuntary attention, for the action of the Self must be involved in every act of attention although at times this action may be obscured and overlooked. It shows us that belief under such a view appears as the establishment of realness by that simulacrum of the Self which we call the empirical ego; each act of belief being seen to involve a voluntary resolution of the deadlock of doubt; and this leads us to see that whenever we experience an act of belief we actually must experience an act of will, or in other words must necessarily 'will to believe'; a fact that

clears up much of the difficulty encountered in the discussions of the morality of believing as we desire to believe, in cases where the evidence on the side to which our desire presses us is not convincing; for it takes this question out of the realm of psychology and shows us that the same canons of ethics are applicable to this willing 'to believe at one's own risk' that are applicable to all our voluntary acts.

Section 18. — With this general outline of the method suggested I must content myself here. I myself am inclined to think that it is likely to prove to be a useful method; but even if when put to the test it be discovered to be lacking in value, this fact will not force me to abandon the conviction that the time is ripe for the adoption in psychology of a new method which shall look beneath the superficial, in search for the more fundamental, aspects of our conscious experience.

STUDIES FROM THE BRYN MAWR COLLEGE
LABORATORY.

THE EFFECT OF THE BRIGHTNESS OF BACK-
GROUND ON THE APPEARANCE OF COLOR
STIMULI IN PERIPHERAL VISION.

BY GRACE MAXWELL FERNALD.

INTRODUCTORY STATEMENT.

The present investigation is a direct continuation of one carried out in 1903-4 in the Mt. Holyoke laboratory.¹ The results of this earlier paper were based on observations of the appearance of the colors at the red-yellow end of the spectrum when seen in peripheral vision, and were in brief as follows:

I. The brightness of a colorless background has a decided effect: (1) On the limits for yellow and orange, the limits for the former color being much wider with the darker grounds, for the latter color wider with the lighter grounds. (2) On *the tone* of red, orange and yellow, the component of the color least like the background in brightness being emphasized in every case — namely, the red with the light background, and the yellow with the dark background. Orange, which showed a greater variation than any other color, appeared as red with the light backgrounds at the same degree of eccentricity at which it appeared yellow with the dark backgrounds. The brightness of the background seems to have no effect on blue.

II. After-images are often experienced at the periphery even when the tone of the stimulus color is not seen.

A monograph by Dr. Baird,² which appeared after our paper had gone to the printer, gives the results of an investigation of peripheral vision under conditions of dark adaptation. His

¹PSYCHOL. REV., Vol. XII., 1905, pp. 386-425: 'The Effect of the Brightness of a Colorless Background on the Extent of the Color Fields and on Color Tone in Peripheral Vision.'

²J. W. Baird, 'The Color Sensitivity of the Peripheral Retina,' Carnegie Monograph, May, 1905.

conclusions, based on results obtained under invariable conditions of background and adaptation, have a bearing on our problem, since they represent the extreme case of dark adaptation and of brightness, contrast between stimulus and background. They are in brief as follows:¹

(1) "With a slight luminosity of stimulus, all colors appear colorless at the periphery of the retina." (2) "When they are brought in far enough to appear colored, those of the red end of the spectrum first appear yellowish or yellow, while those of the blue end first appear bluish or blue. . . ." (3) After-images, 'in the ordinary sense of the term,' were reported in but few cases, and then only when the paracentral regions of the retina were stimulated. Latent after-effects, however, seemed to persist after the stimulation, and to be influential in determining the color-effect of succeeding stimuli, when too short an interval was allowed between tests.

In December, 1905,² an investigation reported by Miss Gordon and Miss Thompson at the Harvard meeting of the American Psychological Association, gives detailed results, showing the effect of a colorless background on the color tone and on the frequency of occurrence of the after-image. The results, as summarized in the *PSYCHOLOGICAL BULLETIN*, are as follows:³

"Finer discriminations are made in the red-yellow end of the spectrum than in the blue-green end, both in stimulus and after-image, for (1) on the part of the retina where the stimuli red, orange and yellow were distinguished from one another, their after-images were not differentiated, *i. e.*, each of these three colors produced pure blue after-images, and (2) on a part of the retina where the stimuli green, blue and violet were not distinguished from one another, but all appeared blue, the after-images to these colors were differentiated, being respectively orange-red, orange, and greenish yellow."

¹The results with reference to the 'stable colors' or 'Urfarbe,' as well as other observations which do not bear on our problem are omitted here. For a full summary of results, see Carnegie Monograph, May, 1905, p. 72.

²This paper was published in full in the *PSYCHOLOGICAL REVIEW*, Vol. 2, March, 1907, pp. 122-167.

³Summary statement, *PSYCHOL. BUL.*, Vol. III., 1906, p. 66

EXPERIMENTAL.

The purpose of the present investigation was to determine the effect of the brightness of a colorless background on the carmine, violet, green-blue, and green, of the Hering series.

Observers.

Miss Edith Claggett and Miss Lida Popejoy, graduate students at Bryn Mawr College, Miss Blanche Hecht, a junior, and the writer, served as observers in the present investigation. Miss Adelaide Case, a sophomore, conducted the experiment, while the writer served as observer.

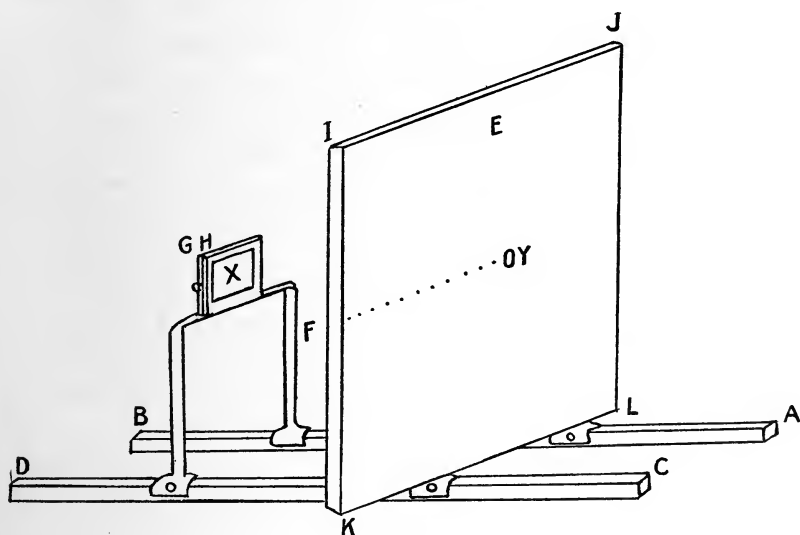
Apparatus.

FIG. 1.

The apparatus employed in our earlier work¹ has been modified in several respects. In order to make possible a more comfortable position on the part of the observer and a more steady head fixation, a vertical campimeter was adopted in place of the horizontal. The campimeter frame *IJKL* (see Fig. 1) was fastened to heavy iron bars *AB* and *CD*, which were placed, parallel to each other, on a long table. Behind the frame *IJKL* was an iron support *F*, which was also secured to the iron bars *AB* and *CD*. This support carried a frame,

¹ PSYCHOL. REV., Vol. XII., 1905, pp. 393-394.

furnished with two grooves, *G* and *H*, into which small frames could be slid. A gray slide (α in the diagram), like the background in brightness, was fitted into the first of the two frames, *i. e.*, the one toward the campimeter, and the stimulus color into the second.

The backgrounds consisted of Hering gray paper, numbers 1, 3 and 34, and when in use, were fastened to the frame *IJKL* (see *E* in the diagram). A circular opening *V*, 1.2 cm. in diameter, was made in the center of each background. Fixation points measuring degrees, calculated on a basis of an arc of 25 cm. radius, were marked out on the background, starting with the center of the opening *V* as zero. As the limits for the nasal meridian could not be obtained on the flat surface of the campimeter, a second frame was attached to the main campimeter frame, perpendicular to the surface of the campimeter along the edge *IK*.¹

The stimuli consisted of Hering colored papers and various shades of Hering gray. Blue, violet, carmine, green-blue and green, gray No. 34 and gray No. 3 were most frequently given as stimuli, though the other colors and the other shades of gray were frequently interposed in the series.

The work was all done in a room, whose walls and woodwork were of white or gray. The illumination came from a skylight which occupied practically the entire ceiling of the room. Gray and white curtains were so arranged that the illumination could be controlled at will.

A circle was so drawn on the gray slide that its center was in the line perpendicular to the surface of the campimeter at the center of the opening.² This circle was just large enough so that, when the eye of the observer was 25 cm. from the campimeter and the visual axis was perpendicular to the center of the circle, the circle on the screen would appear to just fit inside the circular campimeter opening. It will be seen that the eye position just described is the only one in which the two circles will appear concentric.

The head was held in position during stimulation by means

¹ For diagrams see *PSYCHOL. REV.*, Vol. XII., 1906, p. 394.

² A cathetometer was used to determine the center of the circle.

of a vulcanized rubber mouthpiece in which a deep indentation of the observer's teeth had been made. It is evident that when the apparatus had once been adjusted, the head position was absolutely determined, provided the mouthpiece was secure. To insure the stability of the mouthpiece, it was fastened to a triangular support which was screwed to the table.

Method of Experimentation.

The observer was seated in front of the campimeter and the mouthpiece was so adjusted that the right eye was in a correct position with reference to the campimeter opening. The observer then moved the eye from the center of the circle to a given fixation point. This fixation point was held while the experimenter after an exchange of signals gave the stimulus by pulling out the gray screen which covered the color. After a given length of stimulation, the screen was pushed back, and the observer held the fixation until every trace of after-image had disappeared. After a two minute interval, the proceeding was repeated with the same or another stimulus. The stimuli were given in irregular order, the black, white, and gray being frequently interposed between the color stimuli. The observer was kept in complete ignorance throughout concerning the nature of the stimulus.

Results.

I. *Limits of the Color Fields.* — Carmine is the only color whose limits seem to be affected to any extent by change in the brightness of the background. Its limits, like those of yellow, are decidedly wider with the dark background than with the light background. The field for violet is if anything wider with the light background. The actual limits as indicated in Tables I., II. and III. are as follows :

LIMITS FOR CARMINE.

<i>Observer F.</i>		<i>Observer H.</i>	
Background No.	1 — 60° (?) ¹	Background No.	1 — 70°
"	No. 3 — 65°	"	No. 3 — 70°-75°
"	No. 34 — 80°	"	No. 34 — 75°-80°
<i>Observer P.</i>			
Background No.	1 — 75°		
"	No. 3 — 75°		
"	No. 34 — 80°-85°		

LIMITS FOR VIOLET.

<i>Observer F.</i>		<i>Observer H.</i>	
Background No.	1—60 (?)	Background No.	1—40° + (?)
"	No. 3—45°-50°	"	No. 3—40°
"	No. 34—40°	"	No. 34—30°-40°
<i>Observer P.</i>			
Background No.	1—(?)		
"	No. 3—45°		
"	No. 34—30°-40°		

Unfortunately the results for green-blue and for green are not sufficiently well marked or complete to justify any conclusions with reference to their color limits. The observers were especially troubled by the decidedly unsaturated green of the Hering series. The judgments concerning it were uncertain almost to the center of vision. Thus while practically as many results were obtained with green as with the other colors, the results are purely negative. If time had permitted the experiment would have been continued by work with green in the more central regions.

II. *Effect of the Brightness of the Background on Color Tone.*—It was shown in our previous work that red, orange, and yellow are seen as yellow much more often with the dark than with the light backgrounds. For example, with the light background (*i. e.*, Hering gray No. 3) orange was seen as yellow only three times out of 156 tests,¹ as yellow-orange 11 times, as orange 24 times, and as red 102 times. The same orange, with the dark background, was seen as yellow 31 times, as yellow-orange 23 times, as orange 35 times, when the total number of tests was only 92.²

The background seems to have no effect on blue, violet, and carmine, analogous to that just described. The main effect of the background on the tone of these three colors, as indicated by our results, is a tendency on their part to appear blue with the dark backgrounds, at the same points at which they appear colorless with the light background. A possible excep-

¹The interrogation mark means that the results were not sufficiently complete to justify a more positive statement.

²These totals include cases in which no color was seen. See PSYCHOL. REV., Vol. XII., 1905, p. 398.

tion to the above statement occurs in the case of carmine, which is frequently described as more reddish with the light than with the dark background.

The following tables give the percentage of cases in which the colors in question were seen as blue. The percentage is based on a total made up of the results of all observers. Tables I., II. and III. must be consulted for the distribution of the stimuli.

Carmine seen as blue with background No. 34,	13 %	of total number of tests.
" " " " No. 3,	9 %	" " "
Violet " " " " No. 34,	88 %	" " "
" " " " No. 3,	67 %	" " "
Green-blue seen as blue with background No. 34,	54 %	" " "
" " " " No. 3,	49 %	" " "

III. *Effect of the Brightness of the Background on the After-Image.* — Our results with reference to the after-image, are confirmatory of those obtained by Miss Thompson and Miss Gordon¹ (see introductory statement, p. 26). The following tables give the percentage of cases in which no after-image was seen, as well as the percentage of cases in which an after-image of a given color tone was seen. These percentages are based on totals which include the results of all observers. A study of the individual results as given in Tables IV. to X. shows the same general tendency in the results of each observer as that represented in the totals here given.²

CARMINE.

	Background No. 3.	Background No. 34.
Total number of tests,	139.	Total number of tests, 83.
No after-image,	50 per cent.	77 per cent.
Yellow after-image,	22 per cent.	4 per cent.
Green after-image,	28 per cent.	19 per cent.

VIOLET.

	Background No. 3.	Background No. 34.
Total number of tests,	114.	Total number of tests, 79.
No after-image,	17.5 per cent.	25 per cent.
Yellow after-image,	58 per cent.	33 per cent.
Green after-image,	24.5 per cent.	35 per cent.
Reddish after-image,		7 per cent.

¹ PSYCHOL. REV., Vol. XIV., 1907, pp. 127-134. Our experimental work was all completed before the publication of Miss Thompson's and Miss Gordon's paper. Consequently our results were obtained entirely independently of theirs.

² Tables I. to III. must be consulted for the distribution of the stimuli.

GREEN-BLUE.		
	Background No. 3.	Background No. 34.
	Total number of tests, 81.	Total number of tests, 55.
No after-image,	16 per cent.	33 per cent.
Yellow after-image,	67 per cent.	11 per cent.
Orange after-image,	17 per cent.	36 per cent.
Red after-image,		20 per cent.

Relative Frequency of After-Images with the Light and Dark Backgrounds. — The tables show that, in the case of all three colors, after-images are observed less frequently with the dark than with the light background, the total percentage of cases in which no after-image was experienced being 47 with the dark background and 28 with the light background. As the results upon which these percentages are based include cases in which the stimulus color was not perceived, it is interesting to note that the statement just made holds in spite of the fact that the percentage of cases in which the stimulus color was not observed was over twice as large with the light background as with the dark background.

Effect of the Background on the Color Tone of the After-Image.

After-Image of Green-Blue. — The most striking effect of the background on the color tone of the after-image is seen in the case of green-blue, namely, in the only case in which the after-image in central vision is orange or reddish. With the dark background, the reddish component of the after-image is emphasized, while, as shown by our previous work, the reddish component of the stimulus color is emphasized with the light background. With the light background, the after-image for green-blue tends to be yellow; with the dark background, orange or red. The tables show that yellow after-images were seen in 67 per cent. of the total number of tests with the light background, and in only 11 per cent. with the dark background. Moreover, with the dark background, the after-image was orange in 36 per cent. of the total number of tests, and red in 20 per cent., while it was orange in only 17 per cent. of the total number of tests with the light background, and never red.

After-Image of Violet. — With the dark background the after-image for violet tends to appear green, while with the light background it more often appears yellow.

After-Image of Carmine. — Although after-images, especially with the dark background, followed carmine in so few cases, the after-image, when seen, was almost invariably green with the dark background, and was frequently yellow with the light background.

The following percentages, based only on cases in which after-images were seen, show more clearly than the tables in the preceding section, the proportion of after-images of a given color observed with each of the backgrounds.

CARMINE.

Background No. 3.

Total number of after-images = 69
After-image = green 58 per cent.
" = yellow 42 per cent.

Background No. 34.

Total number of after-images = 19
After-image = green 84 per cent.
" = yellow 16 per cent.

VIOLET.

Background No. 3.

Total number of after-images = 95
After-image = green 30 per cent.
" = yellow 70 per cent.

Background No. 34.

Total number of after-images = 58
After-image = green 48 per cent.
" = yellow 51 per cent.

GREEN-BLUE.

Background No. 3.

Total number of after-images = 68
After-image = orange 21 per cent.
" = yellow 79 per cent.

Background No. 34.

Total number of after-images = 37
After-image = orange 54 per cent.
" = yellow 16 per cent.
" = red 30 per cent.

Colored After-Images of Unperceived Color Stimuli.

In agreement with the observations already made in our first paper, and later in the work of Miss Thompson and Miss Gordon, our results show, that in many cases a characteristic colored after-image follows an unperceived color stimulus. In general this after-image is perfectly clear and distinct. Such after-images are perceived most frequently either just inside or just beyond the regular limits for the color, and are more often observed with a light than with a dark background. With the light background, out of 85 cases in which the stimuli, violet, carmine and green-blue were not perceived, a colored after-image was seen 26 times, or in 31 per cent. of the total number of cases. With the dark background, out of a total of 24 cases, in which the stimulus was not perceived, the after-image was

seen only twice. The following table gives results based on Tables IV. to XII.

BACKGROUND No. 3.

Color.	No. of Times not Seen.	After-Image Seen.	
Violet	13	1 green	2 yellow
Carmines	57	2 "	14 "
Green-blue	15		7 "
Total	85	Total after-images seen = 26.	

The following table is based on results obtained with observer H. on the temporal meridian. (Background No. 3.) (For complete results see Table XIII.) After-images were seen in 10 out of 34 tests in which the stimulus color was not seen or in 29 per cent. of the total number.

Color.	No. of Times not Seen.	AfterImage Seen.
Yellow	5	
Carmines	10	3 Green
Violet	9	4 Yellow
Blue	10	3 Yellow
Total	34	After-images seen = 10.

The following results were obtained with observer C. on the older form (*i. e.*, horizontal) campimeter. (For complete results see Table XIV.) Out of 56 tests, with both backgrounds, in which the stimulus color was not seen, after-images were seen 16 times or in 29 per cent. of the total number.

Background.	Color.	Stimulus Color not Seen.	After-Image Seen.
No. 3	Yellow	9	4 Blue
No. 3	Blue	16	7 Yellow
No. 34	Yellow	13	2 Blue
No. 34	Blue	18	3 Yellow

Total number of tests in which stimulus was not seen with Background No.

3 = 25.

Total number of after-images = 11.

Total number of tests in which stimulus was not seen with Background

No. 34 = 31.

Total number of after-images = 5.

That the phenomena here described are genuine after-images is shown by the fact that the color is in every case the color complementary to the stimulus as perceived either in central or in peripheral vision, although the observer was kept in complete ignorance concerning the nature of the stimuli employed, and so had no clew as to what after-image was to be expected in

cases in which the stimulus was not seen. Moreover gray and white, though frequently used as stimuli, were never followed by colored after-images.

Effect of the Duration of the Stimulus on the Appearance of the After-Image.

It has been suggested that one reason why peripheral after-images were not perceived in Dr. Baird's work, and were of frequent occurrence in ours, is that his time of stimulation was three seconds throughout, while in our experiments the color was exposed until it had completely disappeared. Our time records show that, almost without exception, at the outer peripheral regions at which the color was perceived, the time of stimulation was less than two seconds. Consequently it seems safe to assume that the length of the stimulation cannot be responsible for the difference in the two sets of results.

It might be stated here that results obtained when the time of stimulation was arbitrarily shortened to one second, showed no decrease in the percentage of after-images perceived.

CONCLUSIONS.¹

I. The brightness of an achromatic background has a decided effect on the degree of eccentricity at which orange, yellow and carmine can be perceived, but seems not to have a similar effect on blue, green-blue and violet. Yellow and carmine are seen as yellow and carmine respectively at a greater degree of eccentricity with the dark than with the light backgrounds, while with orange and perhaps with red and violet the effect is reversed.

II. Red, orange and yellow tend to appear red or orange with the light background at the same fixation points at which they appear as yellow with the dark backgrounds. The only similar effect observed in the case of blue, green-blue, violet and carmine, is a tendency on the part of all these colors to appear bluish with the dark background at the same points at which they appear as colorless with the light background. A possible exception to the above statement occurs in the case of carmine,

¹ These conclusions are based on the results of papers I. and II. and included those obtained by Miss Gordon and Miss Thompson.

which was often described as slightly more reddish than the stimulus, when observed on the light background.

III. The brightness of an achromatic background has a decided effect (1) on the frequency with which a stimulus color is followed by an after-image (in peripheral vision); the tendency of the lighter background being to emphasize the after-image and of the dark ground to obliterate it; and (2) on the tone of the after-image perceived; the after-images with the light background tending to appear as blue or yellow and with dark background as reddish or greenish. The dark background has a greater effect on the red than on the green component of the after-image.

IV. The duration of the stimulus color, within limits of from one to three seconds, seems to have little effect on the appearance or frequency of the after-image.

Theoretical. — As suggested by Miss Gordon and Miss Thompson, two factors in addition to the tone of the color stimulus and its retinal location, seem influential in determining the tone of the color perceived in peripheral vision, namely (1) the brightness of the background, and (2) the brightness of the color itself. The brightness of the color is necessarily affected by contrast with the brightness of the background, and, in the case of the after-image, by the brightness of the stimulus and by the brightness of the screen upon which the after-image is projected. As it seems impossible at present to determine which of these two factors, namely (1) brightness of the color and (2) brightness of background, is more effective in producing the results described in this paper, and as we are at present at work on the problem, we shall postpone any theoretical discussion until a later paper. It seems probable, however, that the results may be, to some extent, at least, related to the Purkinje phenomenon observed in central vision.

In concluding I wish to express my indebtedness to Professor James H. Leuba, of Bryn Mawr College, for suggestions and criticism throughout the investigation and to Dr. Helen Thompson Woolley for suggestions with reference to the general problem.

TABLE I.¹

OBSERVER F. NASAL MERIDIAN.

Back-ground.	Stimulus.	Color Seen.	40°.	45°.	50°.	55°.	60°.	65°.	70°.	75°.	80°.	85°.	90°.	95°.	100°.
No. 1	Violet	Violet				1y	1y I	3y (1)	4y	Ig 1y I (1)	Ig 2y	I 1y	Iy (1y)		
No. 1	"	Blue	Ig	5g	2g	Ig 2y	2y	1y	Ig 1y	20 3g	10 I (1?)	1 (1)		I	
No. 3	"	Violet	Ig		Ig	I	2g	2g I (g)	20						
No. 3	"	Blue	4g	3g	Ig	I	2 (1) II	II (1)	III (1)						
No. 34	"	Violet	Ig					(2) (Ig)	I						
No. 34	"	Blue	Ig					4 IIy	III Iy Ig						
No. 1	Carmin	Carmin	Ig	2g	Ig	4g	2g (Ig) I	Ig		II IIy (Ig)	II (1) Iy Io	Iy I	II	I Iy	
No. 1	"	Blue	Ig			I	I	Ig		2 (2)	(1g) I	2	I	Iy	
No. 3	"	Carmin	Ig			Ig	I?	Ig 2 (1)	2			2 (1)	I (1)	I	
No. 3	"	Blue	Ig			Ig									
No. 34	"	Carmin	Ig			Ig									
No. 34	"	Blue	Ig			Ig									
No. 1	Green Blue	Green Blue					Iy	3y			Iy	I	Iy	I	
No. 1	"	Blue					Iy								
No. 3	"	Green Blue	10	10	10	20	Iy		10	2y	2y I	Iy I	Iy	I	
No. 3	"	Blue				10	Iy 10					I	I		
No. 34	"	Green Blue	10	20	10		40	I		4	I	I			
No. 34	"	Blue						30 Iy	2r						
No. 1	Black	"					I	I	I						
No. 1	"	"				III	IV	I	II	II	V (I?)	II	IV IIy	I	
No. 3	"	"	I	I	I	I	I	III	II	III	II	II	I	I	
No. 34	"	"	I	I	I	I	I	III	II	III	II	II	I	I	

¹ For explanation of the tables, see p. 43.

TABLE II.

OBSERVER H. NASAL MERIDIAN.

Back-ground.	Color.	Color Seen.	25°.	30°.	35°.	40°.	45°.	50°.	55°.	60°.	65°.	70°.	75°.	80°.	85°.	90°.	95°.	100°.
No. 1	Violet	Violet	I	Iy 1g	Ig(1y)(1g)	3g Iy	Ig 1g 2y	(1y) 1g	2g	Iy Iy	I(y)	Iy	I 2y (1y)	I (g) I	I			
No. 1	"	Blue				2y	3y	3y	Iy 1?	Iy	Iy	4y	3y	6y I	Iy 2	II	III	
No. 3	"	Violet		Ig	Ig	2y	3y	(1g)	Iy I?	Iy	Iy	(1) 1r	Ig I	I	Iy 1	Iy I	I	I
No. 34	"	Violet		Ig 3g Iy		2g(1y)	3y 1g		Iy I		2 I(g) 1g	3 Ig II	Ig I	I				
No. 34	"	Blue				Ig		Ig	I			4 III(2)	IV I(1)	II				
No. 1	Carmine	Carmine							3g	2g 2(1)	3g(1) I	4 III(2)	3 III(1)	IV I(4)	VI	II	I	
No. 1	"	Blue							I	Ig	I	2	5 I (1)	3 III	III	I		
No. 3	"	Carmine				Ig	2g	I	I		Iy	(1y) Iy	I	I (y)				
No. 34	"	Blue						Iy	10									
No. 34	Grn. Blue	Grn. Blue				Iy	10	2y	4y	3y Iy	2y	Iy	I		II	II	I	
No. 1	"	Blue				2y	10	2y	Iy	3y	2y	3y	3y	2y (1y)	Iy 2			
No. 3	"	Blue				Iy	20	I 0	Iy	10		Iy	10 Iy(1)	I	I			
No. 34	"	Grn. Blue			Iy	10	20	I 0	20			Iy			I	Iy		I
No. 34	"	Blue																

TABLE III.
OBSERVER P. NASAL MERIDIAN.

Back-ground.	Stimulus.	Color Seen.	20°.	25°.	30°.	35°.	40°.	45°.	50°.	55°.	60°.	65°.	70°.	75°.	80°.	85°.	90°.	95°.	100°.
No. 1	Violet	Violet						IyI	2g Iy	I	2y Iy	Iy	Iy	Ily					
No. 1	"	Blue					2g	Ig	Iy	Ig	Iy	Iy	Iy	4y	3y			II Iy	I
No. 3	"	Violet						2y	Iy	2g	Iy	Iy	Iy	Iy	Iy				I
No. 3	"	Blue							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	Violet							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	Blue ¹							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	Blue ¹	(Iy)	2y					Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 1	Carmine	Carmine							Ig	Ig	Iy	Iy	Iy	Iy	Iy				I
No. 1	"	Blue							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 3	"	Carmine							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 3	"	Violet							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	Blue							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	Carmine							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	Violet							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	Blue							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	"							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	"							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	Black ²								Iy	Iy	Iy	Iy	Iy	Iy	Iy				I
No. 34	"	"							Iy	Iy	Iy	Iy	Iy	Iy	Iy				I

¹ In five cases the after-images designated were brownish and unsaturated.

² This black was ordinary black pasteboard and showed a slight tendency to appear reddish. The after-images were very faint and indistinct.

TABLE VII.

OBSERVER P.

Carmine.	Background No. 1.				Background No. 3.				Background No. 34.			
Color.		A-I. Green.	A-I. Yellow.	No A-I.		A-I. Green.	A-I. Yellow.	No A-I.		A-I. Green.	A-I. Yellow.	No A-I.
Seen as Carmine.	6	2	3(1 red)		20	15	5		14	6	1	7
" " Violet.					8(1)	1(1)	7		2			2
" " Blue.					2		2		7			7
Not Seen.	4			4	15		5	10	4		2	2

Total No. Tests = 10.

Total No. Tests = 46.

Total No. Tests = 27.

After-image Green = 2. After-image Green = 17. After-image Green = 6.

" " Yellow = 3. " " Yellow = 19. " " Yellow = 3.

" " Not Seen = 4. No After-image = 10. No After-image = 18.

TABLE VIII.

OBSERVER H.

Carmine.	Background No. 1.				Background No. 3.				Background No. 34.			
Color.		A-I. Green.	A-I. Yellow.	No A-I.		A-I. Green.	A-I. Yellow.	No A-I.		A-I. Green.	A-I. Yellow.	No A-I.
Seen as Carmine.	10(1)	3	1?	6(1)	19(9)	9		10(9)	17(1)	4		13(1)
Not Seen.	8			8	20			20	9			9

Total No. Tests = 19.

Total No. Tests = 48.

Total No. Tests = 27.

After-image Green = 3. After-image Green = 9. After-image Green = 4.

" " Yellow = 0. " " Yellow = 0. " " Yellow = 0.

" " Not Seen = 16. " " Not Seen = 39. " " Not Seen = 23.

TABLE IX.

OBSERVER F.

Carmine.	Background No. 1.				Background No. 3.				Background No. 34.			
Color.		A-I. Green.	A-I. Yellow.	No A-I.		A-I. Green.	A-I. Yellow.	No A-I.		A-I. Green.	A-I. Yellow.	No A-I.
Seen as Carmine.	3(2)			3(2)	15(2)	10(1)		5(1)	17(4)	6	1?	10(4)
" " Blue.	2(3)	(1)		2(2)	5(1)	1(1?)	1	3	4(2)			4(2)
Not seen.	7(1)			7(1)	21(1)	1(1)	8(1 or)	11	2			2

Total No. Tests = 18.

Total No. Tests = 45.

Total No. Tests = 29.

After-image Green = 1. After-image Green = 14. After-image Green = 6.

" " Yellow = 0. " " Yellow = 9. " " Yellow = 0.

No After-image = 17. " " Orange = 1. No After-image = 23.

No After-image = 21.

TABLE X.

OBSERVER P.

Green-Blue.	Background No. 3.				Background No. 34.			
Color.		A.-I. Orange.	A.-I. Yellow.	No A.-I.		A.-I. Orange.	A.-I. Yellow.	No A.-I.
Seen as G.-B.	5	4	1		3	1 red		2
" " Blue.	10	1	9		11	7 red	2	2
Not Seen.	4		3	1				

Total No. Tests = 19.
 After-image Orange = 5.
 " " Yellow = 13.
 No After-image = 1.

Total No. Tests = 14.
 After-image Red = 8.
 " " Yellow = 2.
 No After-image = 4.

TABLE XI.

OBSERVER H.

Green-Blue.	Background No. 3.				Background No. 34.			
Color.		A.-I. Orange.	A.-I. Yellow.	No A.-I.		A.-I. Orange.	A.-I. Yellow.	No A.-I.
Seen as G.-B.	14	1	13		8	6 1 red	1	
" " Blue.	17(1)		15(1)	2	7(1)	3	2	2(1)
Not Seen.	7		2	5	2			2

Total No. Tests = 39.
 After-image Orange = 1.
 " " Yellow = 31.
 No After-image = 7.

Total No. Tests = 18.
 After-image Orange = 9 (1 red).
 " " Yellow = 3.
 No After-image = 5.

TABLE XII.

OBSERVER F.

Green-Blue.	Background No. 3.				Background No. 34.			
Color.		A.-I. Orange.	A.-I. Yellow.	No A.-I.		A.-I. Orange.	A.-I. Yellow.	No A.-I.
Seen as G.-B.	6	5	1		9	8		1
" " Blue.	13	3	7	3	12	3 2 red	1	6
Not Seen.	4		2	2	2			2

Total No. Tests = 23.
 After-image Orange = 8.
 " " Yellow = 10.
 No After-image = 5.

Total No. Tests = 23.
 After-image Orange = 11.
 " " Red = 2.
 " " Yellow = 1.
 No After-image = 9.

TABLE XIII.

OBSERVER H. TEMPORAL MERIDIAN. BACKGROUND NO. 3.

Stimulus.	Color Seen.	20°.	25°.	30°.	35°.	37.5°.	40°.	45°.	47.5°.	50°.	52.5°.
Violet.	Violet.						Iy			III IV y	
"	Blue.	1g Iy		2y	2y	3y	3y	(1) Iy	I y		
Carmine.	Carmine.	3g	2g I	1g	II	II g	Ig III	II			
"	Violet.		Iy	Ig							
Yellow.	Yellow.						2b	6b	2b I	3b	VI
Blue.	Blue.		I y		Iy		3y	3y	3y 2I	III y II Iy	IV Iy
Black.	Black.				I		I	2	2	5	2
Gray No. 3.	Gray.						I	4	I	I	I

TABLE XIV.

OBSERVER C. NASAL MERIDIAN.

Stimulus.	Color Seen.	Back-ground.	92.5° N	94°.	95.5°.	97°.	98.5°.	99.5°.	101°.
Blue.	Blue.	No. 34	2	2y 10 I	5 I	II Iy 5	3y 3 II (2)	IV Iy Iy (2)	VI Iy 4
"	"	No. 3	Iy I	2y	II I 3y	I Iy 3y I	II Iy 3 2y	II y II 2y I	II III y I
Yellow.	Yellow.	No. 3	2b	1b Ib	2b 3	I II b 2 Ib	4b I (I)	Ib (3) 2	IV 3
"	"	No. 34	I Ib	5b	3b Ib I	4 3b (I) I	6 2b I	III 6 (I) 5b Ib	VI 5 (2) Ib

EXPLANATION OF TABLES.

The Arabic numerals designate the number of times the stimulus was seen in a given color-tone; the Roman numerals the number of times the stimulus appeared colorless. In cases in which the judgment was doubtful the number is enclosed in brackets. In Tables IV. to XII. the numbers are inclosed in brackets when the observer was doubtful concerning the tone of the stimulus color, a question mark is placed beside the number when the observer was in doubt concerning the tone of the after-image.

The suffix in Tables I., II., III., XIII. and XIV. designates the tone of the after-image in each case: *y* = yellow, *g* = green, *o* = orange, *r* = red and *b* = blue. For example 3y means that the color was followed 3 times by a yellow after-image.

The backgrounds are Hering gray, Nos. 1, 3 and 34, and the stimuli fully saturated Hering colors.

THE DOCTRINE OF PRIMARY AND SECONDARY SENSORY ELEMENTS. (I¹).

BY DR. BORIS SIDIS,
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I.

The theory of perception is fundamental both in normal and abnormal psychology. All mental activities are intimately related with the process of perception. Our wills, our thoughts and our feelings relate to our experience of the outer world of things. Biologically regarded, the percept is of the most vital importance, inasmuch as it forms the medium between the individual and the outer environment; psychologically, the percept reflects the external world and mirrors the conditions of life to which the given organism has to adjust itself. In fact, the percept may be regarded as the coin possessing the value of the external environment. In this respect we cannot help agreeing with Professor Baldwin's statement: "The theory of perception is perhaps the most important as well as the most difficult problem in psychology. The interpretation of the higher processes of mind rests upon it and it underlies the body of our general philosophy. The great philosophies of the world take their rise from initial differences in the method of construing perception."

In abnormal psychology the theory of perception is of the utmost importance, both from a theoretical and practical standpoint. Illusions, hallucinations, dream states, subconscious states, many states of dissociation depend for their explanation on the analysis of the process of perception. In one of my papers on hallucinations, published in this REVIEW, I have developed a theory of perception, a theory which may be characterized as *the doctrine of primary and secondary sensory elements*. This doctrine is based on a close analysis of the

¹ The MS. of this article was received November 1, 1907. — Ed.

normal process of perception and is substantiated by observations and experiments of abnormal mental life.

Before however we state our view of perception it may be well to make a review of what the principal psychological authorities teach on the subject.

James Mill in discussing perception tells us: "The colors upon a body are different, according to its figure, its shape, and its size. But the sensations of color and the sensations of extension, of figure, of distance have been so often united, felt in conjunction that the sensations of the color are never experienced without raising the ideas of the extension, the figure, the distance in such intimate union with it, that they not only cannot be separated, but are *actually supposed to be seen* (italics are mine). The sight, as it is called of figure, or distance, appearing, as it does a simple sensation, is in reality a complex state of consciousness a sequence in which the antecedent, a sensation of color, and the consequent a number of ideas are so closely combined by association that they appear not one idea, but one sensation."

Sully defines perception as a mental act that 'supplements a sense impression by an accompaniment or escort of revived sensations, the whole aggregate of actual and revived sensations being solidified or integrated into the form of a percept.' The revived sensations are equivalent to James Mill's associated ideas and images. We shall point out later the confusion which generally prevails among psychologists and psychiatrists, when they talk indiscriminately of revived sensations and ideas regarding the two as identical.

Höffding describes the process of perception "as the fusing of a reproduction and an actual sensation. The percept is thus conceived as compounded out of a representation and a sensation."

Taine tells us that "Images associated with the sensations of the different senses, especially with those of sight and touch constitute acquired perceptions."

Wundt regards the percept as a psychical compound of ideas or of revived sensations or images. In that respect his analysis differs but little from that of other psychologists who regard

the ideas, images and revived sensations as identical elements going to form the associated whole or psychic compound, the percept.

Külpe speaks of 'centrally excited sensations' regarding them as the ideas and the images of the psychologists and psychiatrists and tells us that he avoids the use of 'ideas.' As far as perception is concerned he closely follows his master Wundt and talks of psychic compounds, of sensations and centrally excited sensations which really are identical with the old fashioned ideas and images.

Titchener follows closely Wundt and Külpe and regards the 'percept as a compound, or a complex of sensations,' of peripheral and of centrally initiated sensations. In order to be explicit he hastens to tell us that there is no fundamental difference between the perception and idea. "It is customary to speak of perception, when the majority of the simple processes in the complex are the result of stimulation of a sense organ, *i. e.*, are peripherally aroused, and of idea when the greater number are the result of an excitation within the brain cortex, *i. e.*, are centrally aroused. If I have a table before me and my eyes open I am said to perceive the table; if I close my eyes and think of what I saw, to have an idea of a table. But we have seen that the sensations aroused centrally do not differ as psychological processes from those aroused peripherally." This statement put in such an explicit form brings out clearly what may be designated as the psychologist's fallacy. The fallacy becomes specially apparent in the domain of abnormal psychology.

Baldwin with his characteristic breadth of comprehension puts the subject of perception on a wide basis: "Perception is the apperceptive or synthetic activity of mind whereby the data of sensation take on the forms of representation in space and time; or it is the process of the construction of our representation of the external world." Baldwin does not commit himself to the ordinary fallacy current among psychologists.

Similarly James with his genius for psychological insight tells us: "The consciousness of particular material things present to sense is nowadays called perception." And again

"Perception thus differs from sensation by the consciousness of farther facts associated with the object of the sensation." He tells us further: "We certainly ought not to say what usually is said by psychologists and treat the perception as a sum of distinct psychic entities, the present sensation namely, plus a lot of images from the past, all integrated together in a way impossible to describe. The perception is one state of mind."

We thus see that most of the psychologists regard the percept somewhat in Spencerian terms as being made up of presentations and representations, or as Spencer puts it as being 'partly presentative and partly representative.' In other words the percept is a compound of sensations and images, a synthesis of peripherally induced sensations and of images, or of ideas centrally excited. One principle underlies the current theory of perception, variously phrased by different psychologists, and that is the identification of ideational and sensory processes.

The identification of ideational and sensory processes may be traced to Spinoza when he tells us in his *Ethics*, Prop. XVII., note, "The modifications of the human body, of which the ideas represent external bodies as present to us, we will call the images of things" and then in another place of Part II., Prop. XLIX., note, "In order to illustrate the point let us suppose a boy imagining a horse and perceiving nothing else. Inasmuch as this imagination involves the existence of the horse, and the boy does not perceive anything which would exclude the existence of the horse he will necessarily regard the horse as present; he will not be able to doubt its existence, although he be not certain thereof. We have daily experience of such a state of things in dreams." The images, according to Spinoza, are equivalent to sensations and percepts, unless counteracted by the more intense peripheral sensations which thus become the 'reductives' of the image, a doctrine afterwards fully developed by Taine. I may add that Spinoza's view of dreams is repeated almost verbatim by the greatest psychological authorities, all uncritically giving their assent to the current fallacy that the image is but a weakened sensation and that the sensation is an intensified image.¹

¹In my experimental work on sleep and dreams, soon to be published, I take up the subject in detail.

This theory of images and perception is perpetuated through Hobbes, Locke, Hartley, Hume, James Mill down to our times.

Hobbes in his terse English puts it: "Imagination therefore is nothing but decaying sense and is found in men and many other living beings, as well in sleeping as waking."

Locke derives his 'ideas' from 'experience,' but his 'experience' is somewhat vague and broad, inasmuch as it flows from two fountain heads,—sensation and reflection. "Let us then suppose the mind to be as we say white paper void of all characters without any ideas, how comes it to be furnished? . . . To this I answer in one word from experience. . . . Our observation employed either about external sensible objects or about the internal operations of our minds, perceived and reflected on by ourselves is that which supplies our understanding with all the materials of thinking. These two are the fountains of knowledge from whence all the ideas we have or can naturally have, do spring." Perception is used by Locke in a broader sense than what it is understood at present, as he uses perception for sensory experience as well as for the introspection of higher mental processes. He tells us, however, that in either case "the mind has a power to revive perceptions which it has once had, with this additional perception annexed to them that it has had them before." Locke evidently entertains the view that sensations can be revived as original sensory experience and that the revived ideas do not differ, except for the addition of pastness, from the original ideas derived from the great source of sensation.

When we pass to Hartley and Hume the identification of sensation and idea is set forth with great explicitness. In fact, it is taken as the fundamental principle of their psychological systems. Thus Hartley postulates in his eighth proposition that "Sensations by being often repeated leave certain vestiges, types or images of themselves which may be called simple ideas of sensation" and correspondingly we have that "sensory vibrations by being often repeated beget in the medullary substance of the brain a disposition to diminutive vibrations which may be called vibratiuncles and miniatures corresponding to themselves

respectively." The vibratiuncle is the physical substratum of what we experience as an idea and is a copy of the original vibration. The vibratiuncle is a weakened vibration and the idea is a weakened sensation.

Hume does not burden himself with Hartley's vibrations and vibratiuncles, but still at the basis of his system we find the same fallacious psychological principle. "All our ideas" he says "are copies of our lively perceptions or impressions." In other words, our sensations are lively impressions, while the ideas are only weakened perceptions,—the idea differs from the sensation only in intensity. There is no qualitative difference between sensation and idea. Ideas belong to sensory processes and do not differ as such from sensations. This view has since become the heritage of current psychological theories.

II.

As in many other sciences, especially the ones of the purely mental variety, a good deal in psychology is traditional such for instance are the tripartite and bipartite division of the mind or the various classifications of the mental activities. Of course, classifications as well as theories have their important function in science, but they should not be permitted to become a bed of Procrustes to the guests whom they shelter.

It may sometimes be well to disregard established principles, classifications and time-honored traditions and study the facts from a somewhat different standpoint. We may then possibly see the facts in a new light and realize aspects and connections which are hidden from the customary view of the phenomena.

Suppose we take a mental cross-section of a moment of perceptual consciousness in the very act of formation of a percept. The whole perceptual moment may be said to be spread out before our mental gaze. We find sensory elements of a relatively intense character. Certain sensory elements stand out first and foremost in consciousness, they are the very first to arrest the mental gaze and keep it steadily fixed on themselves. In the same view however we can also discern other elements, not so prominent, though equally sensory which, on account of their

lack of prominence, appear to be of a subordinate character. The whole tone of the percept is given by the qualitative aspect of the prominent elements which seem to guide and form the organization of the percept.

The general plan of the structure of the percept may be compared to that of the cell. A close examination of the cell reveals the presence of a central element, of a nucleus surrounded by cytoplasm with its meshwork, the cytotreticulum. The nucleus forms the central and important structure having the functions of assimilation and reproduction. The nucleus and cytoplasm however are intimately related; the modification of one affects the other. Both nuclear and cytoplasmic structures form one organized whole, one living cell. Similarly in the percept we find a group of sensory elements which constitute the nucleus and a mass of other sensory elements, possibly the main mass, forming the tissue of the percept. The nuclear elements are more intense and appear to be predominant in the total mental state, — both however are intimately connected and go to form the living tissue of the percept. The nuclear elements of the percept have the lead and seem to possess the organizing, the fermenting power to assimilate the mass of subordinate elements and have them transformed into one unified organic whole. The slightest modification in the structure and function of the nuclear elements brings about a change in the total cytoplasmic mass of the percept, giving rise to a different structure, to a different percept; and again, modifications of the cytoplasmic mass, so to say, affect the formation of the nuclear elements often resulting in a different percept. It requires however quite a considerable change in the subordinate elements to bring about a change in the percept; while the slightest modification of the nuclear elements, whether in quality or intensity, will often bring about a fundamental transformation of the percept. The nuclear elements may be regarded as the sensitive, as the vital point of the perceptual system. We cannot displace nor can we modify the nucleus of the percept without profoundly modifying or even completely destroying the life existence of the percept.

We may point out here a very important aspect of the percept,

an aspect which has been neglected by the older psychologists, but which is now being more and more emphasized by the younger psychologists who lay more stress on the functional and biological side of mental life. Like the life of all organized beings, the life existence of every psychic state is for some reaction, for some adjustments to the conditions of the external environment. In the struggle for existence the animal organism must on pain of death be adjusted to the objects of its external world. Now the central, nuclear, sensory elements awakened by external excitations give the cue for the reaction, they form the sensitive organization for the release of motor energy in definite directions, they signify a definite object to which correspond definite motor tendencies with final reactions of adjustment. To the mouse the cat is not an object of contemplation or an object of observation, on account of its sensory effects, — the cat is an object to run away from. To the dog a cat is not an object of beauty, but something to be run after. The sensory stimulations coming from the 'that' which is mouse is for the cat something to be on the alert, to jump after and to attack. In fact the lower we descend in the scale of animal life, the more prominent do the motor reactions become. Where life is predominantly of the instinctive type, the motor side of consciousness is more apparent. The fly attracted by the scent to deposit its eggs in decomposed meat; the wasp that strikes the caterpillar in definite places paralyzing its nervous system, thus preparing food for the coming larva; the newborn infant starting to suck, when put to the breast — are good examples of motor reactions in response to sensory stimulations coming from external objects. A definite sensory stimulus is the trigger which releases a definite set of motor reactions. The fly, the bee is hardly conscious of the sensory characters of the honey; it is more likely that the sensory stimulations of the honey release the appropriate reaction of flying towards it. The bright colors of flowers developed in the course of natural selection for the fertilization of plants serve the same purpose; they awaken definite responses useful both to plant and insect, as it is hardly probable that the insects are primarily attracted by the beautiful coloring of the flowers. The visual stimuli awakening defi-

nite sensory elements may be regarded as central and nuclear which in turn serve as a highly sensitive trigger to release definite systems of motor reactions. The effect is somewhat similar to that of the moth attracted by the flame, — the flame acts as a peripheral stimulus giving rise to sensory elements which form the sensitive trigger in the release of the reaction of circling around the flame, in spite of the harmful results. The moth reacts to bright objects in going towards them, but this particular bright object, the flame, has not been provided for in the motor adjustments of the moth, hence the lack of adaptation, the going to the danger, instead of flying from it.

So apparently insignificant is the sensory side and so predominant is the motor side with its almost mechanically fatal reactions, that some physiologists put the whole mechanism of excitation and reaction in the lower animals under the category of tropisms, which may be positive or negative, according as the animal goes to or from the particular stimulus. The sensory side is denied, the whole affair is simply a delicate chemical reaction such as the chemotaxis of leucocytes in the phenomena of phagocytosis observed in inflammations and bacterial invasions, or what is still simpler as the phenomena of heliotropism observed in the case of plants. This purely mechanical or chemico-physiological view may be crude and far fetched in the case of lower animals, but it brings out strongly the predominance of the motor reaction in response to definite sensory excitations. The motor attitude of the animal towards the excitations of the external environment constitutes the predominant part of its objective world. The reactions with their sensory-motor effects are part and parcel of the total percept. Sensori-motor life gives reality to the world of objects. The spatial, the resistant, the material character of objects depends on our motor reactions which give content and reality to the world of things. Activity gives the sense of 'physical' reality, the sense of material actuality, or of what is regarded as 'the really real.' In other words sensory-motor reactions with consequent kinæsthetic sensations may be regarded as constituting the very essence of the real, external, material world, — the world of external, material objects.

III.

The percept as we have pointed out forms one organic whole, the constituent elements are firmly integrated into one living organization. In other words, just as the organism is not simply an integrated compound of cells, tissues and organs, but all those lower units go to form the higher living unit, the life of the organism as a whole, so we may say that the sensory elements are not the same as the percept, they are analytically found, on the autopsy of the percept, — the sensory elements are the lower units that help to form the higher unit, the living percept. From a scientific standpoint, as the result of psychological analytical dissection, the sensory elements going to make up the psychic compound, the percept may be regarded as different from the total synthesis with its characteristic living activity and its peculiar form of perceptual consciousness.

The constituent elements of the percept are not of the same definiteness and intensity. The central nuclear elements stand out more distinct, more definite and consciousness lights them up with more power and intensity. They are like the mountain peaks — when glade and valley and mountain side are still immersed in darkness, the rising sun greets the mountain tops and plays and caresses them with its rays; when again the shades of evening begin to flit and gather over vale, ravine and gulch, the rays of the setting sun long linger on the peaks taking of them their last farewell. The central nuclear elements are in the focus of consciousness, — they are the first to be met by the glance of the mental eye and are the very last to be left by it. Consciousness plays with its search-light on the nuclear sensory elements. The central nuclear elements are intense, distinct and definite, while the subordinate elements are of far less intensity, are often quite indistinct, are, so to say, on the fringe of consciousness; in fact, may even be entirely subconscious. And still indefinite, indistinct and submerged as those subordinate elements are, they form the main content of the percept, giving it the fullness of reality.

The nuclear elements form the cue of the total reaction, thus standing for the particular object, forming the reality of the percept for the organism. No wonder then that the cue,

though it may be the smallest portion of the percept, none the less forms for the organism the most vital, the most significant as well as the most constant part of the percept. The attitude, the total reaction of the organism depends on the slightest difference in the cue, on the slightest change of the nuclear elements, since the apparently slight modification may often prove of great significance to the life existence of the organism, — it may be a matter of life and death. The nuclear elements constitute the signal, the sensitive trigger for the release of definite reactions towards the changes of external objects. Hence the nuclear elements come to signify, in fact, to constitute the essence of the percept.

A change of the subordinate elements of the percept does not matter so much as the slightest modification in the quality or even in the intensity of the signal. This, of course, does not mean that the subordinate sensory elements are not psychologically and biologically of the utmost consequence to the organism, but they are not of that immediate importance as the focal nuclear elements appear to the consciousness of the organism. The nuclear elements as signal focus the interest of the animal. We can well realize their vital importance, if we consider that the nuclear elements are the flag which indicates friend or enemy, war or peace, life or death.

IV.

If we regard the percept statically, we may describe it figuratively as a psychic compound, the union of the elements having somewhat the character of a chemical combination. A new compound is formed possessing qualities of its own, different from those of the constituent elements. The sensory characteristics are profoundly modified in the synthesis, so much so that they cannot be directly discerned and can only be discovered by patient analysis. The elements do not exist freely, they are bound up in one indissoluble union of the percept. It seems, as if different qualitative states arise in the union, the qualities of the elements appearing, as if transformed by the effected synthesis.

The percept forms a new compound in which the component

elements are disguised and transformed by the qualitative aspect of the central elements. The subordinate elements become adapted to the active nucleus and come out in the compound with sensory characteristics foreign to their nature. In the process of synthesis the subordinate elements become transmuted and assume the sensory characteristics of the nucleus. To analyze the various elements out of the synthesized percept, the central elements must be shifted, — the subordinate elements must be made focal, giving rise to new percepts, but at the same time making it possible to pass in review the various elements. In other words, the elements become revealed in proportion as we make of them signals, in proportion as they become significant of the total percept with its sensori-motor reactions.

The nuclear elements are the most pronounced, the most prominent, as far as saturation of sensory quality is concerned. They have so much of their peculiar sensory quality that they diffuse it into the other elements, — the subordinate elements appear under the sensory form of the nucleus; they become assimilated by the nucleus and are saturated with its sensory coloring. This holds true not only in regard to saturation, but also in regard to sensory brightness. The central elements possess a sensory brightness far in excess of other elements and hence they shed their sensory light on the more obscure, though no less important sensory elements. What however they illumine is not so much the peculiar sensory characteristics of those elements, but their own coloring with which they have saturated the total percept.

The force of the central elements lies specially in the emotional or affective tone with which they are pervaded. They arouse an attitude towards the external world in general and to the special object in particular, Taine would call it a tendency. The individual is stimulated by those nuclear elements and his whole attention is going out in direction to the object that has excited them. The whole organism is invaded by the subtle influence of the nucleus giving rise to definite sensori-motor reactions, intensifying the affective state which permeates the perceptual consciousness. The affective state of the percept is not always obvious in cases of fleeting percepts, but it becomes

manifest, when the central elements become temporarily fixed, the stress and strain of consciousness tending in one direction. The very changes occurring in the flickering intensity of the nuclear elements tend to sharpen the situation, to enliven the interest, strain the attention and be all agog so to say. The cat getting a glimpse of a mouse, or the dog catching sight of the cat may be taken as good illustrations of the affective states present in perceptual consciousness. The nuclear elements are the ones that are specially charged with affective or emotional states.

Biologically regarded, we can well see the importance of the central nuclear elements, the necessity of their standing out in consciousness as more prominent and more intense than the rest of the sensory elements. Constituting the signal, they come to be the most significant part of the percept, for they announce what 'that' is, they present the object, friend or foe, something to welcome or something to flee from. The central nuclear elements thus come to present objective reality, they safeguard the individual, they are the safety as well as danger signal. The more delicately differentiated those safety-danger signals are, the more protected the individual is in the struggle for existence. The more sensitive the individual becomes to the least difference of the nuclear elements, the better adjusted will he be to the conditions of the external environment and the better will be his chances in the process of survival of the fittest.

This brings us to the purposiveness of the percept. One of the important characteristics of the biological process is the final cause, the purpose which leads to the preservation of that process, to the preservation of the individual. We should therefore expect that in the psychic process which is the most highly developed biological process, purposiveness will be one of the most important traits. In the course of phylogenetic and ontogenetic evolution some sensory elements, the ones to which the organism is more sensitive, will be selected and become the indicators of the total percept, they will become the index or better to say the pain-pleasure flag, the safety-danger signal. The central elements will thus be the most prominent, the most intense for that particular state of perceptual consciousness. The

nature and character of the elements will vary with the organizations of the species and the individual. The dog will become more sensitive to variations of his olfactory sensations, while man will show marked sensitivity towards delicate differences of his visual sensory elements.

The great sensitivity of the nuclear elements is significant in so far as they lead to better adaptation and to more successful reactions. It is not of any consequence for the cow to gaze at the stars, for the pig to observe the phases of the moon, but it is a matter of importance for them to perceive any signs of food or the approach of a beast of prey. The heavenly bodies are non-existent for the brutes, because of lack of all reactions of adaptation, while food and predatory beasts are easily detected, because of the vital reactions bound up in the elements of the percept of which the nuclear elements form the signal. It is on account of the vital reactions that the perceptual nucleus plays such a prominent part and takes the lead of all the other elements. As I have pointed out in a former paper: "Every psychic state is for some reaction and that sensory element which gives the cue for the formation of the psychomotor elements, leading to some given reaction is, for the time being, the center, the nucleus of the total state."

V.

If we inspect the percept more closely, we find that there is some important difference in the character of the various constituent sensory elements. The central elements forming the nucleus of the percept are given *directly* by the sense-organ stimulated by its appropriate sensory stimuli, while the subordinate sensory elements are given *indirectly*, — they cannot be traced to appropriate sensory stimuli exciting those particular sense-organs on the activity of which those subordinate elements depend for their manifestation. In perceiving the lump of ice I can see the color, the size, the volume, the smoothness, the transparency, the distance and even the weight and coldness. Now what I can see directly is only the color, transparency, size, as given immediately by the stimulated sense-organ, by the visual sensations and image on the retina. Whence then come the

rest of the sensory elements so distinctly experienced? They are not memory images, — they have the same sensory characters as the elements given by the direct impression of the sense-organs. It is not that on perceiving a certain transparent object we remember its volume, its distance, its smoothness, its resistance, we perceive all that in sensory terms. They are not images, ideas, or representations — they are sensations. The central sensory elements may be termed direct or *primary*, while the subordinate elements may be termed indirect or *secondary*. The percept then may be regarded as consisting of two classes of elements of sensations, the primary and secondary sensory elements.¹

The secondary sensory elements are not images, nor ideas, nor representations, different terms employed for the same state by various writers, the secondary elements of the percept are essentially sensations. Now sensations are qualitatively different from images, ideas or representations. The image of a light does not shine, the idea of a voice does not sound and the representation of a perfume does not smell. A sensation or presentation as it is sometimes termed differs from an image or representation qualitatively, fundamentally. The sensation or presentation is given as immediate experience, while the image, the representation is essentially mediate, it is a mental substitute for the immediate experience of the sensation. The idea bears the same relation to the sensation as the photograph bears to the original, or rather as a symbol to the thing it represents. Ideas, images, representations symbolize sensations, but they are not sensations. A sensory process is fundamentally different. A sensation is not an intense idea, nor is an idea a weak sensation. Ideas differ far more qualitatively from sensations than visual sensations, for instance, differ from olfactory sensations. There is not a particle of evidence to substantiate the view that ideas or images are copies of sensations in the sense of being weak sensations or 'centrally excited sensations.' There is nothing of the sensory in the idea. The weakest sensation cannot compare

¹It may be well here to point out that the doctrine of primary and secondary sensory elements advanced by me has nothing in common with the primary and secondary qualities of the older psychologists.

with the most vivid representation. The laboratory experiments on that subject (Münsterberg and Külpe) are inconclusive as they either deal with incompletely perceived impressions, or with minimal sensations. In either case the percept is incomplete and uncertain. Külpe himself is forced to admit that ideas or centrally excited sensations as he terms them "cannot be regarded as simple revivals of peripherally excited contents, if only for the reason, that their remaining attributes are very rarely indeed identical with those of perception." He then goes on making a fatal admission: "The most striking evidence of disparity is perhaps afforded by intensity. . . . It is only in special cases that centrally excited sensations can rise from their accustomed faintness to the vividness of sense perception. We then speak of them as hallucinations (?); and they enter into a disastrous competition with the real material of perception, completely transcending the boundary line which so usefully divides it from the material of imagination." Külpe admits that there is no intensity to the image, that there is no variation in 'intensity' of images, an 'attribute' characteristic of percepts. Psychologically regarded this in itself shows the qualitative difference between image and percept.

Ideational and perceptual processes cannot be identified. The two are qualitatively different: the sensation has intensity, the image lacks it. We shall discuss later on the main differences of sensation and image, meanwhile we may point out the differences in brief: (*a*) A sensation has intensity, an image totally lacks it; (*b*) the image is a reproduction or rather a representation, a symbol of a sensation, but no sensation represents another; a sensation unlike an image, is not mediate, but immediate experience; (*c*) a sensation bears the mark of externality, an image lacks it; finally (*d*) a sensation cannot be called up at will, while an image is independent of peripheral stimulations of external objects and is usually under the control of the will. No sensation differs so much from another as the image differs from its corresponding sensation.

To refer as Külpe does to a hallucination as an intensified image is to reason in a circle and at the same time to be in sad contradiction with facts. A hallucination may be regarded as

a fallacious percept, but it is not on that account an image; a hallucination is a percept and is essentially sensory in character. The fact of a percept being fallacious does not in the least imply that it is 'imaginary' and not sensory. The ambiguity of the word 'imaginary' has not a little contributed to the psychological fallacy helping towards the confusion of image and sensation. 'Imaginary' is used in the common sense meaning not corresponding to any external reality, or in the psychological sense of consisting of those internal events or processes known as images or ideas. Now 'imaginary' used in the sense of lack of an external object by no means implies the psychological sense of consisting of images. A hallucination is commonly said to be imaginary in the sense of not having an objective reality, but we have to prove yet that it consists of images. The theories of illusions, hallucinations as well as of dream states and hypnotic hallucinations are vitiated by that fundamental psychological fallacy. As a matter of fact hallucinations are not made up of images, but of sensory elements, while on the contrary hypnotic hallucinations are not made up of sensory elements, but of images. In a former paper of mine I have pointed out that hallucinations are not due to 'images' but to actual sensations, that, psychologically regarded, hallucinations do not differ in their make-up from ordinary percepts. Ideas and images are not possessed of magic virtues and with all the fancy work about them, they cannot display sensory qualities. The image or idea is that bloodless, shadowy, fluttering affair which can no more attain the life of a sensation than a written letter can attain the power of sound. Had it been otherwise the world would have been a large asylum for images to play their pranks in.¹

¹ We may quote Stout as one of the few psychologists who seem not to accept the current psychological doctrine. In his 'Analytic Psychology' he tells us 'that complex perception does not consist in a given impression reviving a cluster of faint images of previous impressions.' And again "impressionial revival does not in the least countenance the theory that ideas are merely faint revivals of impressions. On the contrary, it tends strongly in the opposite direction. It shows that a revived impression is itself an impression, and not an idea." In his 'Manual of Psychology' he says 'that at bottom the distinction between image and percept is based on a difference of quality.' And again, "percepts and images possess a relative independence. This can be accounted for, if we suppose that the nervous tracts excited in perceptual process are not wholly coincident with those excited in ideational process."

The elements of the percept are not ideational, not imaginary, they are essentially sensory. The perceptual elements are synthetized into one percept. To take our stock example, the ice. The lump of ice is experienced as one object with many qualities each of which furnishes respectively its sensory quota towards the formation of the whole of the perceptual experience. We see, we perceive the hard, heavy, smooth, resistant body of ice, — all the elements have alike the intensity of sensation. The hardness, the smoothness, the bodily resistance are perceived by the visual sense and are visual, but as such they of course differ from the sensations experienced by their appropriate sense organs, as when for instance the same sensations are given by touch or by muscular and kinæsthetic sensations. Those muscular and tacto-motor sensations appearing as visual are not memory-images, but they are actual sensations, they are *secondary* sensations; they are secondary sensory elements which give the fullness of content to the percept having visual sensory elements as its nucleus. Unlike memory-images, secondary perceptual elements have the immediacy of sensational experience. Remembered sensory qualities are not immediate experiences given in the object of perception.

If we turn to pathology, we find that cases closely confirm our view. In certain mental diseases the patient can perceive the various qualities, although he cannot represent them to himself. In other cases the patient can clearly and vividly represent objects in all their details, but he cannot perceive the objects, when directly confronted with them. Clinical cases, even if we exclude all facts from introspective analysis, clearly point to the qualitative difference of image and sensation irrespective of the assumption of localization, — they may be due to the function of different brain structures, or to different processes of the same brain structures. In the light of recent research it is more likely that the neuron structures underlying ideational processes differ from those subserving sensory processes. Whichever view however we entertain in regard to the anatomical structures all the facts go to prove that image and sensation are qualitatively different psychic events.

The percept is not ideational, but sensory. There are no

memory-images in perceptual consciousness, although the latter may be closely associated with ideational processes. Such ideas however are on the fringe of the perceptual consciousness and do not constitute the essence of the percept. The percept consists of sensory elements, primary and secondary. The primary elements are initiated directly by incoming peripheral stimulations, while the secondary sensory elements are brought about indirectly, through the mediacy of the primary elements, the secondary elements themselves being really derived from sense-organs others than the one directly stimulated by the peripheral excitation.

If the percept is visual and V stands for the visual physiological processes, A for the auditory, O for the olfactory, M muscular, K kinæsthetic, T for tactual physiological processes; then let V_1, M_1, O_1, K_1, T_1 stand for the primary sensory elements; and let V_2, O_2, M_2, K_2, T_2 stand for the secondary sensory elements, then the total percept may be represented by the formula $V_1 O_2 M_2 K_2 T_2$. Since all the other elements appear in the visual percept under the visual aspect we may represent the percept by the formula: $V_1 M_2^{v_1} O_2^{v_1} K_2^{v_1} T_2^{v_1}$. The secondary sensory elements, though forming the main content of the percept, are apparently of a visual nature and still they really belong to qualitatively different realms of sensations. This clearly reveals their origin and nature: the secondary sensory elements are not visual, but they become so by being initiated through the visual sense. In other words, secondary sensory elements are not peripherally initiated. Are they then centrally excited sensations? No. They can only be induced by an external stimulus. But that external stimulus must act *indirectly*, through another sense-organ. In stimulating a sense-organ we not only get sensory elements characteristic of that particular sense, but also sensory elements belonging to other sense-organs which have not been stimulated. What really takes place is this: the external excitation acting on a particular sense-organ produces its appropriate sensations, but the peripheral physiological process diffuses or rather to say gets irradiated along other neurons of other sense structures, awakening their appropriate sensations. Such sensations, not being directly,

but indirectly peripherally initiated should be regarded as secondary sensations.

VI.

The phenomena of secondary sensations are well known in psychological literature. Some psychologists following the general fallacy of confusing image and sensation describe vivid images succeeding sensations under the category of secondary sensations. Barring such confusion we may say that the pure phenomena of secondary sensations are essentially sensory in character. When a sensation due to the stimulation of a peripheral sense-organ, instead of being followed by a train of association of ideas is followed by another sensation belonging to the domain of another sense-organ, the phenomenon is known as that of synæsthesia or of the secondary sensations.

One image or representation relating to a sensation of one sense-organ may be associated and bring in its train of associations any other image relating to any other sensation of any other sense-organ. The series of ideas or images will be a reproduction of stimulated sense-organs with their accompanying sensations, the ideas running parallel to the original psycho-physiological processes, somewhat on the Spinozistic principle of '*Ordo et connexio idearum idem est ac ordo et connexio rerum.*' And again in other cases, when not reproducing a previous series of sensory experience, the series of associated images may be more irregular and apparently capricious—a process usually described as the work of fancy, or imagination. A sensation or image then may be followed by any series of images without the intermediacy of external excitations and peripheral physiological processes, but a sensation cannot be followed by a series of sensations without the intermediacy of external stimulations. A sensation can only be initiated by its own appropriate stimulus and by its own specialized peripheral physiological processes. The smell of a rose will not by simple association give rise to a series of sensations of touring in an automobile, nor will the eating of a beefsteak give rise, through association, to the hearing of a symphony. In other words, there is an internal association of images or ideas, but there is

not an internal association of sensations. Images once born can be reproduced endlessly and at will, sensations die almost immediately after they are born and must be renewed every time under the same conditions of external stimulations. Briefly stated, there is memory for images, but not for sensations. Sensations are independent, images are interconnected.

If we represent sensations by A, B, C, D and symbolize images by a, b, c, d , the A, B, C, D have no relations to one another, but each one bears a definite relation to each corresponding image, A to a , B to b , C to c , D to d and so with the rest of the series. Sensation A will arouse image a which in turn may arouse the whole train of images b, c, d , but A cannot give rise to any of the sensations B, C, D . The image series a, b, c, d can be reproduced at will, in fact after a series of repetition the whole chain of links may rattle off against will, but nothing of the kind occurs in the case of sensations. Sensations do not form links in a chain which becomes automatic after many reproductions. Repetition of sensations does not form associated series; sensations maintain their independence.

The difference between image and sensation in respect to association is, psychologically regarded, apparently flawless. Unfortunately as it is usually the case with flawless generalizations and descriptions of phenomena observed under normal conditions, there is an ungracious 'abnormal' that refuses to fall into line. There are cases apparently abnormal from the psychological standpoint, cases which refuse to be gathered into the normal psychological fold, the cases seem to run counter to all normal psychological introspection. The sensations seem to run riot, — instead of being linked with their respective images they really call up *associated* sensations, these are the so-called sound-photisms or light-phonisms and similar odd combinations. It is true the sensations are rather awkwardly associated. One sensation always calls forth only a particular sensation and no other one, and besides the called forth sensation does not belong qualitatively to the same domain with the one that has initiated it. It is also true that the sensations show their lack of sociable character by not entering into any association with any other sensation, and that unlike images no asso-

ciative series can possibly be formed. Still the fact remains that a sensation can and does call forth another sensation. Evidently sensations can enter into associative bonds. Such psychic states appear uncanny and are regarded as abnormal. The phenomena are regarded as freaks belonging to the domain of pathology. Now curiously enough our study reveals the fact that what has been regarded as the pathological and exceptional turns out to be the ordinary and the normal. The stone which the builders neglected has become the corner stone. The exception has turned out to be the rule. Far from being the case that secondary sensations are rare and abnormal, they are quite common, since they constitute the very flesh and blood of the percept. Secondary sensations constitute the texture of the percept. The reason why they appear so strange is just because they are so common and so familiar.

The secondary sensation, when appearing alone out of its perceptual complex, cannot be recognized as the old familiar attendant belonging to the indissoluble retinue of the humdrum percept. Dissociated from its perceptual sphere the secondary sensation appears ghostly, hallucinatory. As a matter of fact the secondary sensation, hallucinatory and spooky as its manifestations are, constitutes part and parcel of perceptual experience. In fact, the main content of the percept consists of hallucinatory secondary sensations. Percepts and hallucinations are of the same grain. A percept is a hallucination with the primary nuclear sensory elements *present*, a hallucination is a 'real' percept with the primary sensory elements *absent*.

When secondary sensory elements become dissociated from the perceptual synthesis with the primary sensory elements, the elements, thus dissociated, not being related to any peripheral physiological process of their appropriate sense-organ, are regarded as central phenomena, as secondary sensations which are described as unusual, abnormal events of mental life. What, however, is abnormal is not the secondary sensation *per se*, but the fact of its *dissociation*. A dissociated secondary sensory element becomes manifested as a secondary sensation.

VII.

Secondary sensations are free secondary sensory elements, dissociated from the perceptual aggregate into the synthetic unity of which they enter as important components forming the organic whole of the percept. When appearing isolated, secondary sensations are the simplest form of hallucinations which become more and more complex as the secondary sensory elements, dissociated from the primary elements, become manifested in complex systems. Hallucinations are systems of secondary sensations or of secondary sensory elements.

Sensory elements are, as a rule, not free, they usually appear as perceptual compounds, and this holds specially true of secondary sensory elements. When therefore dissociated from their perceptual compounds, they appear as ghosts of the 'real' percept, as hallucinations. To quote from a previous work of mine: "The integration of the groups and especially of the secondary presentative groups is not of that unmodifiable organic character. Around a nucleus formed by a group, or combinations of groups of primary elements, groups of secondary sensory elements become aggregated, and the total aggregate gives rise to a consolidated and unified system of groups, resulting in a percept. In perceiving the chair yonder only the visual sensations constitute the true sensory groups that form the nucleus of the percept. The other psychic groups that are crystallized round the percept, such as weight, resistance, volume, size, shape, distance are really visuo-tacto motor groups; they are largely tacto-muscular groups tinged by the sensory quality of the nucleus; they are tacto-motor groups sensorially visualized, seen indirectly. Though these secondary sensory groups are firmly integrated, still their integration is not of such a character as not to become disintegrated and rearranged into new systems of groups. Such a disintegration is no doubt effected with difficulty, but it is by no means impossible. The perceptual compounds, unlike the sensory, admit of decomposition into elementary primary and secondary sensory groups. The component elementary sensory groups can be experienced separately under different conditions and circumstances. We can close our eyes and walk up to the object of perception, say the chair,

and thus experience the free muscular sensations of distance, or we may push our hand against the chair and experience the sensation of resistance, or take the chair in the hand and experience the sensation of resistance, or take the chair in the hand and experience the muscular sensations of weight and shape. The primary and secondary groups going to make up the percept can be isolated by withdrawing the organizing nuclear group of primary sensations, thus bringing about a disintegration of the particular aggregate.

“If we inspect more closely this process of isolation, we find that the constituent secondary sensory groups are not really isolated, so as to stand out all by themselves. What actually happens in this seeming process of isolation is simply the formation of a series of new perceptual aggregates in which the particular sensory groups that are isolated and specially brought out become the nuclei, the foci. For in the perceptual aggregate it is always the character of the nucleus that is specially brought out, and it is the nuclear aggregate that tinges with its sensory color all the other aggregates. To revert to our previous example, to the percept-chair. In passing the finger over the chair, the touch may form the nucleus of the moment, but around this primary nuclear sensory group other secondary sensory groups, such as thermal and muscular sensory elements become organized to form the synthesis of the perceptual moment. If we try to find out the shape of the chair by a series of touches, we really form a series of percepts, the sensory nuclei of which are not visual, but tacto-muscular in their nature. A sensory group then cannot in reality appear in a purely isolated form.” In other words, sensory elements appear in groups,¹ and this holds specially true of secondary sensory elements or of secondary sensations. Secondary sensations, though present in every percept, rarely appear in isolation. The affinity of secondary sensory elements to run into compounds becoming synthesized with primary elements makes it

¹James lays stress on this fact of grouping of sensory elements: “*All brain processes are such as give rise to what we may call Figured Consciousness. If parts are irradiated at all, they are irradiated in consistent systems and occasion thoughts of definite objects, not mere hodge-podge of elements.*”

difficult to observe them, except in the peculiar phenomena of synæsthesia and in the abnormal states of hallucination.

If secondary sensations are simple hallucinations, hallucinations are compound secondary sensations. As we have pointed out in a previous paper on hallucinations, a close examination of hallucinations shows them to be cases of systems of secondary sensations dissociated from their primary nuclear elements. In states of dissociation a peripheral stimulation with its physiological processes and concomitant primary sensory elements may become dissociated from systems of secondary sensory elements which alone stand out in consciousness as hallucinations. A close examination reveals the presence of some obscure pathological conditions which by irritation and by irradiation awaken secondary sensory elements giving rise to full fledged hallucinations.

THE PSYCHOLOGICAL REVIEW.

PECULIARITIES OF PERIPHERAL VISION.

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I. SPACE VALUES OF THE PERIPHERAL RETINA.

I. INTRODUCTION. 1. *Problem.*—The size of objects, as they appear to the eye, varies with the position on the retina of the images of the object. Imaged on the fovea, the object appears of one size; imaged on the periphery of the retina, it appears differently. Analogies to this fact are well known in the perception of extent by the various regions of the skin of the body. But such differences in space perception as exist between the temporal and nasal regions of the retinae of the two eyes, are not paralleled by any similar facts in the province of tactual space perception. That these differences which are striking and interesting so easily escape attention, is to be attributed, in part, to the dominance of foveal vision, and, in part, to the absence of objects in the peripheral field, between which comparisons could be made. If, however, two discs of white cardboard, each provided with a black spot on its periphery, be rotated in the field of vision of one eye, in such a manner that the images of the disks fall on widely different portions of the retina, the differences in the size of the orbits described by the two spots, instantly become apparent. Furthermore, if the black spots are attached to movable radii of the discs, so that the area included in the orbit of each spot can be increased or diminished by lengthening or shortening the radius, a convenient measure exists for determining the amount of spatial disparity between one part of the retina and another. Under these conditions, not only differences in size appear, but

changes as well in *rate* of speed of the moving spot and *form* of orbit. While these differences of size, rate of motion and form, which exist between the fovea and the periphery of the retina, have all been previously observed, no exact and exhaustive study has been made of them. Exner¹ first noticed that a moving object appears to move more rapidly when its image falls on the periphery of the retina than when it is seen directly. Both Helmholtz² and James³ have pointed out the disparity between the peripheral and foveal perception of size. The illusion of form in indirect vision has been described by Helmholtz⁴ and others.⁵ The purpose of this paper is to describe the results of observations on the perception of size in various regions of the retina. It is the first of a series of three papers which have as their general theme the peculiarities of peripheral vision. The second and third papers will deal with the illusion of form and the perception of motion in indirect vision.

2. *Apparatus*. — As is evident from the photograph which is here reproduced (Plate I.), the apparatus consisted of a large perimeter. The objects, the sizes of which were compared, were two white cardboard discs each bearing upon it a black spot. These discs were fixed upon a spindle which was so mounted in a metal frame that the frame, spindle and disc could be moved along the perimeter and clamped, by means of a set-screw, at any point desired. An essential condition of the experiment is, that both discs move at the same rate of speed. This requirement was met by turning the discs from the axle of the same pulley. The motion of the pulley was transmitted to the spindles by flexible shafts such as are used by dentists in their drilling machines. By this device, identity of rate of speed is undoubtedly secured; but identity of direction of motion is possible only when the discs, so to speak, have their backs to each other. When the shafts are bent in any other than a direction parallel to that of the axle of the pulley, the directions of revolution of the two discs become opposed. Since

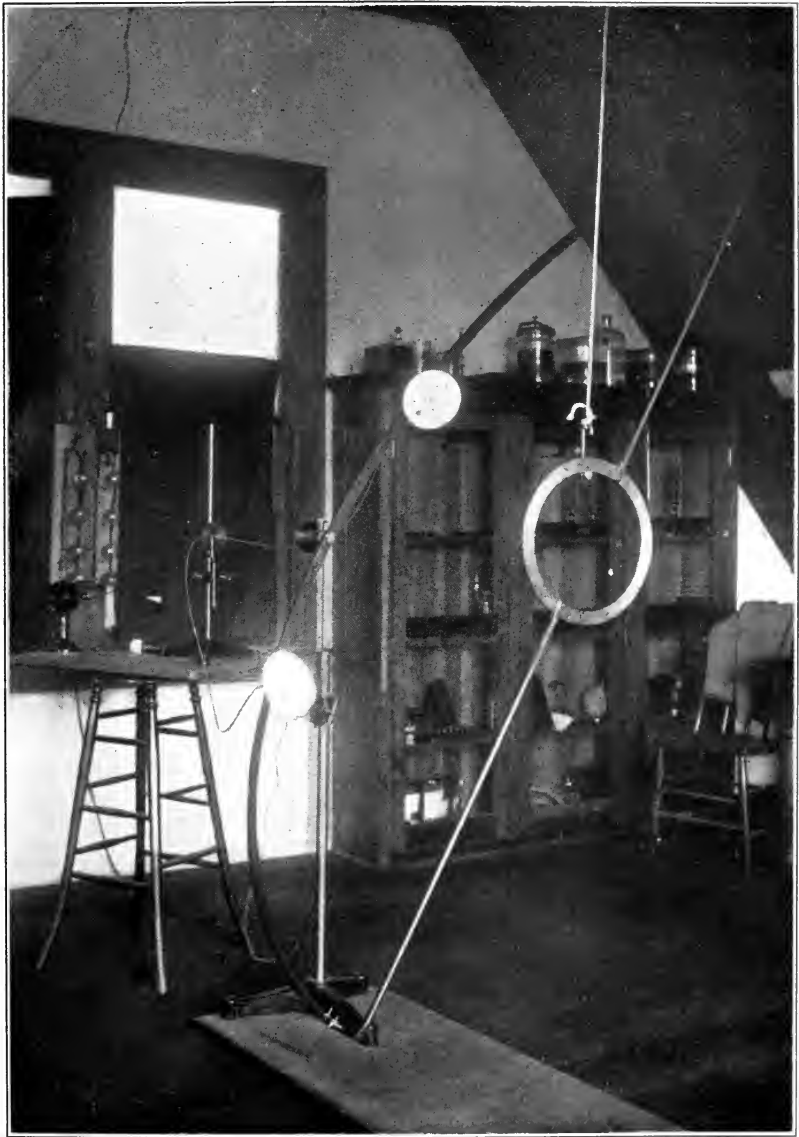
¹ *Pflueger's Arch.*, 38, 217.

² *Physiologische Optik*, 2d ed., 697.

³ *Principles of Psychology*, II., 140.

⁴ *Loc. cit.*, 697.

⁵ Sanford, *Exper. Psych.*, 192.





such a bending of the shafts was necessary with this apparatus, the direction of motion of the spots was opposed, while the rate of motion which was about 9 revolutions in 10 seconds, was the same. That difference of direction of the moving spots exerted no influence on the results of the experiments was shown by another form of apparatus in which identity both of rate and direction of motion was secured. This apparatus was improvised with the Hering indirect color mixer. (The two small wheels upon the table of the machine, which are set at an angle of 45 degrees to the plane of the large wheel, were unscrewed from the table, turned about until their planes coincided with that of the large wheel and, there, clamped. A belt running in the grooves of the three wheels, insures identity of rate and direction of motion. Attached to the spokes of the small wheels were two white discs each bearing a black spot upon its periphery.) The pulley, from the axle of which the flexible shafts were driven, was itself driven by a small electro-motor, the speed of which was controlled by a lamp rheostat. Contrary to what was just stated, the cardboard discs were not themselves the objects of comparison, but rather the space marked off by the black spots when the discs were rotated. Each spot was pasted on a strip of cardboard, similar in form to a tennis racquet, which was held to the disc by being inserted under two flat loops of paper. These loops were fixed to the disc, crosswise to its radial direction. Since the handle of the cardboard strip passed tightly under them, the spot could be pushed towards the center of the disc and the radius of its orbit made less by any desired amount. The discs used in these experiments permitted change in one direction only: their orbits could be diminished in amount, not enlarged. The amount of reduction of the orbit was measured by a mm. scale which was pricked upon the strip and disc.

The perimeter was made of channel-iron, bent in semi-circular form, 25 mm. in width. The ends of the semi-circle were joined by an iron rod, in the middle of which was riveted a flat ring of steel, 250 mm. in diameter. The perimeter is capable of describing, by revolution, a hemisphere, the center of which, is the center of the steel ring and the pole of which, is the middle

point of the semi-circular arc. In making an observation, the observer sat upon a chair with his head so placed inside of the ring, that the observing eye coincided with its center and with the line of sight of the eye directed toward the pole of the hemisphere.

Dimensions of parts of apparatus :

Radius of perimeter.....	97.0 cm.
Length of flexible shafts	96.0 "
Diameter of discs	14.5 "
Diameter of orbit	8.6 "
Range of orbit	1.5 "
Diameter of black spots	1.4 "

The size of the retinal image of the orbit is given by the proportion

$$977 : 16 :: 86 : x,$$

$$x = 1.4 \text{ mm.}$$

When the radius of the orbit was reduced by 15 mm. the retinal image measured 0.9 mm. The actual areas on the retina, that were being compared, varied from 1.4 to 0.9 mm. in diameter.

3. *Method.* — The method of this problem was Fechner's method¹ of equivalents. With the observer's eye in the position just described, the two discs were presented at different points in the field of vision. The difference in size of the two orbits, which is apparent when the images of the discs fall, one upon the superior and the other upon the inferior retina, or one upon the nasal and the other upon the temporal retina, can easily be measured by reducing the orbit of the larger until it equal, subjectively, the orbit of the smaller. It took, usually, six settings of the radius to determine the place of subjective equality. Gradations were at first large, but were reduced, as the place of equality was approached, to changes of 1 mm. The changes were made in one direction only : from larger to equality. The figures given in the tables are averages of the last judgment of larger and the first certain judgment of equality.

Four meridians and three parallels of latitude of the hemispherical field of vision were subjected to exploration. The

¹ *Elemente der Psychophysik*, 131 f.

meridians were horizontal, vertical and two oblique (45°). The parallels of latitude were ten, twenty and twenty-five degrees from the pole of the visual hemisphere. (See Fig. 1 for a representation of the field.) The fact that observation with any degree of accuracy, in the extreme periphery of the field of vision, becomes very difficult, restricted the work to this range.

The observations are of two sorts, according as comparisons were made (*a*) between the two peripheral portions, or (*b*) between fovea and periphery, of the retina. The first class of experiments will be referred to as *peripheral*, the second class as *foveal-peripheral*, comparisons. In the peripheral comparisons, the discs were situated on the same meridian, equidistant from, though on opposite sides of, the pole. In the foveal-peripheral comparisons, one disc was situated at the pole, the other in the periphery upon some one of the four meridians. Since there were four meridians and three parallels in our field of vision, there would be, for the peripheral comparisons, twelve positions of the discs and, for the foveal-peripheral comparisons, twenty-four positions. Observations were made with one eye at a time.

II. RESULTS. — The results of the experiments, owing either to differences of conditions under which the observations were made or to the carrying out of some subsidiary purpose, fall into three classes. (1) Quantitative measurements in the manner described, of the illusion in different parts of the retina. Complete sets of quantitative observations for the positions described in 1.3, were obtained from two observers, Drs. Magnusson and Frye. All observations were made during the college year, 1906–1907. The majority of measurements were made in the tenth, eleventh and twelfth months of 1906. Repetitions of over one half of the observations, for the purpose of determining their constancy and accuracy, were carried on during the third, fourth and sixth months of 1907. (2) Qualitative experiments for the same set of positions as the preceding, made upon two observers, Miss Waddingham, a student in the University, and the author. In these observations, no attempt was made to determine the amount of the illusion. The observer indicated the disc that appeared larger. (3) Crude qualitative observations on the horizontal and vertical meridians, for one

parallel of latitude, usually twenty-five degrees, made upon many persons, students and others, who chanced to come to the laboratory. Also, experiments in which the perimeter was not used. In these experiments, the materials were discs of cardboard or of clay or, infrequently, coins placed upon a table in front of the observer. These observations were made with view to seeing whether there was any connection between the illusion and left-handedness.

1. *Quantitative Experiments.*—(a) Peripheral comparisons. The results of the experiments may be made clear by imagining the perimeter in the vertical meridian with the discs 25° north and south of the fixation point. Furthermore, assume that the perimeter takes up, successively, the positions, northeast-southwest, east-west, southeast-northwest. In the vertical meridian,

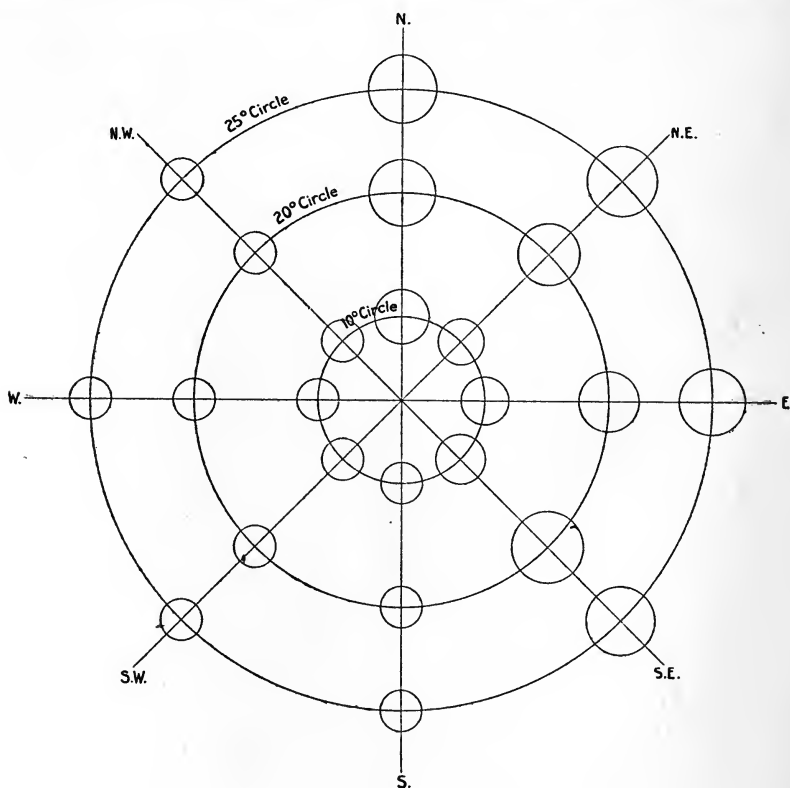


FIG. 1.

the upper disc appears decidedly larger to *both* eyes. In the oblique position, the right disc appears larger to *both* eyes. In the horizontal meridian, the right disc appears larger to *both* eyes. In the oblique meridian, the right disc appears larger to *both* eyes. A similar result is obtained when the discs are set at 10° and 20° from the center. Stated generally, the result is that objects in the right half of the field of vision appear larger than exactly similar objects occupying symmetrical positions, in the left half of the field of vision. This result is, with some exceptions, universal for right-handed observers. The number of exceptions will be stated, when the third class of experiments comes to be considered. The result so far attained, that the right half of the field of vision is constantly enlarged over the left half, is expressed graphically, in Figs. 1 and 2. Without

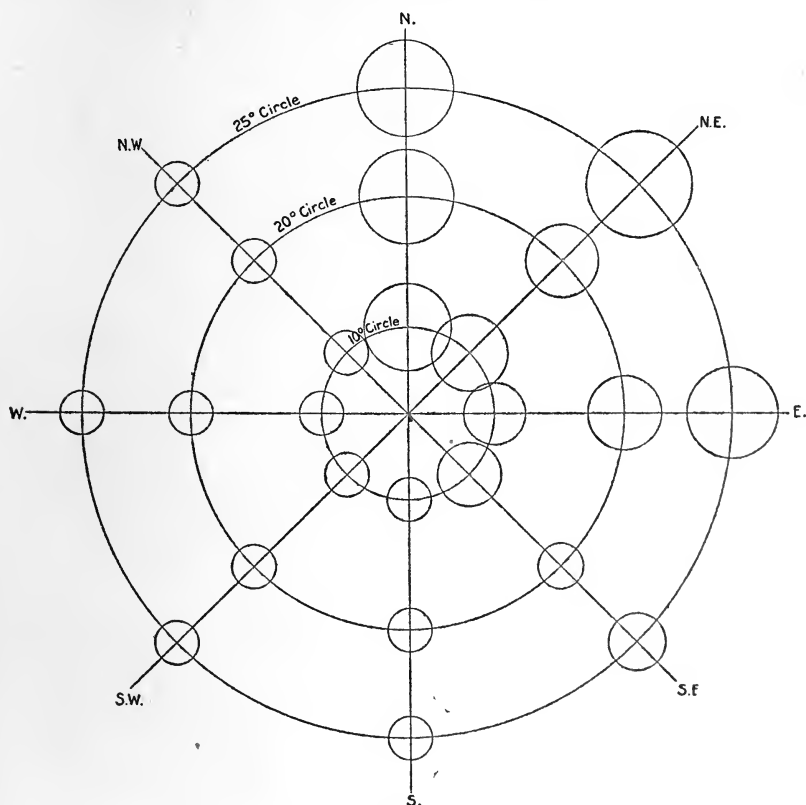


FIG. 2.

attempting to be a plane projection of, the figures represent, the hemispherical field of vision of the right or left eye. The horizontal, vertical and oblique lines stand for the four meridians; the three concentric circles represent the three parallels of latitude. The smaller circles which are placed at the intersection of the meridians and parallels, represent both the positions of the discs, when comparisons were made, and the amount of enlargement a disc in any position undergoes. The circles in the left half of the field are made with a standard radius of 10 mm.¹ The radii of the circles in the right half of the field are *increased* by as many mm. as was found necessary to decrease the radius of the actual disc to make it appear equal to the other. The amounts in mm. by which the radius of any disc was reduced before it appeared to the other, are given for each eye separately, for observers M. and F. in Tables I. and II. The numbers in the tables mean that, to the right eye, Re, and to the left eye, Le, the north, northeast, east and southeast discs appeared larger than the corresponding south, southwest, west

TABLE I.
(MAGNUSSON.)

	25°	20°	10°
N. and S.	Re 7	Re 6	Re 2½
	Le 7½	Le 6	Le 3½
	Re 6	Re 5½	Re 3
	Le 6	Le 6½	Le 3
N.E. and S.W.	Re 7½	Re 5	Re 0
	Le 7½	Le 5	Le 1
	Re 7		
	Le 6½		
E. and W.	Re 5	Re 5	Re 2
	Le 9	Le 4½	Le 1
	Re 7½	Re 4½	
	Le 2½	Le 4	
S.E. and N.W.	Re 7½	Re 7½	Re 2
	Le 7½	Le 7½	Le 2
	Re 7		Re 1½
	Le 5		Le 2½

¹ In the reproductions, the drawings have been reduced proportionally approximately two sevenths.

TABLE II.

(FRYE.)

	25°	20°	10°
N. and S.	Re 9½	Re 10½	Re 8½
	Le 11½	Le 10½	Le 10
	Re 11	Re 12½	Re 11
	Le 15	Le 12½	Le 10
N.E. and S.W.	Re 12½	Re 2½	Re 6½
	Le 14½	Le 7½	Le 8½
	Re 15	Re 7½	Re 8
	Le 15	Le 9½	
E. and W.	Re 11½	Re 10½	Re 8
	Le 11½	Le 6½	Le 8
	Re 11	Re 2½	Re 0
	Le 9	Le 5	Le 0
S.E. and N.W.	Re 0	Re 0	Re 5
	Le ½	Le ½	Le 4
	Re 0		
	Le 2½		
	Re 2½		

and northwest discs, by as many mm. as are indicated by the figures. The tables also show the number of times the observations were repeated. For each position, the table has two spaces, an upper and a lower space. Where both are filled, the observation was made twice. In some cases, the same observation was made three times; all measurements are given in the table. To obtain the measurements from which Figs. 1 and 2 were made, all right eye measurements, for any position, were averaged together and all left eye measurements, for the same position, were averaged together. The average of these averages was used in the drawing. Since, as the tables show, there is no serious discrepancy between the readings of the two eyes, the averaging of the figures can not conceal any essential result. In addition to the result already mentioned, the figures and tables show that the enlargement is greatest in the vertical meridian and least in the southeast-northwest meridian; that it is greater at 25 than at 10 and that the amount of enlargement varies with the observer.

If it is true that objects in the right half of the field of vision are uniformly enlarged over objects in the left half, it follows

as a corollary, that there must be a line of transition between the two halves where similar objects appear of equal size. Experiment verifies the inference. The discs were set, in turn, at 10° , 20° and 25° and the perimeter placed, as an initial position, in the vertical meridian. A glance at Figs. 1 and 2 will show that the upper disc is, here, largely overestimated; while in the northwest meridian, the upper disc is smaller. Between these two points, one would think, the line of transition must run. But experiment does not verify this supposition. It turns out that, when the observer moves the perimeter from the vertical meridian towards the west, until the discs appear of equal size, the perimeter occupies a position between the northwest and the horizontal meridians. The measurements that are about to be given, were made by each observer, with each eye separately, by moving the perimeter from the horizontal meridian (ascending) towards the vertical, until the discs appeared of equal size, and from the vertical meridian towards the horizontal (descending), until the discs appeared equal in size.

			Observer M.	Observer F.
10 degrees	Right eye	Ascending	16.20°	25.92°
		Descending	16.92	22.32
	Left eye	Ascending	28.08	9.72
		Descending	34.20	9.00
20 degrees	Right eye	Ascending	18.00	20.52
		Descending	25.92	21.24
	Left eye	Ascending	18.00	9.72
		Descending	20.88	9.00
25 degrees	Right eye	Ascending	7.20	7.20
		Descending	14.40	39.60
	Left eye	Ascending	19.08	5.40
		Descending	25.56	32.40

The measurements vary greatly. This irregularity may be attributable to the circumstance that the observations were made at the end of the college session, when both observers were pressed with other duties. The other characteristic of the readings, that the line of transition leans much more toward the horizontal than would have been expected from the quantitative observations, the author is at loss to explain.

(b) Foveal-peripheral comparisons. In these observations, as has been stated, one disc was placed at the center of the field of vision; the other was placed upon some one of the four meridians, 10° , 20° or 25° from the center. The results, in mm. for observers M. and F., are given in Tables III. and IV. Observations with the right eye (Re) and left eye (Le) are recorded separately. The tables also show the number of repetitions. Sixteen out of twenty-four of M.'s and thirteen out of

TABLE III.

(M.)

	25°	20°	10°
N.	Re $7\frac{1}{2}$	Re $4\frac{1}{2}$	Re $3\frac{1}{2}$
	Le $8\frac{1}{2}$	Le $5\frac{1}{2}$	Le $4\frac{1}{2}$
	Re 5		Re 0
	Le $7\frac{1}{2}$		
N.E.	Re 7	Re $5\frac{1}{2}$	Re 4
	Le 8	Le $5\frac{1}{2}$	Le 3
		Re 5	
		Le 6	
E.	Re $6\frac{1}{2}$	Re $3\frac{1}{2}$	Re 4
	Le 6	Le $3\frac{1}{2}$	Le 3
	Re $8\frac{1}{2}$		Re $1\frac{1}{2}$
	Le $8\frac{1}{2}$	Le $4\frac{1}{2}$	Le $2\frac{1}{2}$
S.E.	Re $6\frac{1}{2}$	Re $5\frac{1}{2}$	Re $4\frac{1}{2}$
	Le 6	Le 6	Le 4
		Re 3	
		Le 5	
S.	Re 5	Re $3\frac{1}{2}$	Re 4
	Le 4	Le $1\frac{1}{2}$	Le 5
	Re 0	Re 0	Re $2\frac{1}{2}$
	Le $2\frac{1}{2}$	Le 0	Le $2\frac{1}{2}$
S.W.	Re 4	Re 4	Re $3\frac{1}{2}$
	Le 5	Le 3	Le $3\frac{1}{2}$
		Re $4\frac{1}{2}$	
		Le $4\frac{1}{2}$	
W.	Re $3\frac{1}{2}$	Re $1\frac{1}{2}$	Re $3\frac{1}{2}$
	Le $2\frac{1}{2}$	Le $2\frac{1}{2}$	Le $3\frac{1}{2}$
	Re 2	Re $1\frac{1}{2}$	Re 4
	Le 0		
N.W.	Re $4\frac{1}{2}$	Re $3\frac{1}{2}$	Re $3\frac{1}{2}$
	Le $4\frac{1}{2}$	Le $4\frac{1}{2}$	Le $1\frac{1}{2}$
		Re 3	Re 4
		Le 4	

TABLE IV.

(F.)

	25°	20°	10°
N.	Re 10 Le 8½	Re 5 Le 7½	Re 6 Le 6
N.E.	Re 7½ Le 10	Re 5½ Le 3½	Re 4 Le 3
E.	Re 8½ Le 6½	Re 5 Le 0 Re 0 Le 2½ Le 0	Re 5 Le 3
S.E.	Re 6½ Le 8	Re 2 Le 0 Re 0 Le 0	Re 5 Le 2
S.	Re 1 Le 4 Re 2 Le ½	Re 7½ Le 7½ Re 7 Le 9	Re 0 Le 3 Re 0 Le 3½
S.W.	Re 4 Le 4 Re 4 Le 5	Re 5 Le 5	Re 4½ Le 5½
W.	Re 7 Le 3 Re 4 Le 5	Re 0 Le 0 Re 0 Le 0	Re 1 Re 0 Le 0
N.W.	Re 4 Le 4 Re 3½ Le 0	Re 0 Le 1	Re ½ Le 0 Re 2 Le 2½

twenty-four of F.'s observations were repeated. The non-italicized figures of the tables signify that the peripheral disc appeared larger than the central disc by the number of mm. indicated by the figures. The italicized figures signify that the central disc appeared larger than the peripheral disc by the number of mm. indicated by the figures. The measurements of these tables, averaged as were those of Tables I. and II., are

expressed graphically in Figs. 3 and 4. The field of vision is represented here, as in Figs. 1 and 2. The small circle at the center of the field stands for the central disc; the other circles in the periphery of the field, express by their diameters, the exact amounts by which a disc at any place in the periphery, appeared larger or smaller than the central disc. In those positions in which the central disc was larger than the peripheral disc, the central disc was reduced until it equalled the

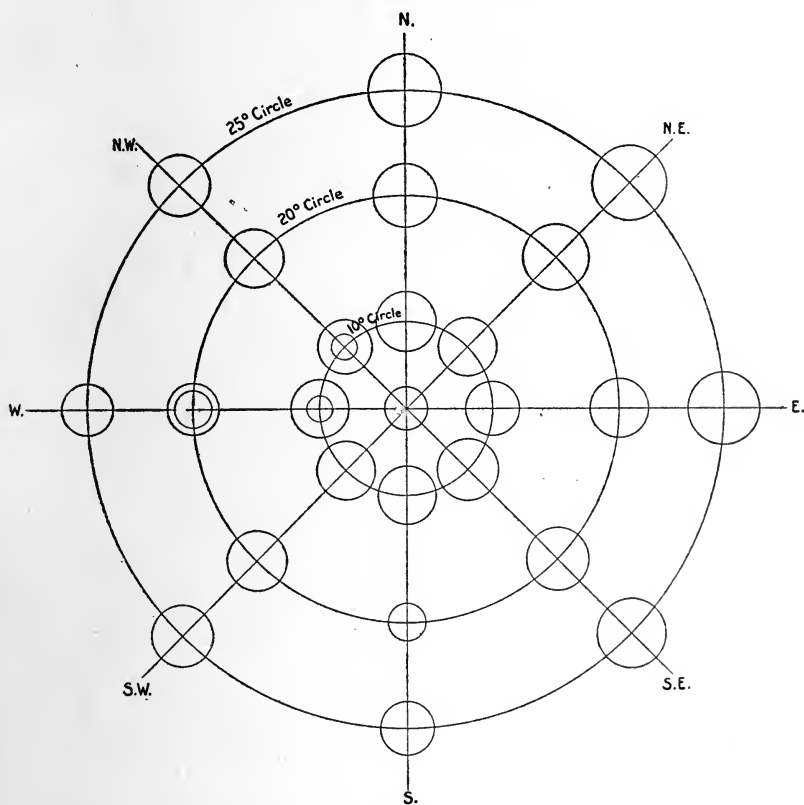


FIG. 3.

peripheral disc. In the drawing, the peripheral circle is diminished by as many mm. as the central disc was diminished. In M.'s observations, three contradictory reports were given. In the figures, both results are expressed by the two concentric circles.

As is evident from the figures, there is a very decided enlargement, in the results of both observers, of the right-upper half of the visual field over the foveal field and an equally

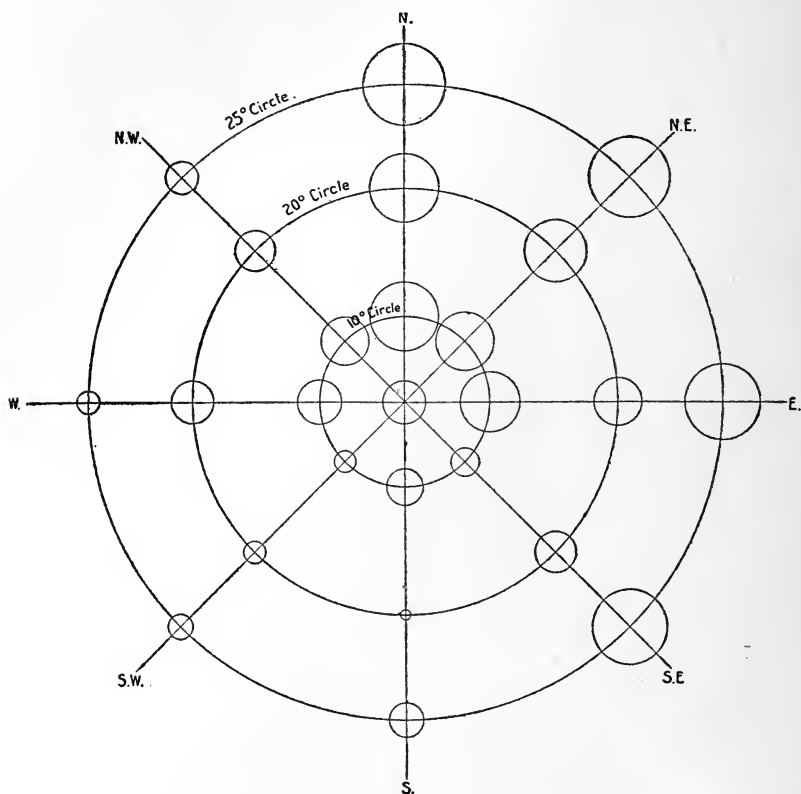


FIG. 4.

noticeable tendency to underestimation (in the case of F.) or to slight overestimation (in the case of M.) of the left-lower half of the visual field over the foveal field. So far, then, from its being true, as James¹ asserts for the retina, from analogy to Fechner's experiments on the skin, that the fovea, as the point of keenest sensibility, imposes its standards of space measurement upon the peripheral parts of the retina, it appears that those parts have a well marked spatial individuality, which resist, surprisingly, reduction to a common unit.

¹ *Prin. of Psych.*, II., 214 and 178.

2. *Qualitative Experiments.* — (a) Peripheral comparisons. These observations were made under the same conditions as those already recorded. As no measurements were taken, it will not be possible to exhibit the results in tables and figures. From the verbal responses of the observers, however, the nature of the result was very easily gathered. Both observers, W. and S., confirm the result found for M. and F., that the right half

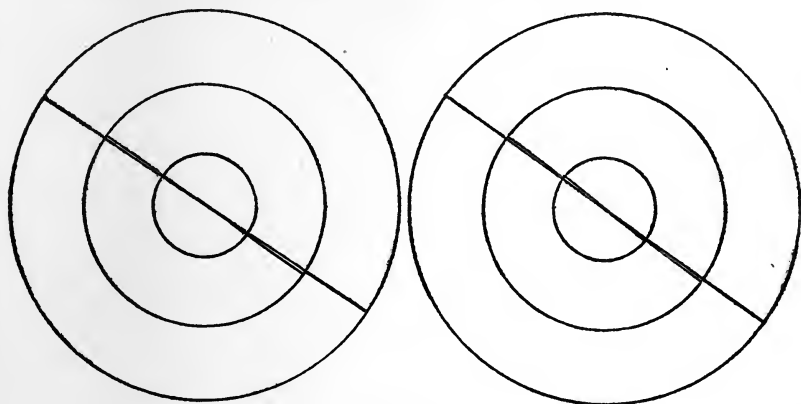


FIG. 5.

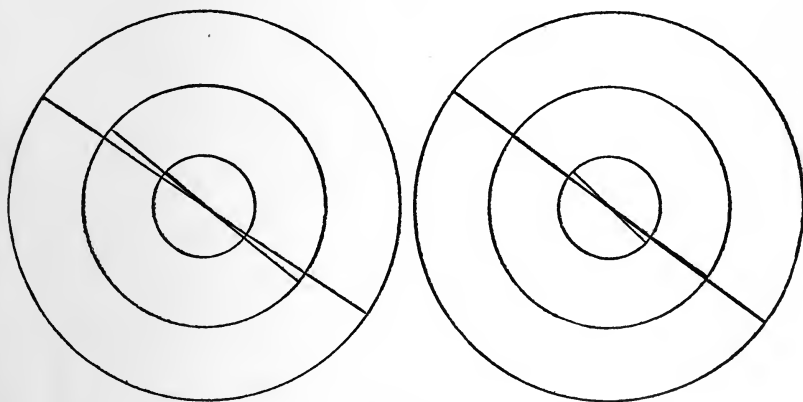


FIG. 6.

of the field of vision is constantly enlarged over the left half of the field. In fact, if the precise amount of magnification is left out of account, Figs. 1 and 2 may serve to represent the results of the experiments for W. and S.

The line of transition between the two halves of the field, was determined for W. and S. in the same manner as for M. and F. The measurements are given both in degrees and, expressed graphically, in Figs. 5 and 6. In the figures, the ascending and descending values of each eye are averaged together. The three circles stand for the three parallels of latitude, 10, 20 and 25°. The results for each eye are expressed separately.

			Observer W.	Observer S.
10 degrees	Right eye	Ascending	25.56	50.40
		Descending	49.32	36.00
	Left eye	Ascending	23.04	46.08
		Descending	43.20	32.40
20 degrees	Right eye	Ascending	28.80	32.40
		Descending	42.48	39.60
	Left eye	Ascending	28.08	30.60
		Descending	39.96	46.44
25 degrees	Right eye	Ascending	32.40	37.44
		Descending	36.72	36.36
	Left eye	Ascending	28.80	36.36
		Descending	36.36	30.60

The measurements show much more uniformity than did those of M. and F. The slant of the line of transition is, however, less than 45°.

(b) Foveal-peripheral comparisons. The results of the observations of W. and S. agree with those of M. and F., with the exception that the left half of the field is always, though slightly, larger than the foveal field. The right-upper field is very decidedly larger than the foveal field.

(c) Retinal regions and cerebral connections. So far, the description of these phenomena has gone on in terms of the visual field. In the peripheral comparisons, the orbit¹ of the disc in the right half, appears larger than the orbit of a similar disc in the left half, of the monocular field of vision. In the foveal-peripheral comparisons, the orbit of the disc in the right-

¹ The author has spoken all along of the disc undergoing enlargement and of its being reduced, when, speaking more strictly, he should have said 'orbit' of the disc.

upper half, appears larger than the orbit of a similar disc in the foveal field of vision. We must now see upon what parts of the retina fall the images of those discs whose orbits in the field of vision appear so much enlarged. (i) Peripheral comparisons: Imagine the perimeter in the horizontal meridian with the discs 25° to the right and left of the fixation point. Let the observation be supposed to be made first with right eye. Under these conditions, with the observing eye at the center of the hemispherical field, the pole of the field is imaged upon the fovea, the image of the perimeter coincides with the retinal horizon and the right and left discs are imaged, respectively, 25° nasalwards and temporalwards of the fovea. Without changing the position of the perimeter or of the discs, let the left eye be placed at the center of the field. Again, the image of the pole falls upon the fovea and the image of the perimeter coincides with the retinal horizon, but the images of the right and left discs now fall 25° temporalwards and nasalwards, respectively, of the fovea. That is to say, the images of the discs fall upon corresponding points of the retinae. The same result obtains, if the perimeter be imagined to take up its position in the vertical and two oblique meridians. The images of the discs fall always upon corresponding points of the binocular visual apparatus. As is well known, the left half of this apparatus, the nasal half of the right, and the temporal half of the left retina is connected with the left occipital hemisphere. The constant enlargement, therefore, of objects in the right half of the peripheral field of vision, has its anatomical ground in the fact that the images of objects so situated, fall upon the left half of the cyclopean retina and that this part of the retina is connected with the left hemisphere of the cerebrum. (The writer disregards, in the absence of evidence, the possibility that the anatomical ground of the results is the number of retinal elements in the corresponding portions of the retinae.) The relations between the field of the vision, corresponding points of the retinae and the visual cortex are well represented by Fig. 7 which, with the addition of the visual field is practically, a reproduction of Fig. 347, vol. 2, of Schaefer's *Text-book of Physiology*. The correspondence between the two retinae is shown in the figure by representing the

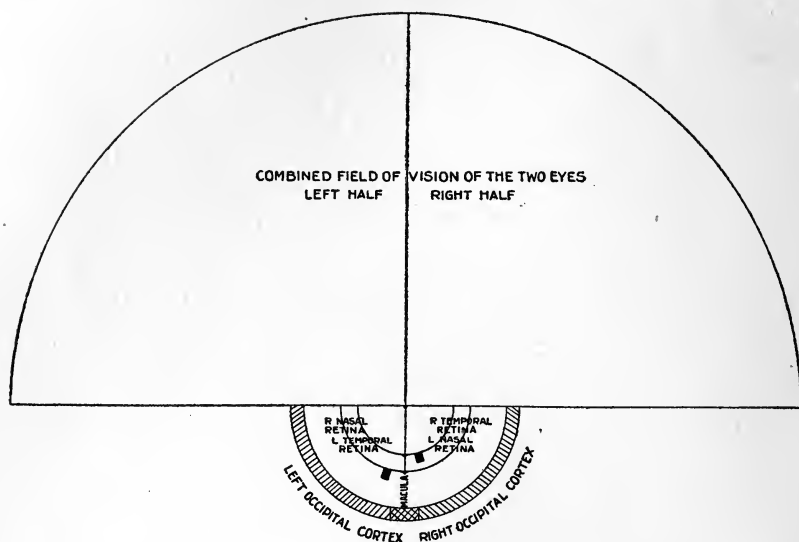


FIG. 7.

left retina as having been set inside of the right; there is a point for point correspondence between the two surfaces. Besides showing the connection between the two halves of the visual cortex and the two corresponding halves of the retinae, the diagram also shows, by the doubly shaded portion of the part representing the cortex, that the macular region of the retina is innervated from both hemispheres. (ii) Foveal-peripheral comparisons: The retinal and brain conditions of these comparisons are exhibited in the same figure. The anatomical conditions of these observations differ from those of the other set in that the fovea, upon which was formed the image of the central disc, is connected with both hemispheres. In view of the fact that the retinal image of the orbit of the spot was 1.4 mm., while according to Koelliker's measurements,¹ the fovea is 0.18 to 0.225 mm., in diameter, it would be more exact to speak of these observations as macular-peripheral comparisons. As cited by Helmholtz, Krause and Koelliker give the horizontal diameter of the macula as 2.25 and 3.24 mm., respectively. According to these measurements, the image of our disc would easily fall upon the macula.

¹Cited by Helmholtz, *Physiol. Optik*, 2d ed., 37.

When this relation between the enlargement of objects in the visual field and the cortex was pointed out to them, it was suggested by my colleagues, Dr. Magnusson and Dr. Savery that a reversal of the illusion might be obtained with left-handed observers who are, presumably, right-hemisphered. The third class of experiments is concerned with that point.

3. *Crude Qualitative Experiments.* — For the most part, these experiments which were all comparisons of the peripheral sort, were made with clay discs (poker chips) 38 mm. in diameter. The discs were placed upon a black cloth at a distance of about 60 mm. from a white fixation mark which was equidistant from the inner edges of the two discs. The cloth with the discs upon it, was placed on a table. The observer standing alongside of the table looked, with one eye at a time, at the white mark between the discs. With his eye in this position, the observer noticed which disc appeared larger. The distance of the eye of the experimenter from the fixation point was about 75 cm., although, undoubtedly, there was much variation on both sides of this distance. Taking this as the average distance, the retinal images of the discs would fall $4^{\circ}32'$ on either side of the fovea. A much smaller number of observations were made with cardboard discs 14 cm. in diameter, placed upon black velvet, with their inner edges 60 mm. from the fixation point. With these materials, the difference in size is much more apparent than with the smaller discs. Some observations with the perimeter are included in this class. Finally, about fifteen observations which were made by correspondents with the help of a questionnaire blank upon which was printed two white discs 51 mm. in diameter, in a field of black. The inner edges of the discs are 37.5 mm. from the fixation point. The observer is directed to hold his eye two and one half feet (75 cm.) from the paper. At this distance, the images of the discs would fall $2^{\circ}50'$ from the fovea. The ages of the observers varied from twelve to sixty years. It is evident that the conditions under which these observations were made were neither uniform nor exact. Yet, in spite of these faults, a fairly definite result does emerge from the observations as a whole. In all, 183 tests were made. According to the answer to the question, which

disc (right or left) appears larger, the experiments fall into six classes. Observations were made both in the horizontal and vertical meridians. In the numerical statement of the results about to be given, only the results of the observations in the horizontal meridian are taken account of, as having bearing on the point at issue. It may be said that, in the vertical meridian, at least 90 per cent. of the results show that the upper disc appeared larger to both eyes. (1) To one hundred persons, the right disc appeared larger to both eyes. (2) To forty-five persons, the left disc appeared larger to both eyes. (3) In sixteen cases, the right disc appeared larger to the right eye and the left disc larger to the left eye. (4) In thirteen cases, the left disc appeared larger to the right eye and the right disc larger to the left eye. (5) In five cases, the discs appeared unchanged in size to the right eye, but different in size to the left eye. Of these cases, the right disc seemed larger four times and the left disc larger once. (6) In four cases, the discs appeared unchanged in size to the left eye, but different in size to the right eye. Of these cases, the right disc appeared larger twice and the left disc larger twice. In making this classification of the experiments, no attention was paid to right- or left-handedness. With the observations so distributed, each class was further divided with respect to right-handed, ambidextrous and left-handed individuals. Of the first class, seventy-six were right-handed, eight ambidextrous, sixteen left-handed. Of the second class, fifteen were right-handed, three ambidextrous and twenty-seven left-handed. Of the third class, nine were right-handed, six ambidextrous, one left-handed. Of the fourth class, three were right-handed, two ambidextrous, eight left-handed. Of the fifth class, one was right-handed, none ambidextrous, four left-handed. Of the sixth class, one was right-handed, one ambidextrous, two left-handed. The results of classes one and two, as unequivocal, are expressed graphically in Fig. 8. The results certainly indicate a tendency to a relationship between right-handedness and the enlargement of the right disc and left-handedness and enlargement of the left disc. Seventy-six per cent. of the observers to whom the right disc looked larger to both eyes were right-handed. Sixty per

cent. of the observers to whom the left disc appeared larger were left-handed. Of the forty-three cases of left-handedness tested, twenty-seven find the left disc larger while sixteen find the right disc larger. It is true that this is not an over-

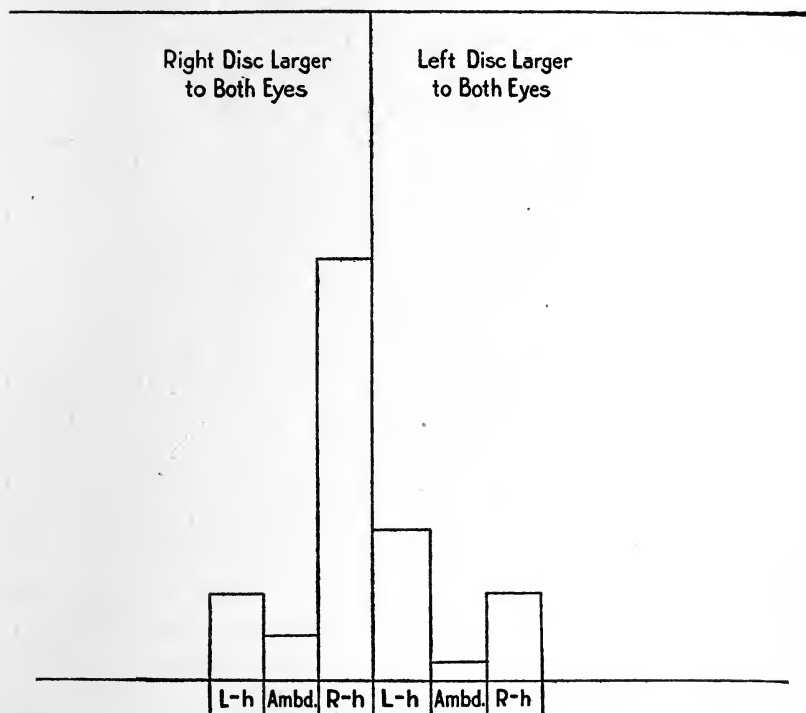


FIG. 8.

whelming majority, but there is an excess of five and one half cases, or 12.8 per cent. of the total number observed, which would be difficult to account for, if chance alone were operative. A serious error of which the author was not appreciative until too late, which may have obstructed a more decided result, is the fact that in all experiments except those carried out with the perimeter, the images of the discs fell at a distance not more than 5° from the fovea. Reference to Tables I. and II. will show that the amount of enlargement at 10° is comparatively slight. Furthermore, as is well known the macular region of the retina is innervated from both hemi-

spheres. Unless the images of the discs fell upon portions of the peripheral retina that are connected with one hemisphere or the other, not with both, the experiment would not signify. To determine the angular distance from the fovea to which double innervation extends, appeal was made to cases of cortical hemianopsia. A case of complete, right, homonymous hemianopsia described by Foerster, is cited by Wilbrand.¹ In this case, the line of division between the blind and normal fields of vision was vertical, slightly to the right of the vertical meridian. In the region of the fixation point, on the horizontal meridian, the line passed two degrees outside of the fixation point. If this case may be taken as typical, most of the experiments with the discs, must have fallen on truly peripheral portions of the retinae. The results of this class of experiments are certainly not final, but taken along with the outcome of the other experiments, that the right peripheral field is constantly enlarged over the left peripheral and the foveal fields, they seem to warrant a suggestion of a theory of right-handedness.

All theories that make right-handedness a matter of use and wont, mere convention, seem to be denied serious consideration, by the fact that it is hereditary. The consensus of opinion, supported by some comparative measurements² of the weights of the two hemispheres, advocates the view that the left hemisphere of the brain is the ground of the phenomenon. But aside from this general reposing of the question in the ascendancy of the left hemisphere over the right, there has been no precise formulation of the manner in which this ascendancy could make individuals right-handed. It has not been asserted whether the ascendancy of the hemisphere resides in the motor or in the sensory region. A consideration will show that the initial difference must rest in the sensory and not in the motor areas of the cortex. The consideration is, that the current of innervation is always from the sensory to the motor region, the current flows only in the 'forward direction.'³ The contraction of muscles of the right side of the body is only a consequence

¹ *System of Diseases of the Eye*, Norris and Oliver, Vol. II., 305.

² Dr. Boyd's and others cited by Wilson, *Left-handedness*, 188.

³ James, *Prin.*, II., 581.

of the discharge of nerve cells in the left motor cortex; but, the discharge of these cells is, again, a consequence only, of the discharge of sensory cells centrally or peripherally situated. If this view is correct, motor bilateral asymmetry is merely symptomatic of sensory bilateral asymmetry. Our experiments have shown a very marked difference in sensory function, to exist in the field of vision, the sensations of which, it is hardly necessary to point out, play an important part in animal behavior. Such a difference in sensation would, probably, first bring about reflex movements of the eyes such that the object on the periphery would be plainly seen. Movements of the eyes would be followed by movements of the head; and movements of the head, by movements of the hand. This view is supported by the fact that the time (7 months) at which a decided preference for the right hand had developed in Baldwin's child¹ comes a little later than the time (5 months) at which Raehlmann² found that an object on the periphery of the retina was recognized by a child.

III. DISCUSSION OF RESULTS. — The manner in which the observations were made, the results of the observations and the theoretical bearing of the results have now been duly set forth. It remains to forestall two possible objections. (1) It may be said the results are due to indistinctness of peripheral vision. It is true that some observers, on some occasions, in certain positions, mentioned that one disc was plainer than the other. For example, in the vertical meridian, F. found the upper disc more distinct than the lower. But, it was only exceptionally that a difference was spoken of. In answer to the objection, then, it may be said (*a*) that there was correlation between the illusion of size and distinctness and indistinctness; (*b*) that there is no reason why indistinctness should be associated with largeness rather than smallness. As evidence of a contrary opinion, it may be pointed out that Helmholtz³ lays it down as a general principle that plainly perceived differences appear larger than differences of equal magnitude which are not plainly perceived.

¹ *Mental Development, Methods and Processes*, 64.

² Cited by E. A. Schaefer, art., 'The Cerebral Cortex,' *Text-Book of Physiology*, vol. ii., 759, without reference to the original.

³ *Physiol. Optik*, 2d ed., 705.

(2) It may be alleged, in explanation of the facts, that they are due to defective accommodation of the lens, for the periphery of the retina. According to Helmholtz,¹ the retinal image is well defined only in the neighborhood of the axis of the eye. As he gives no measurements or other indications of the amount of decrease in definiteness, for the various regions of the periphery of the retina, it is not possible to say whether these results vary with it. However, as having some value as evidence against this interpretation of our results, it may be pointed out that in the schematic drawing of a horizontal section through a right eye, Helmholtz² makes the retina equidistant from the nodal point of the lens, 20° temporalwards and 25° nasalwards, of the fovea. The only experimental evidence with which the author is acquainted, that is pertinent to this point, is the observation made by Aubert,³ on the eye of a rabbit, of the retinal images in the periphery of the retina. Aubert wished to meet the objection that the results of his experiments on the capacity to discriminate two points on the periphery of the retina, were due to lack of accommodation. The eye-ball of a rabbit was removed, cleaned of fat and connective tissue and mounted in a screen. At a distance of 20 cm., the images of the cardboard discs were plainly visible to the naked eye, formed upon the periphery of the retina, when seen from behind through the choroid and schlera. At a distance of 70 cm., images of the same objects were visible on the periphery, when magnified 30 times by a microscope. Of course, the objection to this method of deciding the matter is, that what holds for the eye of a rabbit need not hold, necessarily, for the eye of man. There are, however, two replies which seem to the author adequate to the objection. (a) If the results were due to defective accommodation for the peripheral parts of the retina, one would not expect to find the defect distributed with so much uniformity from right to left and as agreeing so well among four observers. (b) Observations show that the same results obtain for 5° from the fixation point where, it must be supposed, the lack of accom-

¹ *Physiol. Optik*, 2d ed., 87.

² *Loc. cit.*, 90.

³ *Physiologie der Netzhaut*, 250.

modation is very slight, if at all existent, as obtain for positions farther out in the peripheral field. (3) The illusion is not due to defective eye-sight. The eye-sight of observers F., W. and S. is normal or better. M. has a very slight scar on the cornea of his right eye. He does not wear glasses. In the crude qualitative experiments, persons who wore glasses kept them on during the observation.¹

¹ The MS. of this article was received August 20, 1907. — ED.

VOCABULARY AND WORD-BUILDING TESTS.

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At the meeting of the American Psychological Association in December, 1905, Professor Kirkpatrick gave a brief account of a simple vocabulary test, which he has since described more fully.¹ This test I have applied with some modifications to two classes of sophomores and juniors at Cornell University; the discussion of the results of this test forms the first section of this paper. In the second section there is described another test, that of word-building, which exhibits certain points of similarity to the vocabulary test. Attention is also paid to the correlation between these two tests, and between them and school standing.

A. KIRKPATRICK'S VOCABULARY TEST.

This test consists, in principle, in the examination of a limited number of words taken by chance from the pages of a dictionary, and the determination of the percentage of these words whose meaning is known, unknown, or doubtful. On the basis of this examination, the 'understanding vocabulary' is estimated at that percentage of the total number of words in the language that the test has indicated. Naturally, the longer the list examined, the more accurate is the index secured. Kirkpatrick is, however, convinced that 100 words form a sufficiently lengthy list upon which to compute the index in question, at any rate, sufficiently well to be representative of one's vocabulary for comparative purposes.

Purpose of the Test. — My object in using the test was:
(a) Primarily to examine its reliability, *i. e.*, to see whether college students would be apt to overestimate or underestimate

¹ *Pop. Sci. Mo.*, LXX., February, 1907, 157-164. The examination of the test with which this paper deals was nearly completed when the originator's paper appeared, and although he has anticipated therein certain points of criticism, I have published my results in their first form. The reader may also consult E. H. Babbitt's article in the same volume, p. 378.

their vocabulary in the absence of a strict definition-check; (b) to determine the average vocabulary of college students; (c) to determine the correlation of the corrected vocabulary with ability to construct words in the word-building test; (d) the correlation with standing in college classes, and (e) the correlation with sex.

Nature and Method of the Test.—(1) The following list of words, the same used by Kirkpatrick, was distributed in the class, with these instructions: Place a plus sign (+) before all the words you know, a minus sign (−) before those you do not know, and a question mark (?) before those of whose meaning you are in doubt. When through, count, and fill out these blanks. Number known . . . Number unknown . . . Number doubtful . . .¹

abductor	escheat	paid
abeam	escort	pail
abed	eschalot	publication
abet	gourd	pudding
baron	gout	puddle
baroscope	govern	pudgy
barouche	gown	scroll
barque	intercede	scrub
channel	interdict	scruff
chant	interest	scrunch
chanticleer	interim	subcutaneous
chaos	matting	sub-let
decemvirate	mattock	subdue
decency	mattress	tycoon
decide	maturate	tymbal
deception	page	type
eschar	pagoda	
amalgamation	filing	photo-lithograph
amanuensis	fill	rejoice
amaranth	hodman	rejoin
bottle-holder	hoe	rejoinder
bottom	hoecake	rejuvenate
bottomry	hog	skylight
boudoir	lanuginose	skyrocket

¹ The request to write the opposite of a series of ten words, to define ten words, five of which were in the list, and to indicate the magazines and books read within a specified time, which formed a part of the Kirkpatrick test, was omitted, in part to save time, in part because it was desired to see whether the test could be used with safety without these devices for instilling an attitude of cautiousness in the student.

concatenate	lanuginous	skysail
concatenation	lanugo	skyward
concave	lanyard	tenderloin
conceal	muff	tendinous
disentomb	muffin	tendon
disentrance	muffle	tendril
disepalous	mufti	virago
disestablish	photograph	virescent
filiform	photographer	virgin
filigree	photography	

(2) To arrive at a correct vocabulary-index and to detect the presence of a tendency either to overestimate or underestimate, I required the students to write the definitions of forty words selected from the above list *after* they had completed the first test. This definition test was, of course, entirely unexpected by the students. It was intended to require the definition of every word that might possibly be unknown or doubtful, but, as events showed, to accomplish this result the list would have to be extended to embrace sixteen additional words.

The definition list, for which twenty minutes was allowed, was as follows: abductor, abet, baroscope, chanticleer, chaos, decemvirate, eschar, escheat, eschalot, gourd, interdict, interim, mattock, matureate, pudgy, scruff, scrunch, subcutaneous, tycoon, tymbal, amalgamation, amanuensis, amaranth, bottomry, concatenate, disentrance, disepalous, disestablish, filiform, hoecake, lanugo, lanyard, mufti, photo-lithograph, rejoinder, skysail, tendinous, tendril, virago, virescent. Concatenation, lanuginose and lanuginous can, of course, be checked off by the definitions given for concatenate and lanugo.

The words which experience showed should have been added were: abeam, abed, barque, barouche, boudoir, disentomb, filigree, hodman, pagoda, rejuvenate, scroll, sub-let, tenderloin, — a rather amazing list for college students!

Results. — In the vocabulary test proper, 70 students, aged 16 to 25 years, 16 men and 54 women, on the average, marked 77.6 per cent. known, 17.2 per cent. unknown, and 5.2 per cent. doubtful. The highest known was 92 per cent., the lowest 64 per cent.

In the second part of the test, the actual definitions of the 40 selected words, the results were treated in the following manner. A record was made for each student of (1) the number of words not defined, and (2) the number of words wrongly defined. (3) These were added to give the total number of words unknown in the list of 40. (4) By reference to the

vocabulary test the number of other words unknown beside those in the definition test was ascertained (this was from two to ten). (5) There remained in some instances (33) from one to three words each (averaging for all those tested 0.6) that had originally been marked doubtful, and which still remained doubtful because they were not on the definition list: these scattering doubtful cases were regarded as unknown. (6) By combination of all the unknown cases, it was then possible very easily to compute the final corrected vocabulary-index of each student, and (7) by comparison with the original markings, to determine the amount of over- or under-estimation.

The results, based on 70 cases, are as follows:

Average number of words in list of 40 not defined.....	15.50
Average number of words in list of 40 wrongly defined.....	6.64
Average number of words in list of 40 not known.....	22.14
Average number of words outside list of 40 not known.....	4.20
Average number of words left doubtful.....	0.60
Average corrected vocabulary-index.....	73.26 (m. v. 5.5)
Average amount of overestimation.....	4.37
Number of students overestimating.....	59
Number of students underestimating.....	10
Number of students neither over- nor underestimating.....	1
Largest overestimation.....	18
Largest underestimation.....	4

The decided nature of the tendency towards overestimation is more clearly evident from its distribution as given in Table I.

TABLE I.

OVERESTIMATION OF THE VOCABULARY-INDEX (70 COLLEGE STUDENTS).

Per cent. Overestimated.	Number.	Per cent. Overestimated.	Number.
18	1	5	7
15	2	4	6
14	3	3	7
13	1	2	10
12	3	1	9
11	1	0	1
9	2	— 1	6
8	2	— 2	2
7	1	— 4	2
6	4		

It will be seen that, of 70 students, 11 overestimate by more than 10 per cent., and that 20, or more than one quarter of the

students, overestimate by 5 per cent. or more. From these figures it is evident that, without a somewhat elaborate definition-check, the value of the vocabulary-test is distinctly lessened.¹

The corrected vocabulary-index is of sufficient interest to justify a brief presentation of its distribution (Table II.).

TABLE II.
DISTRIBUTION OF THE CORRECTED VOCABULARY-INDEX
(70 COLLEGE STUDENTS).

Index.	Number of Cases.
85-89	5
80-84	5
75-79	19
70-74	22
65-69	13
60-64	6
55-59	1
Highest index,	89.0
Average index,	73.26
Lowest index,	58.0

Sex differences in vocabulary cannot with certainty be established from the small number of cases here considered, but the sixteen men average 75.8 and the 54 women 72.6 for the corrected index.

On the basis of Webster's Academic dictionary, circa 28,000 words, Kirkpatrick estimates the average vocabulary of college students at 20,120. From the present test, the students' own estimate figures 21,728, while their corrected vocabulary would be 20,512. The largest vocabulary would be 24,920, the smallest 16,240, or approximately that assigned by Kirkpatrick to the average second-year high-school student. Thus the wide individual variation in size of vocabulary to which Kirkpatrick calls attention is still further confirmed and emphasized.

The results of the definition-test are worth considering in

¹This result may be compared with Kirkpatrick's conclusion that very young children are apt to underestimate because the isolated words of the list fail to arouse associations such as they would if they had a context. Again, when Kirkpatrick defined the words of the list to normal school students, he found that the errors of over- and under-estimation tended to cancel one another, while when college classes defined 20 words, 114 of 246 students (about 46 per cent.) correctly defined the same proportion that they had marked as known, and only 7 per cent. erred by as much as 3 in 20.

more detail. No word of the forty was correctly defined by every student, and, as we have noted, there were 16 other words that were unknown or doubtful. It follows, therefore, that *only 44 of the 100 test words were certainly known by every one of 70 college students.*

It is at times rather difficult to decide from the definitions whether the student does or does not know the meaning of a word with sufficient exactness to be credited with knowledge of the term in question.

To a slight extent, therefore, the ranking is arbitrary and might not agree with that of another experimenter who was using the same test. In general, however, I have erred on the side of leniency in consideration of the difficulty of accurate definition and of the short time (about twenty minutes) that could be expended upon the forty definitions. To illustrate, the following were accepted: 'disestablish — to overthrow,' 'decemvirate — a body of ten,' 'mattock — a garden tool,' 'amaranth — a flower'; while the following were disallowed: 'lanyard — one of the spars of a ship,' 'decemvirate — Roman civil officer,' 'gourd — a hollow vessel from which to eat and drink,' 'concatenate — to argue,' 'baroscope — an instrument for measuring something.'

Of interest, in this connection, are the erroneous definitions. These, as Kirkpatrick has pointed out, are most likely to result from the confusion of the given word with some word resembling it in sound or spelling. Other definitions are evidently sheer guesses from the fancied etymology of the word, *e. g.*, disepalous — without a head (from *dis* + *cephalous*). In the following list of typical errors of definition, the assumed source of confusion is indicated by the terms in parentheses after the definitions:

- amanuensis — poet laureate, lovingness (amativeness).
- amaranth — a precious stone (amethyst).
- abet — although (albeit), a wager (a + bet), diminish (abate).
- bottomry — the art of bottoming chairs, deceit, bottom of anything.
- chanticler — one who sings a loud song, one who leads a chant.
- decemvirate — composed of five, count out by tens, formerly a group of ten men, but any number now.
- disentrance — failure to enter.
- disepalous — apart from the head, without shoulders.
- gourd — reward (guerdon), to slash or whip (goad), morning glory.
- interim — time between two reigns (interregnum).
- lanugo — a kind of language.
- lanyard — yard where leather is tanned (tanyard), yard about the lane.
- mattock — a lock of hair (matted locks?), a kind of bird, a sort of rug, a kind of robe (cassock).

maturate—to ripen (mature), to matriculate.

sky-sail—a sail in the sky, a kite.

tycoon—a violent wind (typhoon), an animal, a silk-worm, a natural phenomena (sic).

tendril—a membrane connecting two bones (tendon).

tendinous—capable of endurance (tenacious?).

scrunch—a good for nothing person, (scrug?).

virago—a kind of bird (!) (vireo), a disease, giddiness (vertigo).

virescent—sparkling (iridescent), of or pertaining to a man (!) (virile).

B. A WORD-BUILDING TEST.

The word-building tests were suggested to me by the familiar game of anagrams as well as by the advertisements often seen in magazines in which a prize is offered to the person who can make the most words from a given word or series of letters. This test is easily administered and evaluated: it is one that calls for ingenuity and active attention: it might fairly be said to demand that ability to combine isolated fragments into a whole, which Ebbinghaus has declared to be the essence of intelligence and for the measurement of which he devised his well known 'combination method';¹ and, finally, its execution is conditioned to a certain extent by the richness and readiness of the examiner's word-vocabulary. One may expect, therefore, to find a correlation between this test and the vocabulary test and possibly between it and school standing or general intelligence.

Nature of the Test.—After some preliminary trials, two word-building tests were arranged and distributed to the classes above mentioned in the form of mimeographed blanks which read as follows:

WORD-BUILDING TEST, No. 1.

Make as many words as you can from the six letters given below. You may use any number of letters from one to six, but no letter may be used twice in the same word, and no other letters than these six are to be used. You will have five minutes.

a e o

b m t

¹H. Ebbinghaus, 'Ueber eine neue Methode zur Prüfung geistiger Fähigkeiten und ihre Anwendung bei Schulkindern,' *Zeits. f. Psych. u. Physiol.*, XIII., April, 1897, 401-459.

Then followed numbered spaces for 30 words, and blanks for name, date, etc. The second test was exactly similar save that the six letters given were: *e, a, i* and *r, l, p*.

The possibilities of combination are larger than one might suppose: from the first at least 70, from the second at least 105 words may be formed. Proper names were allowed, but words in foreign languages were not allowed.

Test No. 1 was given to two groups of college students and likewise to a group of fifty boys from the seventh and eighth grades of the Ithaca public schools.¹ Test No. 2 was given to the college students only.

Results. — In Table III. the chief results of these tests are summarized. It will be seen that Test No. 2 offers more possible combinations, that more words are made with it and a greater

TABLE III.

Test.	Date.	Grade.	Male.	Female.	Largest.	Smallest.	Average.	Mean Variation.	Total No. Different Words.	Possible Words.
1	2/19,06	College	7	15	25	10	18.6	3.54	41	70
1	3/19,07	"	9	27	26	10	18.6	3.30	41	70
1	4/10,06	Grammar	50	0	21	6	12.4	2.37	38	70
2	3/6,06	College	7	26	32	14	21.9	4.00	57	105
2	3/19,07	"	9	27	33	15	23.5	3.66	61	105

number of different words. It will also be noted that the individual differences in rank are large; thus it happens that not a few grammar school boys make more words than some of the college students: to be more explicit, it may be stated that, with Test No. 1, 10 grammar pupils make 15 words or over, while 13 college students make fewer than 15 words.

By examining the papers in detail, and tabulating the total number of words formed and the number of times each of these words is given, one may discern something of the principles which govern the operation of the test. The following are the data thus secured:

TEST NO. 1. 58 COLLEGE STUDENTS. (45 DIFFERENT WORDS.)

Over 50 times — bat, mat, bet.

40-49 times — eat, met, Tom, at, boat.

¹This was in connection with an extensive investigation upon the correlation of various physical and mental tests, the results of which I hope to publish soon.

30-39 times — meat, to, tea, beat, team, tab, ate, am, moat, mob, me, beam, toe.
20-29 times — tame, oat, be, mate.

10-19 times — boa, mote, bate, abet, tomb, tome, tam.

5- 9 times — Mab, Abe, Mae, ma, atom, a.

1- 4 times — bot, mot, o, Moab, beta, bema, tabe.

Not given¹ — ab, ambe, ambo, amt, atmo, ba, bam, bo, bom, boma, bote, ea, eam, eb, em, eta, mao, meta, mo, moa, moe, ob, obe, om, ta, tambo, tema,

TEST NO. 1. 50 GRAMMAR GRADE BOYS. (38 DIFFERENT WORDS.)

Over 40 times — mat, bat.

30-39 times — bet, at, met.

20-29 times — to, eat, Tom, beat, tea, meat, be, am, boat.

10-19 times — toe, mob, beam, me, ate, team, tab, boa, oat.

5- 9 times — ma, bate, a, moat, mot, tame, mate, bot.

1- 4 times — tam, tomb, Abe, mote, Moab, Mae, o.

Not given — those not given by college students, plus abet, atom, bema, beta, Mab, tabe, tome.

TEST NO. 2. 69 COLLEGE STUDENTS. (66 DIFFERENT WORDS.)

Over 60 times — lip, lap.

50-59 times — rip, rap, pear, ear, real, pie, leap, rail, pale, reap.

40-49 times — reap, pail, pile, ale, pair, are, ape, lie, pea, peal.

30-39 times — pare, earl, pearl, air, par, lair, ripe, liar.

20-29 times — ail, Lear, rape, ire, pal.

10-19 times — lea, pa, rile, pire, era, pier.

5- 9 times — per, a, alp, Eli, plea.

1- 4 times — I, paler, peril, lira, rep, rale, ile, lare, ra, pil, piler, ril, April,

Ira, la, pareil, pi, pilar, Rea, Rae.

Not given¹ — ai, aiel, aile, aire, al, apl, ar, Ariel, aril, ea, el, ela, epi, er, eria, il, irp, le, lep, lepra, lerp, li, lier, lire, lirr, paie, pali, parel, parl, pela, pel, pia, piel, pila, plie, plier, prial, prie, re, rei, rial, ril, ripa.

Inspection of these lists shows (1) that three-letter words are in every instance those most frequently formed, (2) that two-letter words and the one-letter words, which one might expect to be most frequent since most simple, stand relatively low, *e. g.*, *ma*, *be*, *am*, *pa*, *me*, *a*, *o*, *I*,² (3) that grammar school boys give all the words given by college students save a few rather unusual terms such as *atom* and *tome*, (4) that usage and ordinary speaking vocabulary condition the formation of words, in as much as the most ordinary words have the greatest fre-

¹ This list is based on the words actually given in the Standard dictionary, not including, however, Scotch terms.

² It appeared, upon inquiry, that some of the college students had omitted words like *pa*, *ma*, *a*, *o*, and *I* on the ground that they were 'not real words,' or 'didn't count,' but, oftener, they seem to have been passed over because the attention was concentrated upon the making of combinations.

quency, *e. g.*, *bat*, *mat*, *bet*, *eat*, *lip*, *lap*, whereas words that are less frequently used in every-day speech, although their meaning is doubtless perfectly well known, do not suggest themselves so readily under the conditions of the test, *e. g.*, *tomb*, *tome*, *era*, *plea*, *paler*, (5) that the words not given by any one are, with one or two exceptions, *e. g.*, *plier*, words of extremely rare usage or unusual form, alternative spellings, etc.

Sex differences may not with certainty be made out, yet, as Table IV. indicates, in every group tested, the men did slightly better than the women: though this difference is small—less than the mean variation, yet it is constant in direction in all four instances.

TABLE IV.
SEX DIFFERENCES IN WORD BUILDING.

Test.	Date.	Men.	Average.	Women.	Average.
I	1906	7	18.7	15	18.6
I	1907	9	19.7	27	18.0
2	1906	7	23.6	26	21.4
2	1907	9	25.8	27	22.7

C. CORRELATIONS.

In the case of the college students I have been able to test the correlation of vocabulary and word-building test with one another and of each test with the class standing in Educational Psychology. This class standing was based upon marks obtained in examination and upon class exercises, and was secured with suitable precaution, at least in the case of the examinations, to render it absolutely objective.

With the grammar-school boys, it was possible to compute correlations between word-building and numerous other tests. Save for class standing the latter are reserved for a later paper. All of the correlations were worked by the well-known Pearson formula, save that when the distribution was symmetrical, the value of sigma (the standard deviation) was computed from the average deviation by multiplying by the constant 1.2533—a procedure which cuts the work of computation by one half and gives values closely approximating those obtained by the usual method of computing the standard deviation.

TABLE V.
CORRELATIONS.

Data Correlated.	Cases.	<i>r.</i>	<i>p.e.</i>
Vocabulary index and word building	58	+.53	.05
Vocabulary index and class standing	58	+.45	.06
Word building and class standing	58	+.13	.07
Word building and class standing	50	+.08	.08

D. SUMMARY.

1. The determination of the vocabulary-index, as proposed by Kirkpatrick, by means of a list of 100 words selected by chance is clearly influenced by a tendency to overestimation when no precautionary restrictions are employed. In tests of college classes, 15 per cent. of those tested had an overestimation error amounting to 10 per cent. or more, and 25 per cent. of those tested had an overestimation error of 5 per cent. or more.

2. By check definition-tests it is possible to eliminate or to measure this error of overestimation. When such a check was applied, the average vocabulary-index for college students was found to be 73 per cent., with a maximum of 89 per cent. and a minimum of 58 per cent. This minimal index is less than that assigned by Kirkpatrick for the average second-year high-school student, and illustrates forcibly the unevenness of the mental equipment of college students.

3. The definition-test reveals an unexpectedly large number of erroneous definitions. The source of these errors may frequently be traced to confusions with words of similar appearance or to fancied etymological derivations.

4. Simple word-building tests correlate fairly well with the vocabulary test. Marked individual differences are apparent here, as in the vocabulary test; so marked, indeed, that some grammar-school pupils excel some college students in the construction of these lists.

5. An inspection of the lists of words thus constructed reveals the psychological conditions which affect the process. In general those words are most frequently given that are in most common use in the daily speaking vocabulary, whereas

words that are equally well known but in less frequent use are apt to be omitted.

6. Sex differences cannot be clearly established in these two tests, but what differences appear are constant in direction and suggest the superiority of men and boys over women and girls.

7. The vocabulary test correlates fairly well with class standing, but the word-building test rather unexpectedly shows no such correlation.¹

¹The MS. of this article was received November 15, 1907. — ED.

THE DOCTRINE OF PRIMARY AND SECONDARY SENSORY ELEMENTS. (II.)

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VIII.

In the cases of hallucinations investigated by me I have found pathological processes which gave rise to secondary sensations crystallized into hallucinations. Thus one of my cases suffered from auditory hallucinations. The patient heard voices telling her all kinds of disagreeable things. She complained that the voices came not through the ear, but through a spot located over the Fallopian tubes. An examination of the ear showed nothing abnormal. Physical examination revealed nothing abnormal in any of the other sense organs. The Fallopian tubes, however, were very tender and painful to pressure. The patient suffered from an old chronic salpingitis. The hallucinations, which were of a sexual character, became more severe at regular intervals coinciding with monthly periodicities.

One case of mine suffered from visual hallucinations. He saw spirits, ghosts and visions of saints. When he travelled in a car, he could see little men with benevolent faces and for some religious reason he regarded them as saints who came to his help. He could see them splitting the rocks and disappearing there, or sometimes the rocks split open and the saintly little men came to the surface. Occasionally apparitions of the dead visited him. The visions were never quiet, but always in motion, they did not stay long and rapidly disappeared, giving rise to new visions. An examination of his special sense-organs showed nothing abnormal. The sense of touch, pressure and kinæsthetic sensibility manifested peculiar abnormalities. The skin of the body was very sensitive and that of the scalp was extremely tender to touch. The patient could not bear any pressure of the scalp and was mostly bareheaded, though he was

very sensitive to draught and to changes of temperature. Occasionally he experienced a sense of formication all over the body, especially in the scalp and in the region of the neck, the muscles of which were extremely sensitive to pressure. Now when the head was inclined to one side or pressed hard or kept in tense state for a couple of minutes at a stretch, he could see spirits floating in the air, he could see the little men with their saintly faces coming out of the ground and disappearing into it again.

One case of functional psychosis, with epileptiform attacks presenting phenomena of dissociated states with distinct tendencies toward the formation of multiple personality, suffered a good deal from auditory hallucinations. It will take too much space to give an account of the details of the different seizures and of the various dissociated states manifested by the patient. For our present purpose it is enough to refer to the hallucinations. The patient complained that she could hear voices talking to her, her mother and brothers communicating with her from a distance. An examination of the auditory apparatus proved it to be in excellent condition. Now in this case the phenomena of unconscious phonation were quite well developed, the patient was observed to move her lips and whisper — the whisper becoming sometimes quite loud so that many words which the patient referred to the voices of the mother and brothers were really uttered by the patient. An examination of the eye revealed the presence of an astigmatic condition and a limitation of the field of vision. When the patient was made to count or to read aloud or when absorbed in a conversation, the auditory hallucinations ceased. The auditory hallucinations considerably diminished, both in frequency and intensity, when the astigmatism was corrected by eye glasses.

Similarly in another case the patient suffered from auditory hallucinations. Here the patient was observed talking to himself. This was so pronounced that now and then he himself became conscious of the fact that he was talking to himself. He describes this experience of automatic talk which seems to be uncontrollable and of which he is often unconscious by the term of 'autovocalization.' In this case the patient now and

then can catch himself telling things to himself which he takes for the voices of other people as he is then conscious of the hearing, but not of the utterance of the words and phrases. This, however, is not always the case; in fact in a good many cases where unconscious phonation is present, as, for instance, in the case of the patient with the epileptiform seizures described above, the patient is entirely unconscious of the fact of 'whispering.' When attention was drawn to the phenomenon, the whisper and the hallucination disappeared.

One of my cases, a lady of about sixty, suffered for about fourteen years from auditory and visual hallucinations. She complained that she was surrounded by ghosts of departed family-members who did not leave her alone. The spirits talk to her, they give her advice which is often against her interests. Her departed husband and his brother are the chief leaders, the 'guides' so to say. They talk to her on all important occasions and try to guide her in life. The patient resents such interferences. There is no need to go here into the details of the case. When the voices became insistent she also had visions of the spirits and could hear them talk to her, a proceeding which she always attempted to discourage, but she admitted that the voices and the spirits had the best of her and she was forced to follow their instructions. Now an examination of the patient revealed the fact that the hearing on the left side was rather defective, the tympanic membrane was thickened and there was present a chronic pathological process due to a former condition of middle ear disease. Any continuous and prolonged irritation of the diseased ear started the voices, increased their intensity, and caused the manifestations of the visions.

I may also refer to a patient under my care who suffered from auditory hallucinations and thought herself possessed by demons. From her ninth year she suffered at various intervals from those voices which sometimes told her quite unpleasant things. Along with the hallucinations she also had attacks of automatic speech. Now and then she simply heard voices and was not conscious of any involuntary speech, but occasionally the involuntary utterance took such possession of her that she could not control it. She felt as if some other being got possession of her organs

of speech. This frightened her even more than the hallucinations. She kept away from her friends fearing sudden attacks of involuntary speech. It appeared to the patient, as if some other beings made her talk against her will. She shunned society, because the other beings forced her to tell aloud what she thought of the people in whose company she was present. When she was not conscious of the forced speech, she often heard voices which she ascribed to the same demons. There was nothing of the delusion of paranoia in it as she could not account for the involuntary speech and auditory hallucinations. The patient was of Irish descent and uneducated though very intelligent, and the explanation of 'demoniacal possession' was given and maintained by her family in Ireland. She was glad to take my view of the phenomena which I tried to make plain to her, as much as it was possible under the circumstances. A quotation from her written account may be of interest: "When I was nine years old, one day I remember I sat down on a stone and suddenly I heard a voice: 'If you live four or five years more you will wish you had never grown up.' I thought it was strange, but soon forgot it and went to play again. I had no trouble until I was fourteen, when the voice changed and forced me to talk with my own voice. The voices would make me speak of things that in my own self I had no idea of doing and would not do for anything. About eight years ago I had a terrible fright after which I thought I talked with saints and angels and saw unusual things, I really saw them." We find here the presence of automatic speech, unconscious phonation with subconscious states resulting in dissociations of secondary from primary sensory elements with the consequent formation of various forms of hallucinations.

IX.

I should have liked very much to bring in here some of the work on hallucinations carried out by Dr. William A. White, but space requirements forbid. The cases studied by Dr. White are extremely interesting and go to substantiate the theory of hallucinations advanced by me. By a close study of a series of cases he sustains the validity of the present theory of hallucina-

tions. Dr. White's studies are of great importance to normal and abnormal psychology, and the reader who is interested in the subject I refer to his original contribution.¹

Observations and experiments incontestably prove that hallucinations are synthetized compounds of secondary sensory elements, dissociated completely or incompletely from their primary elements.² Normal and abnormal perception do not differ psychologically as to their make-up, except in the relation of their primary and secondary sensory elements. Hallucinations are not central; they are essentially of peripheral origin; they are induced by peripheral excitations giving rise to peripheral physiological processes awakening primary sensory elements which are subconscious or fall out entirely of the patient's consciousness leaving the groups of secondary sensory elements to stand out as fully developed hallucinations. The hallucinatory secondary sensory elements may be tinged with the qualitative aspect of the dissociated primary sensory elements, thus pathological processes in the auditory sense organ may give rise to voices; or morbid processes of the visual apparatus may give rise to visions. Quite often, however, the dissociation is so deep and extensive that the synthetized system of secondary sensory elements does not bear the least trace of the qualitative aspect of the primary sensory elements; thus a morbid condition of the pharynx, for example, may give rise to an auditory and even to a visual hallucination. Whatever may be the qualitative character of the sensory compounds one thing stands out clear and distinct, and that is the fact that the percept, whether normal or abnormal, does not consist of images, but of sensations, primary and secondary.

X.

Contrary to the general view maintained by most psychologists we have laid special stress on the fact of the fundamental qualitative difference between image and sensation. We shall not venture far from our facts, if we arrange images and sensations in two qualitatively different psychic series. Sen-

¹ See *Journal of Nervous and Mental Disease*, 1904.

² It gives me great pleasure to add that Professor James in a note to me finds the theory advanced fully convincing as it is substantiated by the facts.

sations can be ranged in a graduated series of *intensities*, while images or representations can be ranged in a graduated series of clearness and distinctness, or of *vividness* as it is sometimes described by some psychologists. I use the term vividness in the sense of clearness and distinctness and not in the sense of intensity as it is often used; even those psychologists who do not use intensity and vividness indiscriminately ascribe both of them equally to sensation and image. Now vividness and intensity are understood by me to be two fundamentally qualitatively different aspects, or attributes. Sensations have intensity, but no vividness; images or representations have vividness, but no intensity. Sensory elements may vary from *minimum* to *maximum* intensity. This variation in intensity holds true both of primary and secondary sensory elements. Similarly, images or representations may pass through all degrees of vividness from *minimum* to *maximum*. The image represents the sensation. In this respect we may somewhat modify the well-known dictum of the sensationalists into: 'Nihil est in imagine quod non antefuerit in sensu.' The sensory element is symbolized by its respective representative element. Now the representative elements may refer with different degrees of vividness to the same sensory elements. An image with one degree of vividness can be substituted for another with a different degree of vividness and still refer to the same sensory elements. The degree of vividness does not change the qualitative character of the representation. Not so is it with the qualitative attribute of the sensation. The slightest change in the intensity of the sensation changes its qualitative character. A sensation with one degree of intensity cannot be substituted for another. A sound or a color of a definite intensity cannot be substituted for a sound or color of a different intensity. The two are different sensations and no sensation can substitute another. Sensations falling in the same series of intensity are really independent of one another, but each sensation of the intensive series can be represented by a whole series of representations of different vividness, from *minimum* to *maximum*. Different series of representative elements may also be regarded as independent, since they refer to independent sensations.

If we symbolize a series of sensory elements by the letters : $A_1, A_2, A_3, A_4, A_5, \dots A_n$; and if we symbolize the corresponding series of representative elements by $a_1, a_2, a_3, a_4, a_5, \dots a_n$, then the series of both sensory and representative elements may be symbolized by the following formula :

$$\begin{array}{cccccccc}
 A_1 & A_2 & A_3 & A_4 & A_5 & \dots & A_n \\
 a_1 & a_2 & a_3 & a_4 & a_5 & & a_n \\
 a_1^1 & a_2^1 & a_3^1 & . & . & & . \\
 a_1^2 & a_2^2 & a_3^2 & . & . & & . \\
 a_1^3 & a_2^3 & a_3^3 & . & . & & . \\
 a_1^4 & a_2^4 & a_3^4 & . & . & & . \\
 a_1^5 & a_2^5 & a_3^5 & . & . & & . \\
 . & . & . & . & . & & . \\
 . & . & . & . & . & & . \\
 . & . & . & . & . & & . \\
 a_1^n & a_2^n & a_3^n & a_4^n & a_5^n & & a_n^n
 \end{array}$$

The characteristic of the image, or of the representative element is just its extraordinary plasticity and possibility of substitution. This function of substitution was described by Taine with all the power of his lucid style. The great modifiability of the representation plays an important rôle in psychic life — adaptability to various conditions of life increases, reactions cease to be rigid and uniform, but change easily in response to a changing environment. Variations of sense-organs with their physiological processes are rather slow and tardy, often requiring generations for an effective change, while the representative element can be modified and adapted within the life-existence of the individual and often in a very short time. In brief, the function of substitution possessed by the representative element in the process of mental selection is the substitute for natural selection in the highest representatives of animal life.

Now under ordinary conditions of life the gradated series of representative vividness runs parallel to the gradated series of sensory intensities. Usually a more intense sensation is represented with greater vividness. The increase or decrease of intensity of the sensory series has a corresponding change in the vividness of the elements of the representative series. Intensity and vividness vary directly. Such direct variation, however, is not always the rule. There are cases, when the two part

company. In states of distraction, in subwaking states, in states of dissociation and generally in the conditions of functional psychosis, intensity and vividness do not vary directly. Strong stimulations may give rise to sensations of great intensity, but the vividness of the representative elements may fall so low as almost to reach the minimum. When the vividness is so low as to reach the *minimum*, the representative elements cannot be used as substitutes and, since reproduction belongs to representative elements which symbolically reproduce the sensations by the process of substitution, reproduction or memory of the original experience is absent and there is a break, a gap in mental continuity, dissociation results. The depth and extent of dissociated mental systems may be regarded as variables of vividness. Dissociation varies inversely as vividness. When vividness is at its *minimum*, dissociation is at its *maximum*. The phenomena of functional psychosis having their origin in states of dissociation may thus be regarded psychologically as functions of vividness, the most characteristic attribute of representative elements. Functional psychosis with all its protean manifestations, the great variety of dissociated and subconscious states may thus be reduced to variations of one fundamental attribute — vividness.

XI.

We must not omit to point out another fundamental difference between sensory and representative elements. Sensations have the significance, or possess the attribute of external reality, while images, ideas or representations entirely lack it. Put in Professor Baldwin's excellent terminology — sensations have the coefficient of external reality, the sensory coefficient of reality. No matter whether the sensation was produced by an external stimulus, or by a pathological process going on in the sense-organ, or brought about indirectly through the action of another sense-organ by means of indirect association-paths of neuron-collaterals, no matter whether the sensation is primary or secondary, as long as it is a sensation at all, it possesses the sensory coefficient of reality. A sensation whether 'true or false' possesses rightfully the coefficient of reality as its necessary and inherent attribute. The percept, true or hallucinatory,

consisting of sensory elements has therefore the sensory coefficient of reality.

Psychologically regarded, the 'true' percept and the hallucination have the same sensory constitution with the same attributes. The difference between the true and false percept may be regarded from a biological standpoint as a matter of adjustment. The percepts with successful adjustments are true, while those with unsuccessful motor reactions are false and hallucinatory. Psychologically, the difference between the 'true' percept and hallucination is in the *shifting* of the primary and secondary sensory elements. *Where the secondary sensory elements can be shifted and become primary, the percept is regarded as true; where the secondary sensory elements do not admit of being shifted and become primary, the percept is regarded as hallucinatory.*

If we turn now to the representative elements, we find that they lack the sensory coefficient of reality. This lack of sensory coefficient is only the negative side of the image. There is also a positive side to it. The image is not felt as image simply because it is not sensation or lacks the sensory coefficient, but because it possesses a qualitative character of its own. A sensation is not felt as such simply because it lacks the character of another sensation. Thus sensation green is not experienced as the particular color sensation, because it has not the *quale* of sound or of pressure, but because the sensation green has a positive experience of its own. The same holds good of the representation—it possesses its own characteristic *quale*. As an experience *sui generis* we claim for the representation a special psychic mark, an 'ideational or representative' coefficient. The image has its own qualitative character just as the sensation possesses its own. In contrast to the sensation which possesses the coefficient of external reality, the image or representation has the coefficient of internal reality. Both sensation and image have reality, each one has its own kind of reality—the sensation has external *objective* reality, the image has internal *subjective* reality. It is on account of the ideational or representative coefficient that every image is placed unhesitatingly into its own world of reality, into its own series of images with which it easily associates and fuses.

Writers on psychology in trying to define further the coefficient of reality refer it to the will. Some maintain that the coefficient of reality is the 'independence of the will,' while others claim that the coefficient of reality is 'subjection to the will.' Professor Baldwin in his paper, 'The Perception of External Reality,' offers an extremely interesting solution which reconciles both views. He points out that there is a difference between the 'memory coefficient' of reality and 'sensational coefficient' of reality. The two coefficients are opposite as far as control of will is concerned. The sensational coefficient is independence of the will, while the memory coefficient is control by the will. A sensation, in short, is not under the control of the will, while an image is subject to the will. He makes a further distinction between a simple image or 'memory image' and a 'memory image of external reality.' The memory image can be brought up voluntarily by its proper associates, but it has no sensational coefficient as a result, while the memory image of external reality can be followed by sensational coefficients, that is, sensations can be brought about in the train of such an image. To quote Professor Baldwin: "Certainly a present sensible reality is not under the control of my will; it is independent, and if my coefficient is to be discovered in the relation of the presentation to my voluntary life, this must be its expression and I go over to the class of writers who find the psychological basis of external reality in sensations of resistance. But when we come to inquire into the 'memory' coefficient—asking the question what character is in a memory-image which testifies to its being a memory of reality? the tables seemed to be turned. Without stopping to examine other views, I hold that that image is a true memory which we are able to *get again as a sensation* (Professor Baldwin's italics) by voluntarily repeating the series of muscular sensations which were associated with it in its first experience. The memory coefficient therefore is subjection to the will in the sense indicated. . . . A true memory in short is an image which I can get at will by a train of memory associates, and which, when got, is further subject to my will; a memory of external reality, on the contrary, is an image which I can get at will by a train of sensational associates and which, when got, is not subject to my will."

Now if I understand Professor Baldwin aright, a sensation does not fall under the control of the will, while a simple 'memory image' and a 'memory image of external reality' are both under the control of the will, the difference being that the former does not terminate in a sensation, whereas the latter does. This I take to mean that a sensation does not depend on the subject (will), but on the external object; in other words, a sensation cannot be produced from center to periphery (not internally initiated by the will), but is initiated by an external excitation peripherally stimulating the sense-organ and giving rise to sensation. An image, on the other hand, does not depend for its initiation on the external object or excitation, but is essentially an internal event which can be brought about from within by the process of associative activity so highly characteristic of the image. Thus far my analysis seems to me to be in full accord with Professor Baldwin's view. Similarly, Professor Baldwin's views in regard to 'memory images' and 'memory images of external reality,' the former not ending in sensory experience, the latter terminating in experience with sensory coefficient, seem to me to be closely related to the views expressed by me in this paper and in my other works on the subject.

In spite of the agreement on so many points there are other points which do not appear to me acceptable. We may agree that kinæsthetic and muscular sensations or sensations of resistance are at the core of things, but are they the be-all of external reality? Have not sensations of pain, of hearing, of color, or of smell as much reality as our sensations coming from muscle, joint, synovial membrane and articular surfaces? The acute, shooting, twinging pains of rheumatism, gout, tabes-dorsalis, the burning pains of meningitis, the excruciating throbs of megrim, the fine stabbing pains of toothache, the agony of angina, the sharp tormenting pains of facial neuralgia and many other pains coming from different organs and tissues, are not they real and external? In fact do they not bear on them more the mark of grim, pitiless, external necessity than any of the sensations coming from active muscle and joint? What about light, color, sound, smell, are not they sensations of ex-

ternal reality, even if sensations of resistance do not enter into their make-up? Muscular and kinæsthetic sensations may be granted to play a very important rôle in our knowledge of things, but psychologically regarded, all sensations bear on them unmistakably the mark of external reality. It is not the particular form or kind of sensation, but it is the sensory *quale* as such that gives the coefficient of reality. As far as resistance is concerned Professor Baldwin is right, if it be applied to each and every sensation. For each and every sensation possesses this mark of stubbornness about it; it shows opposition, resistance and floods the mind. We may say that the stimulus forces open the gates of the sense-organs and invades the mind with an overwhelming power. Still, on the whole, Professor Baldwin is right in laying special stress on sensations of activity (?) and resistance since, biologically regarded, they are the ones that give the smack of life and the kernel of things and help to bring about adjustments to the external environment.

Thus far the difference between Professor Baldwin and myself seems to be rather insignificant.¹ When, however, we reach what Professor Baldwin terms the 'memory image of external reality' the difference stands out somewhat more strongly. He contrasts the two, image and sensation, on the basis of dependence or independence of the will. The sensation is independent of the will, while the memory image of external reality is subject to the will which *can bring about the sensation originally experienced*. Now it seems to me that we are just as sure of the external reality of a sensation referred to by the memory image, even if we *cannot* bring about the original experience. We may perceive sensations which cannot

¹The difference is far less than I have originally thought. In a letter to me Professor Baldwin writes: "I am much interested in your views. You will find my later and fuller treatment of resistance and of the nature of memory images in my *Thought and Things, or Genetic Logic*, where I attempt explicitly to trace the genetic development of knowledge from sense objects to image objects in detail, being I think nearer to your views than my earlier article brought out." I have since made myself acquainted with Professor Baldwin's great work on the genesis of knowledge, which I find to be of the utmost importance to psychology and epistemology. Much as I wish to discuss that masterly work in connection with my present theory, I find it impracticable on account of the lack of space. I hope, however, to return to the subject in another paper.

possibly be repeated and still they are regarded in memory as events that have taken place in the world of external reality. We may have the perception of a comet which may never again come into our experience, and even if it should come its coming is not due to our voluntary control; it is not *we* that can make the comet-experience come into our perceptual or sensory world with its sensory coefficient of external reality. We may be in the position of Plato's cave-dwellers and have no control over the reality, the reflection of which is displayed before us, and still we may agree with Plato that for the cave-dwellers the memory images of external reality, the recurrence of which is not under control, will still be discriminated from a general memory image, from an image of fancy. The sensation or percept may be unique, its reproduction may not be possible and still its memory image will be that of external reality.

On the other hand we meet in psychopathology with a vast domain of phenomena, such as recurrent mental states, insistent ideas which force themselves on the patient's mind against his will. The recurrent mental states or the insistent ideas are far more stubborn and uncontrollable than any resistant sensory object. The ideas may come like attacks which overcome the patient more than any sensory reality, or the idea may be persistent gnawing at the very vitals of his mental life. No external object is so stubbornly, so painfully resistant as just such an idea; and still the insistent idea is not regarded as a sensory reality. The insistent idea possesses the coefficient of external reality, independence of the will, painfully so, and still it is not regarded by the patient as external reality; in spite of its being independent of the will, it is still regarded as an idea.¹ It seems to me that we cannot express the sensational and ideational coefficients in terms of will of control or non-control. It is not resistance to the will that makes experience sensory, nor is it subjection to the will that makes experience ideational or representative. Why not state the fact as it is, external reality is the *quale* of sensory experience, while internal reality is the *quale* of the image or representation? A sensation is experi-

¹ Professor Baldwin admirably discusses this point. See Baldwin, *Thought and Things*, Vol. I., Ch. X., § 2.

enced as sensation, no matter whether or no it depends on the will, the independence is a secondary matter; the same is in the case of the image, it is experienced as image, independent of the fact of its subjection to the will.

XII.

There is another view which finds the fundamental difference between percept and image in what is and what is not common to all selves. Perceptual experience is common, while ideational experience is not common to all fellow-beings. I see the sun and other people can share it with me, while my image of the sun is experienced by myself. Thus one writer¹ tells us: "I perceive lowering heavens, pouring rain, bare trees and drenched sparrows, but I imagine wide horizons, brilliant sky, blossoming apple-trees and nestling orioles. The main difference is this: in the one case I assume that my experience is shared by other people and that everybody who looks out sees the same dreary landscape; but my imagination of the sunny orchard I regard as my private and unshared experience." Now the mark of being common is not the essential coefficient of external reality given by the percept. The percept is not experienced as external, because it is common to other people. We do not see the tree yonder, because other people can see it too; we would see it there, even, if, like Robinson Crusoe, we had no fellow-being to compare notes with. A hallucination is as fully a percept and is perceived in the full garb of external reality, although it may have no currency with my fellow-men. The percept possesses the coefficient of external reality, no matter whether or no others can share in it.

Moreover, psychologically regarded, the percept is as much of a private experience as the image is; in fact every psychic state has the privacy ascribed to the image and as such is unshared by other selves. It is simply the old psychological fallacy of confusing the physical with the psychic object or with the psychic state cognizant of the physical object.² The flower

¹ Mary W. Calkins, *An Introduction to Psychology*.

² Royce and Münsterberg define the physical object in terms of 'sociality,' but if I understand them correctly they do not regard the definition as a psychological one.

as physical object, as stimulus is shared by all who perceive it, but the perception of the flower varies with each individual. My perception of the flower cannot be experienced by any one else; like the image, the percept is entirely individual, unshared by other selves. I perceive the flower as having external reality not because my perceptual experience is the same as that of other people, nor because it is shared with others — as a matter of fact, it is *not the same* and from its very nature *cannot* be the same as the experience of others, as we *cannot possibly share* our individual psychic experience with our fellow-men. We perceive the flower as an external reality simply and solely because it is *sensory*. The percept consisting of sensations, primary and secondary, bears the impress of external reality; it possesses what Professor Baldwin so aptly terms ‘sensational coefficient’ giving external reality. External reality is given directly and *immediately* by the sensation or by the sensory compound, by the percept.

To quote from a former paper of mine: “Sensation carries along with it the reality of its stimulus. It is not that the sense of reality is different from the sensation, it is given in the sensation itself. Similarly the percept and the sense of external reality are not two different things; they are given together in the same process of perception and are identical. . . . The sensory process is also the process of the sense of external reality. . . . In seeing or perceiving the chair yonder we do not perceive it as real, because of its social or common character — the reality of its existence is given directly in the sensory processes of the percept itself. . . . The sense of reality of the external object is strengthened by association of the original sensory systems with other sensory systems, and the intensity rises in proportion to the number of systems of sensory elements, brought into relation with the functioning sensory systems. . . . The more systems of sensory elements are pressed into service, the stronger is the sense of external reality and the more assured is the reaction to the stimuli of the external environment. In the evolutionary process of man’s adaptation to his environment he becomes extended in being and grows more developed, because of his social relations. Man presses into active service

the systems of sensory elements of his fellow-beings. Adaptations and hence successful reactions to the external environment are now more assured and the sense of external reality is still further emphasized and intensified. Throughout the course of intensification of the sense of reality the principle remains unchanged in nature. The sense of reality is given by and consists in nothing else but the sensory elements." From a philosophical and epistemological standpoint the social aspect may perhaps be sufficient to fix the externality of the object, but from a psychological standpoint the trade-mark of 'shares and common stock' has no currency. The percept consisting, as we have shown, of sensory elements, primary and secondary, possesses, on that account, the sensory attribute of external reality.

MEMORY FOR PAIRED ASSOCIATES.¹

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The experimental studies of memory have been almost without exception studies of the retention of *series*, such as lists of figures, words or nonsense syllables and sections of poems or prose passages. The present study deals with the retention of the connections involved in paired associations, connections whereby, when the first member of a pair is given, the second can be supplied from memory. This memory of paired associations, or of isolated connections, may be defined in terms of the series type of memory as memory for a series of two terms when the first term is given.

In ordinary life such memorizing appears in such cases as connecting certain names with certain objects, faces, places, books and the like, connecting the appropriate words of one language with the words of another, connecting certain figures with $7 + 2$, 3×6 , $19 - 13$ and the like, connecting events with dates, places or names, and so on through the practically countless number of cases where some one thing given should call to mind some other not given.

The data which are at the basis of my report consist of records of the objective achievements and subjective experiences of twenty-two adults, seniors or graduate students, in learning the English meanings of 1,200 German words, or of so many of them as they did not already know.

The list was made up without special care, though (1) words most likely to be known words, such as *ja*, *nein*, *zwei*, *Himmel*, (2) easy compounds of words already in the list, and (3) words whose etymological relation to English made them easily guessable, were in general excluded. There were some mistakes in spelling and occasional obsolete meanings. The nature of the list may be estimated from a random selection of 100 words from it given below.

¹ The MS. of this article was received Nov. 7, 1907.—ED.

For purposes of study the 1,200 words were arranged in a study list of 120 numbered sets of 10 each, each set being type-written in a vertical column, a German word and its English equivalent being on the same line in the order (from left to right) of German-English. For purposes of a test-list the 120 sets were retained with their numbers, but the order within any one of them was made entirely random with respect to the order in which they appeared on the study lists. Only the German words were given, of course. There was also arranged for purposes of testing a random selection of 120 of the German words, which had no correspondence with the arrangements by sets.

Gesellschaft	besiegen	finster	billig
Neid	bedauern	Besuch	Gebilde
Grund	fangen	flach	albern
bedenken	erbieten	eintreten	gewahren
Abschen	fromm	Speise	Krebs
Loch	Gemüt	erkennen	Lump
schlank	Pfau	Kunde	Flur
schlagen	Lein	Wehmut	Flieder
Waffe	Nadel	Gegenteil	kleben
Höhle	fressen	Dienst	Abend
Lektüre	Kauel	Schweisz	innig
deutlich	Hecht	gnädig	ganz
nutz	Eule	plaudern	leifern
meiden	Mensch	vergraben	Hummer
Hippe	Dieb	Last	Knast
Kanapee	Reich	anfangen	gelten
Gemüse	streng	zittern	Enkel
Ort	Grimm	beleidigen	Erz
Falbel	Geschlecht	Auge	Falle
Haupt	umsonst	Wesen	merken
einfallen	schieszen	lass	Kantel
Bote	Tafel	Eidechse	dürfen
Geschichte	neckten	Eidam	hehlen
führen	leugnen	Filz	leicht
fruchtbar	Wache	Hirsch	Heirat.

In order to secure enough subjects willing to undertake to spend thirty or more hours in memorizing vocabularies, I had to forego the desirability of having only such as knew no German at all. In a test at the beginning of the experiment with the 1,200-word list my subjects gave substantially correct meanings (liberally interpreted) for from 2 to 345 words, the detailed records being those of column 1 of Table I.

After this preliminary test the study list and the following instructions were given to each person :

“ For the home tests the instructions are :

“ Each training period to be approximately 60 minutes.

“ *First.* — Get the materials needed, viz., pen or pencil, scrap paper, vocabularies to be studied, vocabularies to test with at end of hour and paper (a long sheet) for this test.

“ *Second.* — Note the exact time in minutes when you are to begin to study the vocabularies. *E. g.*, 7.10.

“ *Third.* — Study the vocabularies by whatever method you think the best. (You are to be entirely free to change your method, use several or do anything you please so long as you try always to make the best record possible, to do your utmost.) Notice the time occasionally so as not to run over the hour far. When an hour or approximately an hour (try never to work over 65 minutes or under 55, but do not be incessantly looking at the clock) has passed, stop studying the vocabularies, record the time of stopping. Put the vocabularies away.

“ *Fourth.* — Take immediately the pages with only German words, place your test sheet of paper beside it and write for each German word its English meaning, numbering each such list with its proper number. Write on only one side of the paper. If you cannot make any likely guess, even, put a dash instead of the English word. Plan to spend not over 30 minutes in doing this. Record the number of minutes spent. Record the month, day of month, and time of day, your name, and the number of the practice period.

“ In each practice hour 10 vocabularies, making 100 words, are to be studied. You may distribute your effort somewhat equally over the entire 10 or you may work with one 10 till you feel fairly sure of them, then with another 10 and so on, or you may study them in any way that you like.

“ Twelve practice periods or six days will thus cover once the 1,200 words. With the thirteenth practice period you will use again the first 10 vocabularies, and so on for a second drill for practice periods 13-24, or six days more. With the twenty-fifth practice period you will begin a third time the vocabularies now twice studied and so on through a fourth and fifth expe-

rience. In case you find in these later experiences that the words are all perfectly known, never mind that fact but study them just the same.

"Some of the words may be misspelled or spelled differently in the 'German only' and the vocabulary sheet. Some of the English meanings also may be somewhat misleading. Pay no attention to any such irregularities which you may notice.

"Do not ever look at any vocabulary, German dictionary or the like except during the practice periods. Do not look at your test records at all after they are done. Put all such test records away safely where they cannot be lost or destroyed."

When in the first day or two of study it was found that some could learn 100 words in less than an hour, added instructions were given to the effect that the number of words to be studied in an hour could be raised to 150, 200, 300, 400 or 600 as seemed best. Consequently in the course of study individuals varied widely in the number of words studied in an hour. For example, the records of Bu. and of Hy. were as follows:

RECORD OF BU.

							Estimated from 20 per cent. of all
1st round.	1st study period.	60 min.	100 words.	100 correct.			written.
2d	"	"	"	100	"	"	"
3d	"	"	"	200	"	185	"
4th	"	"	"	200	"	200	"
5th	"	"	"	200	"	185	"
6th	"	"	"	200	"	180	"
7th	"	"	"	200	"	185	"
2d round.							
8th	"	"	"	400	"	380	"
9th	"	"	"	400	"	390	"
10th and last	"	"	"	400	"	370	"

RECORD OF HY.

1st round.	Study periods 1-12.	60 min.	100 words studied.	41 aver. correct.
2d	"	"	13-24	"
3d	"	"	25-36	"
4th	"	"	37-42	"

As a rule, when an individual felt reasonably confident that he knew practically all the 1,200 words, he was tested with the entire list. In the case of five of the twenty-two individuals this final test was taken after 33, 36, 42, 30 and 24 hours of

study, respectively, although they had by no means mastered the list. Two tests were given with the selected list of 120 words to all but two or three of the twenty-two at times such as to give for all, except a few of the very rapid memorizers, records of achievement from a smaller amount of study than was needed to master the entire 1,200. To test the permanence of the connections over a long interval another test with the selected list was given over a month after the end of all study. The arrangement of these four tests with respect to the amount of study antecedent to each and the interval between each and the *last* study period antecedent to each in the case of the first three, and between the test and the average date of the last round of study in the case of the fourth, is given for each individual in Table I., columns 12, 13, 16, 17, 20, 21, 24 and 25.

We have then for each individual a record like the following for J. A. R., showing by the score of the first round the ability to learn and retain the words long enough to write them out immediately after the study period; showing by the score of the later rounds the saving in learning due to the retention of the effects of earlier rounds; showing by three tests the number of words learned well enough by a given amount of study to be held in mind for a few days; and showing by one test the number of words learned well enough by a given amount of study to be held in mind for a month or more.

In the preliminary test J. A. R. knew 96 of the 1,200 words; he then studied (Feb. 14-22) 100 words per hour for 12 hour-periods giving correctly at the ends of the hours 83, 85, 82, 80, 81, 85, 80, 88, 77, 74, 82, 77. His average for the first round was thus 81. In the second round he studied 100 words per hour for 12 hour-periods (Feb. 23-March 1) giving correctly 89, 90, 90, 93, 90, 88, 88, 94, 85, 94, 95, 88. His average for the second round was thus 90. Two hours after the close of the third study period of the second round, that is, after 15 hours of study, in a test with the selected list of 120 words, he gave correctly 40, corresponding to 400 out of the 1,200. In the third round (March 2-7) he studied 100 words per hour for 3 periods, scoring 100, 90 and 95 (estimated from 20 per cent. of the records) and then began a new round studying 200 words per hour, giving correctly at the ends of the hours 193, 189, 195, 183, 183, 185, or an average of 186. He did not take the second test with the list of 120 words. On March 16, 9 days after his last study period and 11 days after the average date of his last round of study, he was tested with the entire 1,200 words, and wrote correctly, as a result of 33 hours of study, 1,088. On April 15, 39 days after his last study period, he was tested with a list of 120 and wrote correctly 56, *i. e.*, 560 on the basis of the 1,200 list.

In order to measure the real achievements some discount must be made for the number of words known before any study. For instance, J. A. R.'s 1,088 words includes presumably all or nearly all of the 96 words he knew before any study. It would seem that $1,088 - 96$ was the real achievement of his study. So simple a discount is not, however, infallible. For besides knowing well enough to write them these 96 words J. A. R. may have known other words well enough to relearn them more easily than if he had had no acquaintance whatever with them. On the other hand, the 96 scored as fully known, had in some cases to be learned over again because the translation given in the vocabulary was different from that which the individual had in mind.¹

From a comparison of the results in the case of the nine who knew less than 100 of the 1,200 words in the preliminary test, with those for the six who knew over 170, it appears that to subtract the number of words known in the preliminary test from all achievement records is a sufficient allowance, that the remainders are conservative measures of the achievement due to the study periods of the experiment.

Thus for J. A. R., who knew 96 or 8 per cent. of the 1,200 words, the real achievement in the first round of study would average $81 - 8$ or 73 new words learned in 60 minutes. His average achievement for the second round would be $90 - 8$, or 82, new words, a gain of 9 over the first round. His average achievement in the test of 120 words after 15 hours' study would be $40 - 9$ or $40 - 9.6$ (according as we subtract those known of the 120 themselves or one tenth the number known of the 1,200). His average achievement in the final round with 200 words per hour would be $186 - 16$, or 170, new words. As a result of 33 hours of study J. A. R. had learned $1,088 - 96$, or 992, new words so as to write them a few days after the close of the study periods and $10 \times (56 - 9)$, or $560 - 96$ (according as we subtract the proportion known of the 120 themselves or the proportion

¹ Though the subjects of the experiment knew that in all scoring any correct translation would be scored as correct, they all learned the meanings given in the vocabulary, apparently finding it easier to do so than to take the time to assure themselves that their old understanding of the word was correct.

known of the entire 1,200), new words so as to write them 39 days after the close of the study periods.

All my general statements about memory achievements will be based on such discounted results. These are, I think, if anything more likely to underestimate than to overestimate the rapidity and permanence of memory for these paired associates.

Another matter of method must be noted. In all tests the entire record was utilized, but in the scores for the study periods, the estimate was made (1) from 20 per cent. of the vocabularies or (2) less often, from the entire record for omissions and from 20 per cent. of the vocabularies for errors, and but rarely from the entire record for both omissions and errors.

A third matter also needs mention. The results from the 1,200 list and the 120 list are comparable so far as concerns the proportion known in the preliminary test. The proportion was on the average the same within 1 per cent. But in the test of 1,200 words some help to memory was given by the grouping of tens in correspondence to the groups of tens studied. A word would be remembered in its ten which might not be remembered if seen in another connection. In the test with 120 words this help was of course lacking. It will not therefore be strictly fair to compare the results of the two sorts of tests. For instance, we cannot say of J. A. R. that of 992 words, known for a few days, exactly 470 were known for 40 days, the conditions of 'knowing' not being precisely the same. In point of fact, however, this difference is negligible, for in the case of 5 individuals who took the 1,200 test and the 120 test a few hours apart a few days after the last round of study, we find the results practically identical, namely:

<i>A.</i>	<i>B.</i>	
Test with 120 ($\times 10$).	Test with 1,200.	Difference ($A - B$).
1,140	1,164	- 24
1,110	1,097	+ 13
1,200	1,161	+ 39
1,080	1,135	- 55
1,170	1,189	- 19
Average difference - 9 or less than 1 per cent.		

This result is corroborated by the fact that in three other cases tested with the two tests after the same amount of study but with the 120-word test after longer intervals (46, 26 and

100 hours compared with 19, 10 and 53 hours) the inferiority of the scores in the 120-word test averaged only 3 per cent.

The results of the experiment are given in the 25 columns of Table I., which states them more clearly and economically than is possible in a reasonably brief verbal description. In the text that follows I shall simply report certain main features of the results with respect to (1) the rapidity of formation of paired associates, (2) their permanence of retention, (3) the relation between an individual's capacity in the one respect and in the other, (4) the influence of practice upon the former capacity, and (5) the individual differences in respect to memory for paired associates.

TABLE I.

Individual.	Test with 1,200 Words before Any Study.				First Round of Study.			Second Round of Study.		
	Sex.	Number of Mean-ings Correctly Given.	Percentage of Meanings Cor-rectly Given.	Number of Mean-ings Correctly Given for 120-Word List.	Number of Words Studied per Hour.	Average Number Known at End of Hour.	Achievement per hour; i.e., Column 5 Corrected by Columns 1 and 2.	Number of Days Between Average Dates of 1st and 2d Rounds.	Average Number Known at End of Hour.	Achievement per Hour.
		1	2	3	4	5	6	7	8	9
Ab.	M	114	9.5	11	100	47	38	(7)	80	61
Ag.	M	330	27.5	26	100	96	69	(8)	184	129
Ba.	F	44	3.7	4	100	96	92	(5)	177	170
Bur.	M	328	27.3	30	200	186	131	(4)	380	271
But.	M	129	10.8	13	100	99	88	(12)	197	175
Cra.	F	324	27	41	200	198	144	(3)	397	289
Cri.	M	2	.2	1	100	23	23	(6)	53	53
D.	M	165	13.8	22	100	89	75	(6) ²	187	129
E.	F	108	9	13	100	97	88	(5)	195	177
G.	M	92	7.7	13	100	94	86	(5)	189	174
Hi.	M	120	10	14	100	56	46	(14)	79	69
Hy.	F	— ¹	.4	— ¹	100	41	41	(6)	54	54
Ke.	F	4	.3	2	100	95	95	(6)	173	172
Ki.	M	30	2.5	3	100	84	82	(5)	167	162
J.	M	77	6.4	6	100	95	89	(8)	144	134
L.	M	135	11.3	14	100	97	86	(5)	184	161
J. R.	M	96	8	9	100	81	73	(7)	90	82
M. R.	M	124	10.3	8	100	63	53	(7)	78	68
Ro.	M	174	14.5	18	100	90	76	(9)	180	151
Ru.	F	79	6.6	8	200	190	177	(2)	294	274
S.	M	345	28.8	31	200	133	75	(4)	173	115
T.	M	197	16.4	15	100	94	78	(7)	175	142

¹ Not tested, but knew no German; probably not over 6 out of 1,200 had test been made.

² Approximate. Exact dates were not recorded.

TABLE I.—*Continued.*

Individual.	Test with 120 Words, February 25.				Test with 120 Words, March 6.			
	Number of Meanings Correctly Given.		Number of Study Hours Preceding.	Hours Since Close of Last Study Hour.	Number of Meanings Correctly Given.		Number of Study Hours Preceding.	Hours Since Close of Last Study Hour.
	Gross.	Corrected.			Gross.	Corrected.		
10	11	12	13	14	15	16	17	
Ab.	37	26	15	1.5	48	37	29	2
Ag.	65	39	12	1.5	100	74	21	18
Ba.	80	76	19	3	114	110	33	14
Bur.	75	45	10	60	111	81	10	184
But.	37	24	3	12	81	68	12	20
Cra.	117	77	17	38	120	79	17	268
Cri.	23	23	22	12	85	85	41	1
D.					63	41	16	0.5
E.	97	82	22	2	112	97	32	46
G.	91	78	21	1.5	112	99	29	26
Hi.					34	20	18	12
Hy.					27	27	36	14
Ke.	62	62	18	1.5	108	108	29	24+
Ki.	69	66	21	1.5	94	91	32	1+
J.	53	47	12	50	82	76	22	25
L.	90	76	18	13	117	103	29	19
J. R.	40	31	15	2				
M. R.	48	40	14	2				
Ro.	81	63	15	8	112	94	28	2
Ru.	98	90	16	144	100	92	16	360
S.	81	50	15	2	116	85	24	84
T.					90	75	21	1

THE RAPIDITY OF FORMATION OF PAIRED ASSOCIATIONS.

In the case of groups of 100 or 200 words to be retained for 15 or 20 minutes.

The number of meanings learned in an hour and retained long enough to write them out varied from 23 to 177 (see column 6 of Table I.) with the central tendency for the group at 80. The average deviation of the individuals from 80 is 23; the median deviation, 12.5. The 80 is too low; for if we take those who knew less than 10 per cent. of the words before studying them, the corresponding figures are: Central tendency, 86; average deviation, 26; median deviation, 9. Moreover, if the study hour had been spread over 150 words in the case of Ag., Ba., Bu., E., G., Ke., J., L., R. and T., higher records would probably have been obtained.

So far as I know, no experiments with learning in this way more than a small group of pairs have been made hitherto, nor has anyone ventured to predict what the rapidity of learning 80 or 90 such meanings would be. The general impression one gets from discussions of memory by psychologists and writers on education is that they estimate the capacity at less than half its real strength.

In the case of 1,000 to 1,100 words to be retained for three or four days.

Because of my unwillingness to impose any more inconvenience on the subjects of the experiment than was absolutely necessary, the number of hours of study and the exact date of

TABLE I.—*Continued.*

Individual.	Test with 1,200 Words. On the Average March 9.				Test with 120 Words, April 15.			
	Number of Mean- ings Correctly Given.		Number of Study Hours Preceding.	Hours Since Last Study Hour.	Number of Mean- ings Correctly Given.		Days Since Middle of Last Round of Study.	Per Cent. of Loss Since Test with 1,200 Words
	Gross.	Corrected.			Gross.	Corrected and Estimat- ed for En- tire 1,200 Words.		
18	19	20	21	22	23	24	25	
Ab.	427	313	33	24	41	296	40	7
Ag.	1,010	680	22	72	79	460	42	32
Ba.	1,164	1,120	33	12	62	576	42	47
Bur.	1,097	769	10	184	96	632	48	14
But.	1,175	1,046	18	24	94	811	28	23
Cra.	1,161	837	17	200	108	756	51	20
Cri.	1,099	1,097	47	16	70	698	39	37
D.	1,145	980	19	7	57	405	37	52
E.	1,190	1,082	32	19	76	652	45	43
G.	1,160	1,068	29	10	68	588	44	48
Hi.	937	817	36	16	52	400	33	54
Hy.	386	380	42	48	23	230	39	41
Ke.	1,135	1,131	29	24	86	856	42	24
Ki.	1,039	1,009	33	24	49	460	42	54
J.	1,126	1,049	26	16	79	713	38	31
L.	1,189	1,054	29	17	95	815	43	24
J. R.	1,088	992	33	216	56	464	41	52
M. R.	842	718	30	24	53	406	39	38
Ro.	1,175	1,001	31	7	75	576	40	44
Ru.	1,190	1,111	16	0	95	871	55	22
S.	1,160	825	24	6	104	695	44	10
T.	908	711	24	36	75	553	40	17

the test after the close of study vary widely so that the results do not lend themselves to a simple statistical presentation. An examination of the data of Table I., columns 19, 20 and 21, will, however, show that the central tendency of the group is to a score of approximately 1,030 new words known 18 hours after the last study period (and, as is shown by detailed records not given in the table, three days after the middle of the last round of practice), as a result of 30 hours of study. With the 30 hours of study there were approximately 8 hours of time spent during the tests made in writing out the words known at the close of each of the study periods. These were probably equivalent in value to about 5 hours of unconditioned study.

The variability of the group around this central tendency is such that half the cases would probably lie between 34 and 26 hours of study if all had been tested three or four days after the middle of the last round of study and had studied just long enough to make in such a test a record close to 1,030 new words. The range of the actual records is from: (Hy.) *380 words learned, in 42 hours of study, and retained to 48 hours after the last study period, or 4 days after the middle of the last round of study*, to (Bu.) *1,046 words, in 18 hours of study, retained 24 hours after last study period, or 5 days after the middle of the last round*; or to B., *769 words, in 10 hours of study, retained still longer*. (The case of 1,111 words in 16 hours of study was in a test directly after the last study period.) Bu., that is, learned roughly three times as many words as Hy., in three eighths of the time taken by Hy. B. learns twice as many words as Hy. and in a fifth of the time.

THE PERMANENCE OF RETENTION OF PAIRED ASSOCIATIONS.

Considering how quickly the connections are formed their persistence is remarkable. This is most fully shown by the results of a test made a month after all study had ceased. It is also shown: (1) By tests of certain of the subjects made several days after all study had ceased; (2) by the fact that in from two to five repetitions of study of the 1,200 words all but two of the twenty-two subjects could learn 90 per cent. or more of the

entire number; and (3) by direct comparisons of the achievements in the first round of study with the achievements in the second round, of achievements in the second round with those in the third round, and so on.

From the data of column 23 of Table I., considered in connection with the other relevant columns, I calculate that the central tendency of the group is a retention of 576 words to 37 days after the final 1,200-word test, 40 days after the last study period, and 42 days after the middle of the last round of practice, as a result of 27 hours of study plus the extra help gained from writing out the meanings in the tests, roughly equivalent to 6 hours of unconditioned study.

We may make as an estimate for the permanent result of 30 hours of study plus the necessary testing (the number of hours of study for which the central tendency of achievement, 1,030, in the final 1,200-word test, was given) 640 words, or, supposing the 1,200-word test not to have been given and the help it gave to later memory to have been absent, 620 words.

The group of 22 individuals being taken as the unit, we may say that 30 hours of study, plus 8 hours of testing, give command of 1,030 words for 3 days and of 620 of them for 42 days. The loss in the month and a third between the 3 days later and the 42 days later test is thus only 40 per cent.

The more significant measure — the central tendency of the losses when the losses are calculated for the 22 individuals separately — is only 35 per cent.

It would be possible in the cases of 17 of the subjects to estimate with some reliability the progress of loss from the time immediately at the end of the last study period. It would not be far amiss to say that the central tendency would be to a loss of a twentieth in an hour, a tenth in three days and between four and five tenths in 40 days. These per cents must be used intelligently in our inferences from them, since they are relative, in the case of such large groups of pairs, to the perfection with which the group was learned. For example, if 200 words, of which 195 were given correctly, say, on February 25, are studied again for an hour on February 28, and are thereafter tested, the loss in an hour will be very slight; whereas for 200 words of

which 120 were given correctly on February 28, studied an hour February 28, the loss an hour thereafter will be considerable. In the former case more words will be *over-learned*, that is, connected more firmly than is necessary for retention till barely the close of the hour.

The effect of such over-learning influences the results 3, or 40, or even 400 days later, too, of course. That a word is learned does not mean that it is learned to just the same extent as some other word learned by the same or another subject. I have, therefore, been careful to give figures of retention and loss always as of retention or loss *of certain results gained from stated amounts of study*.

A quantitative comparison with Ebbinghaus's classic experiment is not allowable because of the difference in the units of measurement of loss with lapse of time and the greater probability of *over-learning* in the present experiment. However, it is certain that the common inference from Ebbinghaus's figures that half the effect of memorizing is lost in less than an hour and two thirds in a day is very far from holding true of memory for paired associates.¹

THE RELATION BETWEEN AN INDIVIDUAL'S CAPACITY WITH
RESPECT TO THE RAPIDITY OF FORMATION OF ASSO-
CIATIONS AND HIS CAPACITY WITH RESPECT
TO THEIR PERMANENCE.

Rapidity of formation is ambiguous, inasmuch as any connection, to be formed, as to be made permanent for some length of time. The particular relation which I have measured is that between (*A*) the amount learned per hour and remembered for 15 or 20 minutes in the first round of study, and (*B*) the proportion of that retained for three days which was retained for forty days. My measurement of this relationship is only approximate because the lack of uniformity in the conditions of study among the twenty-two subjects unfits the figures for ordinary statistical procedure. I have simply ranked the twenty-two in an order for their work in the first study round, and also

¹This inference was found by Professor Cattell to be false also in the case of vocabularies learned as series; that is, so that both German and English words are given and the proper English word is given for each German word.

for the retention from the three-day to the forty-day test The rankings are given in Table II.

The correlation between *A* and *B*, by my calculation, is .4. The opinion that *those who* learn slowly remember long is evidently a superstition whose origin is probably the fact that *what* is learned thoroughly, and so by much study, is remembered well. The same person studying the same thing longer will naturally remember it longer! But it is the quick learners who are the good retainers.

TABLE II.

Individual.	Rapidity of Learning: Order in Achievement in First Round.	Permanence of Associations: Order in Amount of Retention (from Column 19 to Column 23 of Table I.).	Individual.	Rapidity of Learning: Order in Achievement in First Round.	Permanence of Associations: Order in Amount of Retention (from Column 19 to Column 23 of Table I.).
Ab.	21	1	Hy.	20	14
Ag.	17	11	Ke.	5.5	9
Ba.	5.5	17	Ki.	11	21
Bur.	3	3	J.	9	10
But.	5.5	7	L.	9	8
Cra.	2	5	J.R.	15.5	20
Cri.	22	12	M.R.	18	13
D.	14	19	Ro.	13	16
E.	5.5	15	Ru.	1	6
G.	9	18	S.	15.5	2
Hi.	19	22	T.	12	4

THE INFLUENCE OF PRACTICE UPON THE CAPACITY TO FORM PAIRED ASSOCIATIONS.

In the general capacity to form the associations well enough to retain them at the end of the hour there was no demonstrable improvement; that is, none in the course of the first round of twelve hours. No more words were learned in the last half of it than in the first. The facts are as follows:

Ab., G., Hi., Hy. and M. R., for whom the 100 words per hour were a sufficient test, averaged for the 12 successive periods (in order):

4¹ 4¹ 53 48 46 36 51 44 45 42 37 54
or, by twos,

4¹ 50.5 4¹ 47.5 43.5 45.5
or, by fours,

4⁶ 44 44.5

Du., Ki. and J. R., for whom the 100 words per hour were probably a sufficient test, averaged :

86 87 92 87 81 85 85 91 82 83 83 84
or, by twos,

86.5 89.5 83 88 82.5 83.5
or by fours,

88 85 83

For Ag., Bar., But., E., G., Ke., J., L., Ro. and T., for whom the test was too easy, our best estimate is the number of records 95 or over at each period. These are ;

8 8 9 9 6 10 8 6 8 7 8 8
or, by twos,

16 18 16 14 15 16

Bur., Ru. and S., whose first rounds were irregular, showed no appreciable practice effect.

The same absence of improvement is observable within the second round.

The absence of practice effect in the case of this score of educated adults must not be assumed to be proof or even important evidence that in general the capacity to form and retain paired associations is not susceptible to improvement by training. With subjects who in their every-day life did not have already a vast amount of such training the result might well be different. It is significant that my subjects did not to any considerable extent vary their methods of study in the course of the experiment. They all came to use the method of 'recall,' that is, of covering up the English words (after studying them for a brief period) and trying to recall them at the sight of the German words, verifying their memories thereafter and refreshing their memories by the percepts only when necessary. And with very few exceptions they used this method from the start. One result of practice did appear. The work became easier in the sense of being more interesting, less objectionable.

The absence of practice effect in these subjects, does, however, differentiate memory for paired associations from memory over very short intervals for long series such as poems or short series such as nonsense lists, lists of objects and the like. For

in the latter cases a marked practice effect is found even with subjects of the age and training of these. I am inclined to think that the same relative difference would hold with untrained subjects, who would probably improve in learning vocabularies for moderate retention, but would improve still further in learning lists and passages for very brief retention.

The interpretation of this difference is not an aim of the present report, but it may be noted, that the hypothesis that the more a memory function involves grasping, rather than retaining, the more susceptible it will be to training, deserves experimental testing.

INDIVIDUAL DIFFERENCES IN MEMORY FOR PAIRED ASSOCIATES.

The facts already given of the variability in memory achievements have shown the great individual differences in separate features of associative memory. I shall now compare the total records of certain individuals. Even within so homogeneous a group as a class of graduate students and seniors, and so small a group as 22 of these, we find such extremes as :

Hy., who could learn only 41 words in an hour so as to write them at its close ;
who could learn only 270 words in 36 hours so as to write them 4 days later ;
who could learn only 386 words in 42 hours so as to write them 4 days later ;
who knew only 230 of the 386 words 35 days afterwards.

Ke., who could learn 95 words in an hour so as to write them at its close ;
who could learn 1,131 words in 29 hours so as to write them 4 days later ;
who knew 856 of the 1,131 words 37 days afterwards.

Ky. and Ke. are strictly comparable, as neither knew before study more than 6 words of the entire 1,200. Both worked under similar conditions. In view of the fact that Ke. would almost surely have done much better than 95 had she tried 150 or 200 rather than 100 words, we may put her superiority as :

3 to 1 in amount learned in an hour for short retention,
 5 to 1 " " " " 30 hours for moderate retention,
 4 to 1 " " " " " " " " long retention,
 5 to 4 in proportion retained from the moderate to the long interval.

Comparison is also fair between Hi. and Bu., who knew before any study 120 and 129 words, so that the method of discounting used can favor one or the other only by the barest trifle. The conditions of work were more unfavorable for Bu., so that the obtained differences should be, if anything, increased.

Hi. learned 46 per hour,
 learned 79 per hour in the second round,
 " 220 in 18 hours,
 " 817 in 36 hours,
 knew 400 words 33 days later.
 Bu. learned 88 per hour,
 " 197 per hour in the second round,
 " 1,046 in 18 hours,
 knew 911 words 28 days later.

Bu.'s superiority is:

2 to 1 in the amount learned in an hour for short retention,
 5 to 1 " " " " " 18 hours for moderate retention,
 4 to 1 " " " " " " " " long " 1
 8 to 5 in the proportion retained from the moderate to the long interval.

The record of Ab. is lower than that of Hi. and the record of Bur. is higher than that of Ke. or Bu., but the comparison of Ab. and Bur. is too involved.

¹ Estimated.

THE PSYCHOLOGICAL REVIEW.

VOLUNTARY CONTROL OF THE DISTANCE LOCATION OF THE VISUAL FIELD.

BY PROFESSOR HARVEY CARR, PH.D.,
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In a previous paper,¹ I reported two cases of voluntary control over the distance location of visual objects. In order to secure new cases of the phenomenon and to determine the relative frequency of its occurrence, I have canvassed a series of classes in psychology. The *involuntary* movement of the visual field occurs quite frequently ; a description of some typical cases of the involuntary phenomenon will be reserved for a later paper. Such involuntary movements occur with all persons possessing voluntary control, but this latter power is possessed by only a small percentage of those persons subject to the involuntary illusory movements. On the average one person out of every seven is subject to the involuntary illusion, while but five cases of voluntary control were discovered among 350 students. Of those subject to the involuntary illusion, about one in ten also possesses the power of voluntary control. Several new features in the voluntary phenomenon were reported which are of sufficient interest to merit a short description.

I. The first subject is a New York business man about forty years of age. The phenomenon first occurred involuntarily at the age of 17 years during convalescence from a severe attack of typhoid fever. Later it was found that the illusory movements could be produced at will. The volitional control is possible at all times and under any conditions. The amount of movement possible is directly proportional to the intensity of the

¹ PSYCH. REV., Vol. XIII., No. 4, pp. 258-275.

illumination. On a bright day objects can be moved forward up to a distance of two feet from the face or back to the apparent distance of the horizon. The movement refers to the entire visual field. The visual objects do not become confused or blurred in the least; they remain single and maintain a constant size throughout the depth displacement. As a consequence the movements are real and striking in appearance and the visual objects retain all their tangible and substantial characteristics throughout the movement. When the objects are brought forward close to the face, the subject feels that so far as appearances go he could reach out and touch them with as much assurance as in normal perception. After a displacement, the objects are regarded as having attained their true location when they are brought back to the apparent position where they were first seen.

The subject could give no account of the method of voluntary control. He could detect no strain or altered feeling which could be located or described. He was merely conscious of the mental decision. This may be due to the fact that the subject has never had any practice in introspective descriptions in psychological terms. No movements of the eyes or of the lens were detected by the writer. In the dim illumination necessary for a phakoscopic examination, the extent of the illusory movements was much minimized and, as a consequence, the lenticular changes would be small in case they did condition the illusion. Not even a suggestion of a lens change was present, and the writer was forced to the opinion that the volitional illusions with this subject are in no way conditioned by eye or lens movements. This conclusion is also supported by the fact that the visual images undergo no change in size or distinctness during the illusion. The subject possesses good vision, he has never been afflicted with any eye troubles, nor does he wear glasses.

2. With the second subject the illusion is merely one of distance and not of movement. The visual field appears now far away and now near, but it does not *move* backward and forward. Objects appear to get to positions without movement; they become larger and smaller, but merely the result and not the process is perceived. The phenomenon occurs both voluntarily and involuntarily.

(a) The subject first noted the involuntary phenomenon when she was about nine years of age. It may have occurred before this time for all she knows. She had no sickness or unusual experiences at this time. The phenomenon has occurred rather frequently ever since — a period of twelve years. It may occur under any condition of illumination though it has been more frequent at night with dim artificial lighting. A rather long and steady fixation seems to be a predisposing condition. The phenomenon has occurred very frequently while the subject has been listening to a speaker in a church or lecture hall. A constrained position of the eyes in the sockets tends to induce the illusion. All objects in the visual field suddenly appear much farther away than usual. This increased apparent distance varies from 100 feet to one half of a mile, but it is constant for any particular experience. The objects do not become doubled, blurred or confused in the least; they remain as vivid and as distinct in outline and surface as in normal perception. The visual objects decrease in size in proportion to their increased distance from the observer. This change in distance and size is not experienced; the objects are merely seen smaller and farther away than usual. While listening to a speaker, the corresponding auditory illusion occurs; the voice seems to come from the distance. Although the voice remains as loud and distinct as usual, the subject has noted that she involuntarily leans forward as one naturally does in accommodating for a far distance. The illusion persists for eight to forty-five minutes in spite of all efforts to destroy it. When she turns her head and eyes about during the illusion, generally all objects appear much farther away than usual no matter where she looks. Sometimes the new objects are perceived at their proper distance, but in this case the illusion still persists whenever she looks back at the primary field. She has attempted to destroy the illusion by rubbing, blinking and moving the eyes. Occasionally these efforts are successful if persisted in for some time, but generally such means are not effective. The only certain method is eye closure for a period of five to fifteen minutes. When the illusion disappears, it does not recur within ten minutes, and generally not for some time. The illusion is not conditioned or accom-

panied by fatigue nor by any disagreeable ocular experiences. Some slight eye strain is generally present. In no case has the visual field ever appeared to be located in front of its actual position. The illusion has always been one of increased distance.

(*b*) In describing the experience to her friends several years ago she was induced to attempt a voluntary production of the illusion. She succeeded in the first trial and her ability has increased quite noticeably with practice. The phenomenon may be produced at any time, though dim artificial illumination is a favoring circumstance. She fixes her attention on some object and steadily imagines it in a more distant location. A period of one half to two minutes is necessary to provoke the illusion. The eyes water and smart to some extent. There is always an orbital strain situated back of the bulb. No feeling inside of the eye balls can be detected. The increased distance of the field varies in the different tests but it remains constant for any one trial. The subject cannot influence the amount of the illusion either before or during the test. She never has beforehand the least idea as to how far back the field will appear. No movement is perceived. Objects remain as distinct as usual but they become smaller in proportion to their increased location. The forward illusion has never been produced. The phenomenon is terminated by moving or closing the eyes and by relaxing the orbital strain. Both conditions are necessary. When she rotates her eyes while maintaining the strain, all objects, no matter where she looks, appear more distant than they really are. Generally the illusion is terminated immediately by these means, but occasionally two minutes are necessary to effect the result. Apparently the length of time necessary in terminating the illusion is proportional to the time necessary to initiate it. The illusion is not accompanied by any movement of the eyes or of the lens. The subject possesses good eyesight but wears glasses whenever she does much reading.

With monocular conditions, the illusion may be produced much more readily than with binocular vision. The illusion occurs immediately and without any orbicular strain. More-

over the apparent distance of the visual objects varies during the test instead of remaining constant as it does under binocular conditions. The illusion persists during all eye movements; it can be terminated only by eye movement and a return to binocular vision.

3. The depth illusion with the third subject was described briefly in a previous paper on the 'Apparent Control of the Position of the Visual Field.'¹ The phenomenon first occurred after a severe nervous attack some seven years ago. The field may be moved up to five feet of the subject or back to the horizon. The extent of movement possible and the ease of its production depend upon the intensity of the illumination. The visual objects decrease slightly in size as the field moves backward, but the decrease in size does not seem to be proportional to the increase of distance. Introspectively the decrease in size is due to the fact that the edges of the images seem to fade away. There is no doubling of images. Confusion of contour and surface occur as the field is moved from its real location. In the return movement, the field is judged to have reached its real position when the maximum of distinctness is secured.

The illusion can be produced with monocular vision but not so easily as under binocular conditions. It also occurs much more readily with the left eye than with the right.

Each direction of movement is accompanied by a characteristic sensory experience located within the eye in the ciliary region. The subject was not able to describe these feelings as satisfactorily as one might wish. For the backward movement, the feeling was termed an 'expansive' one which on the whole was effortful. The antagonistic experience was termed a feeling of contraction and relaxation. The terms seem to refer to a radial expansion and contraction. Marked pupillary changes occur but they are irregular and spasmodic in character. No definite kind of pupillary change was an invariable concomitant of each direction of image movement. No eye movements were present. In the phakoscopic tests the extent of illusory movement possible was extremely small owing to the dim illumination necessary. I was under the impression that slight lenticular

¹ PSYCH. REV., Vol. XIV., No. 6, pp. 357-382.

changes occurred concomitantly with the illusory movement of the field, but the changes were too slight to admit of any statements in regard to their accommodatory character. The feeling inside the bulb, the pupillary changes, and the blurring of the images support the assumption of lenticular disturbances.

4. This subject has always experienced difficulty in motor adaptations to visual objects.' She invariably tends to adapt her movements for too short a distance. She has noted the difficulty especially in such activities as playing tennis, catching balls, crocheting, etc. The first step of a stairway generally presents some difficulty. Without glasses this tendency to reach in front of objects is much exaggerated. In this condition there is a constant strain within her eyes. Objects seem very large and very near to her. In walking along a street, the houses simply overpower her with their apparent vastness, while she feels herself to be about the size of a fly and experiences a marked tendency toward dizziness.

The subject possesses an absolute control over the distance of the visual field. She can bring the field close up to her eyes or remove it to the apparent distance of the horizon. She has possessed this power all her life. The illusion may be effected at any time and under all circumstances, though the ease and degree of the control is at a maximum with strong illumination. The movement is effected in immediate response to her will without the least difficulty. To use her own words, she moves the field in the same manner that she moves her hand by merely thinking of the intended position. Objects grow larger as they move toward her and become smaller as they are removed to more distant positions. The clearness and distinctness of the images vary with the movement. The maximum distinctness of the fixated object is the criterion by which she judges as to its real location in depth. This volitional movement of the field is not a matter of amusement but it is rather one of the necessities of life, for she is accustomed to move the field back and forth in order to secure more distinct vision and to attain a more adequate conception of the real distances of objects.

The illusion can be effected only with binocular vision.

Under monocular conditions no voluntary movement of the field is possible.

Each direction of movement is accompanied by characteristic sensory experiences inside the bulb. With the forward direction, she experiences an enlargement of the pupil and a contractile, or effortful, muscular feeling located in the ciliary region. There is a pull, or movement feeling, radially outward and backward to some extent. When the field is removed, the pupil feels smaller. The muscular experience is one of relaxation having a forward and a radially contractile direction.

Such introspective descriptions are necessarily difficult to a novice, and the question naturally arises as to their reliability. The description of the pupillary changes is correct and the subject detected the alterations without any suggestions on my part. In first studying the case, I noted these concomitant pupillary changes and in order to confirm the correctness of my observations I requested the subject to move the field back and forth as she pleased while I would attempt to call out the direction of the movements initiated. My success rather dumbfounded the subject but she finally exclaimed that she understood my method because the pupil became larger and smaller for the forward and backward movements respectively. This introspective detection of the pupillary changes also occurred with Miss Allen. The kinæsthetic experiences inside of the bulb were first described in response to a series of questions. The influence of suggestion is quite possible. Some nine months later the subject was requested to write out as fully as possible a description of all the changes she could detect. In some respects her language was a trifle vague, but on the whole her description corresponded to that formerly given.

In regard to observed concomitant changes, no eye movements occur. Alterations of the size of the pupil are so marked that an observer can easily call off the direction of the correlated movements of the visual field. In the dim illumination necessary to the phakoscopic test, the extent of the illusory movements is minimized, and as a consequence lenticular adjustments, if present, would be small. However, I was quite confident that corresponding movements of the anterior lenticular image were

present. The changes in the distinctness of the visual objects, the pupillary alterations and the presence of motor feelings inside of the bulb support the contention as to the existence of accommodatory changes of the lens corresponding to the movements of the visual field.¹

The last two cases are similar to those previously reported. Accompanying the volitional control of the visual field are changes in the distinctness and size of the images and in the size of the pupil, characteristic motor experiences within the bulb, and concomitant lenticular adjustments. No eye movements occur. These two cases support the general contention of the former paper² that the relative functional importance of the various criteria of depth is an individual variant, and that, so far as accommodation and convergence are concerned, there is a rare type of case in which accommodation possesses the greater function. In this type, dissociation of the two motor functions may be obtained by direct voluntary control over the lens. The evidence in favor of lenticular changes as conditioning the volitional movements of the field is not equally conclusive for the three subjects. With Miss Allen the evidence was clear cut and definite, while a minimum of assurance was felt with the third subject of this paper.

The experiences of two other persons belong to the above type. The extent of volitional movement possible is quite small. The only new feature is the fact that one person was unaware of her ability until the possibility was suggested by my accounts of such cases. The involuntary phenomenon had occurred very frequently previous to this time. The ease of production and the extent of movement are increasing with practice.

The first two cases are similar in the following respects: No eye movements, lenticular adjustments, or pupillary changes

¹ It is to be noted that the pupillary changes in relation to the direction of the illusion in the above account are the reverse of what they are in other cases where I have been able to make observations with any degree of confidence as to their accuracy. The fact indicates for this subject a receding illusion for near accommodatory adjustments if the usual relation between the pupil and the lens obtains.

² *PSYCH. REV.*, Vol. XIII., pp. 258-275.

occur. There are no kinæsthetic experiences within the bulb, nor any changes in the distinctness of the visual objects. Evidently the third dimensional movements are not accompanied nor conditioned by any appropriate motor adjustments that can be detected. The facts again support our contention as to the individual variability of the relative importance of the criteria of depth, and indicate the existence of a new type in which neither accommodation nor convergence is of major importance. This effective criterion of depth is termed a 'central factor' because (1) it is a subjective condition inasmuch as it is directly susceptible to volition; (2) it involves no detectable adjustments in the sense organ, and (3) it is unknown so far as any positive evidence is concerned. By the term 'central factor' I mean these three things and nothing more. Outside of this the matter is one of speculation.

Of the various known criteria of depth, brightness is one which potentially meets these conditions. Indistinctness of surface and contour might be a factor, but it presupposes lenticular or convergent disturbances. However, confusion of images did not occur with the two subjects with whom it is necessary to assume the effectiveness of a central factor. Several objections can be raised against the brightness hypothesis: (1) The changes in brightness are not noticed. This objection is not insuperable, for it is possible that these changes are not noticed because interpreted in distance terms. (2) The volitional alteration of the brightness of perceptual objects is questionable. Granted that the brightness might be decreased, yet it is necessary to assume an increase of brightness beyond the normal to account for the movement of the objects to positions in front of their real location. This would necessitate the assumption of a central reinforcement and inhibition of the brightness of sensory experiences by appropriate cortical activities. That such a result may occur with some individuals is not altogether improbable. In a previous paper¹ I described a case wherein volitional central activities approximated a perceptual reality.

It may be assumed that the central factor consists of motor impulses normally involving or accompanying distance adjust-

¹ PSYCH. REV., Vol. XIV., No. 6, pp. 357-382.

ments of the sense organ, which movements for some reason do not occur during the illusion. The contention has been advanced previously¹ that the efficient factor in space perception is the innervating impulse and not the afferent impulses resulting from the actual adjustment. If this theory is true, it is necessary to assume the existence of either a convergent or accommodatory innervation without the usual consequent act. The difficulty consists in explaining the absence of motor results. One possibility may be mentioned. Suppose that the eyes are strained to the right while the attempted movement is prevented by the antagonistic muscles. In one sense the two opposing motor innervations are equal because a condition of equilibrium results. In another sense the rightward innervation is much the stronger and it overflows, as it were, into many secondary channels. All of the facial muscles are drawn to the right. In other words, antagonistic innervations are not necessarily equal in intensity or spatial significance. The writer is somewhat inclined to ascribe to such a view largely because of an aversion to using *undefined* central conditions as explanatory principles except in a case of real necessity.

It has been suggested that these illusions occur during moments of monocular vision. Undoubtedly the strength of the visual activities in the two eyes does alternate from time to time and there may be occasions when the vision of one eye is practically *nil*. This suggestion presents several difficulties: (1) It would be necessary to assume that these subjects possess the power to neglect vision of one eye at will. This objection is not insuperable, however. (2) Granted that this condition obtains, yet the theory fails to explain anything. The illusory movements must still be due to changes in some of the factors governing depth. For example, the rapid oscillation between monocular and binocular vision effected by the interposition of a screen before one eye is accompanied by changes in the apparent distance of the fixated object, but this change in depth is supposed to be due to *convergent movements* of the eyes.²

¹ Carr, 'Visual Illusion of Motion,' *PSYCH. REV.*, Mon. Sup., Vol. VII., pp. 92-111. Also *PSYCH. REV.*, Vol. XIII., No. 4, pp. 273-275.

² James, *Principles of Psychology*, Vol. II., p. 92.

The theory leaves the problem as to the immediate effective conditions of the illusion still open. The fact that convergent movements do not occur during these volitional illusions indicates that the suggested theory is questionable. (3) Binocular parallax conditions depth perception, and since the effectiveness of this factor is destroyed by the conditions of the assumption, it might be supposed that depth factors subject to volition are effectively operative upon the location of the field only under this condition; the illusion could be produced only or much more easily when the effect of the binocular parallax is absent, *i. e.*, with monocular vision. As a matter of fact, the illusion is more difficult to produce under monocular conditions with Miss Allen and with subject 3. The fourth subject cannot effect the illusion at all with monocular vision. The assumption has a potential validity only with subject 2. (4) The hypothesis that monocular vision obtains during the illusion is disproved by the following tests. With Miss Allen, objects were placed in the line of vision on both sides of the fixated object. Both images of these objects remained visible during the illusion. With three subjects the following experiment was performed to test this hypothesis. The subjects fixated some distant object. Two objects were placed a foot apart and some eighteen inches in front of the observer. A screen was so placed that the distant object was perceived binocularly, while each eye could perceive but one of the near objects. During the illusion both near objects were continuously visible and they participated in the movement of the field. Evidently a condition of monocular vision is not necessary for the production of the illusion.¹

¹ The MS. of this article was received January 25, 1908.—ED.

ON MEANING. A SYMPOSIUM BEFORE THE
WESTERN PHILOSOPHICAL ASSOCIA-
TION, DECEMBER, 1907.

I. MEANING AND IMAGE.

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In the current use of the word meaning we have one of the best instances of the current tendency to confuse structure and function. Meaning can be very easily conceived and even represented to ourselves as long as we consider its use alone, but it is very illusive as soon as we attempt to pin ourselves down to accurate definition, and gives even more trouble when we attempt to point out the structures that stand at the basis of the meaning. If we look to the history of the term we find that Bradley had no difficulty in demonstrating that an image and its signification were entirely distinct, that no image, as images were ordinarily defined in the psychology of his day, could be what the logician reasoned with or about. 'Man' that we have in mind as we think 'man is primarily distinguished from the animal by his readier and more complicated responses' is not the picture that we have as we formulate the sentence or conclusion. But if one looks to Bradley's writings for a definite statement of what meaning is as a conscious process, one is everywhere baffled. Meanings are the things that are really associated. They are the only things that logic is concerned with. They are organized into a universe that may or may not be said to exist in advance of knowledge. When we ask however how this world of meanings is related to the individual consciousness that we know or to the images or particulars with which all knowing is assumed to begin, we look in vain for a satisfactory answer. The most that we get from Bradley or Bosanquet on this point is metaphor, the metaphor of signal flags and their signals, of words and their meanings.

It may be said with some truth that since Bradley all of the discussions have been devoted toward giving a clear statement

of the relation between meaning and idea, between the world of thought and the mental content. This has been variously pictured. Gore would have us believe, and with good warrant, that image is stimulus, meaning the response, image, the structure, idea the use that is made of the structure. The view harmonizes well with the current use of the two words and with actual observations in the thought world.

More recently Hoernlé has insisted that meaning and image cannot be separated, with the added implication that the meaning is an ultimate process that cannot be further defined or described.

We may accept both of these theories, but even then we meet other difficulties in distinguishing the two processes. There is no stimulus without response. What we ordinarily appreciate is the reference not the symbol; as we think we have meanings always, never images. If we accept Gore's definition, meaning alone tends to be left in consciousness, image is a vanishing quantity. By Hoernlé, too, the problem seems to be stated only, not solved. To make image and meaning different aspects of one psychic whole is a formal statement in denial of the previously asserted separation that probably must be accepted but the assertion is supported by no definite proof nor does it bring us much nearer an adequate idea of the relation that we are concerned to understand.

Still another use has been made recently of the distinction between image and meaning. I refer to the discussion by Woodworth and Thorndike of the necessity for an image in advance of voluntary movement. From one point of view this discussion avowedly contributes nothing to the elucidation of the nature of meaning. It rather makes use of the earlier developed distinction to escape the *impasse* in the explanation of the origination of voluntary movement. Briefly Woodworth becomes convinced by observation of himself and others that voluntary movements are frequently executed when there is no image that can be detected, or at least no image that is at all closely related to the movement that is performed. If there be no image present, Woodworth argues that the only alternative is to assume that the movement is controlled by pure thought or meaning.

Before we can do justice to this theory or use it as a solvent for the explanation of the relation between image and meaning, it will be necessary to consider what seems to me the more helpful constructive side of Woodworth's theory, the physiological explanation. This, it will be remembered, is that movement is determined by large masses of nervous elements acting as a unit, that no part of the activity can be regarded as alone responsible for the movement but the whole system must play its part.¹ If we carry this statement over to meaning it would indicate that meaning would be the correlate of large masses of nerve units that are closely connected. Image would presumably correspond to the action of a relatively restricted number of elements in the sensory area. This view seems to harmonize perfectly with the facts. There is probably no voluntary movement that cannot be thus referred to a vast mass of related elements, even if we consider nothing but the sensory elements. As one reads aloud even in a reflex sort of way the voice must be controlled by the visual impressions from the page, by the sound of the spoken words, whether loud or low, and by the sensory impressions from the organs of speech as well. Were any one of the sensory elements removed by blindness, deafness, or anæsthesia of the muscles of speech, reading would be impossible or would be uncertain in its quality. But in addition to all of this there must be some control by the general purpose in reading and the general meaning of the context that would determine the modulation of the voice, and would inhibit the pronunciation of any word that was not in harmony with the whole. It is certain that one need be conscious of but very few of the elements in this complex and of but one group at a time. Certainly too any one group of elements in the complex may be unconscious and the movement take place as it does. What dominates consciousness is almost always the purpose of reading or of the movement of whatever kind, not the sensations that pathological and physiological facts assure us must be present during the movement. This general complex is what too on any interpretation of the kind must be called meaning. So far we may go with Woodworth in his statement of the nature of the processes that control action.

¹ *Garman Studies in Philosophy and Psychology*, p. 391.

A similar series of experiments that emphasizes a slightly different phase of the problem, and reaches conclusions of a slightly different kind is that of Ach in *Die Willenstätigkeit und das Denken*. Ach it will be remembered worked with reaction times, and studied the sensory and other elements that controlled the response in very much the same way as Woodworth. He too found that many responses were without any preliminary image. When, *e. g.*, the subject was working with choice reactions, the stimulus alone would receive attention and no noticeable imagery would intervene between stimulus and response. What determined the response was the purpose or awareness of the task that had been set by the experimenter for that series and even this was often but vaguely conscious. The response itself became very nearly reflex, but choice was made between the several possible reflexes that had been developed in the course of the experiments by the purpose that dominated that particular series. The stimulus is always effective in some degree and helps to determine the course of the action but all of the sensory elements have dropped from consciousness as they always do when motor responses become automatic. In the theory of Ach, purpose or task is the essential element in the determination of action. Idea and even stimulus takes a secondary place. To bring together then the factors that control voluntary movement, we find that we must have stimuli from two or more different senses which share in the immediate control of the movement, that these stimuli must be interpreted by earlier experiences and coördinated by a present purpose or task. What idea, if any, need be present cannot be said with certainty. Either the remote or the resident sensation may be conscious or may drop from consciousness and the purpose may be but vaguely represented in consciousness and the action still follow its usual course; but each and all of these factors must be represented in the physiological activities out of which the response grows.

If we agree with Woodworth and Ach that these are the elements that are present in the voluntary act, our question recurs to our original problem, how much of the process are we to call image and how much are we to call meaning. Certainly

the bare image alone can never suffice to control movement ; we must always have the larger appreciation of purpose that corresponds in action to what the logician calls meaning. If now however we accept Woodworth's application of the word, then all of the complex process outlined above must constitute the meaning. In other words, dropping out the elements that may not be conscious at the moment of action, what we are conscious of and what is essential to action is the complex interrelation of sensation with sensation and of sensation with idea and purpose, and this it is that by their definition we must call meaning. But if we make strict application of this theory and connect it with general observation it would seem that all action takes place through meaning, never through image.

While then we may agree with Woodworth as to the facts of the control of voluntary movement, we may take exception, it seems to me, to his assumption that the meaning is anything mysterious or unusual in consciousness, or even to the implication that it is any particularly new addition to the elements that are ordinarily considered in a discussion of the voluntary movement. His meaning or pure thought is not apparently, from his physiological interpretation, anything added to stimulus, sensation or idea, is in fact nothing more than a new coördination, a new interrelation between sensation, idea and earlier experience, controlled or represented by the purpose or task of the moment.

If we compare the factors involved in the control of movement with the processes involved in meaning in reference to thought, we can see that the two harmonize in so far as the image is ever subordinate, while the meaning is always the important element. This I have attempted to show in earlier papers before the society and it has also been asserted by Baldwin¹ for all concrete mental processes. Moreover each specific sensory element is subordinated to and dependent upon the more general purpose that dominates thinking as it dominates action. If we say with Gore that meaning is function or response, image structure or stimulus, we find that what response is given to stimulus, or what use is made of structure depends upon the

¹ *Thought and Things*, I., p. 137.

general content or purpose of the moment, just as the action depends upon the purpose or task set by oneself or another. In this case too the physiological processes would be similar to those that control action. We would have not one sensory element, but a sensory content associated with a vast number of other sensory and motor elements, dominated and controlled by still other and more remote nervous processes. So, in a simple example, when I say 'that man is good' the meaning of the word good is to be found in the earlier associates of the word and in the present context, the present purpose with which I use the word. If I speak the word in this connection or to a psychologist or a psychologist, I probably mean skill in psychological analysis, or extended knowledge of psychological facts, obviously, were I delivering a funeral oration or selecting a man for a football team, the same words would have an entirely different meaning. So both in action and in thought the important element is meaning not image, and meaning is the correlate of the physiological processes that have long been recognized as at the basis of thought and action. Meaning in this sense is a total consciousness as opposed to some detached fragment of that consciousness. In another sense however we find some justification for the assertion of Bradley and Bosanquet that meanings are always universal or typical. Even this however is only to say that consciousness in the concrete is never in terms of bare particulars but is always made up of experiences that have been rounded out and modified by other experiences. Even in sense perception we never receive the bare sensation of psychology; we always replace it by a construction that has developed gradually through earlier experience, to explain, harmonize, or standardize concrete experiences. We see acute and obtuse angles in furniture but we perceive right angles. Furthermore we are aware not of the acute and obtuse angles that we see but of the right angles that we perceive. Similarly in thought we deal not with the concrete changes of color in the test tube but with interchange of atoms or ions, a statement of theory grown out of experience to standardize or interpret experience. So everywhere in scientific and every day thought, we find that we deal with meanings, or with standards that have

precipitated from experience not with the immediate experiences themselves. In this sense all thought deals with constructions, with abstractions. Both of these uses of meanings apply to all thought, and are in reality very closely related. One cannot have this typical representative except in the larger setting of consciousness, and on the other hand one cannot think ideas in their relations without using these earlier developed types or standards.

We come then to the conclusion that meaning is practically everything. We always see the meaning as we look, think in meanings as we think, act in terms of meaning when we act. Apparently we are never distinctly conscious of anything but meanings. If meaning is thus the exclusive factor in consciousness one-half of our problem still remains to be solved, what is image. We have practically reversed the ordinary starting point. Usually image is taken for granted and meaning must be explained. The fact seems to be however that far from being something ultimate and inexplicable added to image, meaning is the concrete process, the process actually open to observation and image needs accounting for. In this respect the relation between image and meaning is much like that between sensation and perception. Image is logically first, but is recognized late in concrete experience, if it is present at all except as a theoretical construction.

Our next problem then is to determine what the image is and how it happens to exist in addition to the universal, the immediately given conscious experience. The simplest answer is to say that image is just another meaning.¹ The image is the psychologist's construction to explain the mental operations as the ion is the chemist's to interpret his reactions. It is a type that he sees as he looks into his own consciousness as the table top with edges perpendicular is the type he sees in the world outside. Just as the latter meaning too comes spontaneously under a given set of circumstances so the interpretation of a mental state that makes of it an image is the spontaneous outcome of another set of circumstances. One is apparently a meaning on exactly the same level as the other. A diamond looked at as a chemical

¹ Cf. Baldwin : 'Discussion, Thought and Things,' *Psych. Bull.*, IV., p. 125.

substance is one thing, has one meaning, as a symbol of wealth or affection it has others. When one looks at the experience in the furtherance of a psychological investigation it takes still a fourth meaning. The thing will have a different appearance in each meaning. What gives the different meanings and the different appearances is the difference in the purpose and in the mental setting that is present. Under the influence of the dominant mental process different interpretations start up to modify the central element. These make the diamond now a piece of crystallized carbon, now an investment, and again a token of affection. When the observer later turns psychologist the same experience becomes a complex of visual sensations, a revived memory process or a mass of organic sensations. The psychologist's image then is but one meaning among many. It has the same physiological basis. When one interpretation is given the diamond, one group of associates is aroused by it, one group of sensory nerve-cells is started into simultaneous response; when viewed in another way another mass of cells is aroused although each excitation irradiates from the same central point. The image too is not so far as perceived a simple element. It must be constituted of other elements grouped about the common point of departure. In this case however the aroused experiences are earlier mental experiences, rather than other chemical, bartering or emotional experiences. An image then is a meaning in both uses of the word. It is an aggregation of one sensory element with other sensory elements that interpret it, and it is a type or standard that is used by the psychologist to explain the mental processes as the chemist uses the atom to explain his reactions. This particular meaning then is one that attaches to every experience in so far as it is capable of psychological interpretation. In that sense too every meaning may be regarded as made up of images so that what temporally is prior is, from one point of view, logically a sequence. This again is merely to assert that every experience is capable of at least two interpretations, has at least two meanings, a psychological and a physical.

The immediate incentive to the psychological interpretation, to regarding an experience as an image or as composed of im-

ages, is to have a psychological question in mind. In this respect again the psychological is not different from any other meaning. The meaning of any object changes with its setting, with the question in mind as one looks. What gives rise to the psychological question varies with the individual and from moment to moment with the same individual. We may agree with the Dewey school that one powerful incentive is the failure of memory or disparity between the memory and the renewed experience in the external word. When mental processes fail us we are compelled to be interested in the nature of the ordinary and the exceptional memory content. But there are probably other circumstances that give rise to the question, and given the question the meaning or interpretation is bound to arise. We are not here concerned with the natural history of the psychological function.

We have then practically inverted the ordinary relation between meaning and image. Where the usual view is that the image is the primary process and the meaning is derived from it in some way or is another ultimate, we find that in concrete consciousness the meaning is the primary process, and image is but another kind of meaning. This view has the advantage that it can give some explanation of the image, while if we assume the image as the starting point it is not possible to assign a satisfactory place to the meaning in terms of the image. The only alternative is to make it another ultimate, and that unnecessarily multiplies postulates, particularly as no essential relation of one to the other can be established.

II. THE NATURE OF THE MENTAL IMAGE.

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A much-abused word, within psychology and without, is imagination. Popularly the term usually stands for a state of mind given over to the contemplation of unrealities and to the creation of fancies; to delusions and extravagant romancing. Yet very little reflection should convince us that imagination (if we mean by it anything more than the wildest fantasies of the

abnormal mind) has, even in its forms of free productive creation, a very firm grasp on the real universe, and that it is by no means an airy nothing, divorced from the realm of concrete being.

Not alone the plain man, but sometimes the psychologist as well, would have us believe that the chief distinction between the mental image and the percept is that the former is unreal and the latter real. While it is not my purpose to defend here to any extent the perfectly tenable proposition that the object of imagination has an external reality and is not merely subjective and individual, I wish to insist in passing on the thoroughgoing reality of the mental image and to claim for it the same sort of objectivity as that which belongs to the object of sensation, namely, the objectivity of a transmental reference, and to urge that this is the only sense in which an object of consciousness can be real.¹

When I imagine a book, I have not set into operation an act of capricious, individual fancy. I refer the imagined book to a world external to my passing momentary thought, just as truly as I refer the perceived book to this same external world.²

Further, if there were any warrant for making such a distinction between the image and the percept, it is a distinction that, as Miss Calkins points out, is rather epistemological than psychological. The psychologist cannot get at the transmental object of either imagination or perception. The only criterion that he can employ is the pragmatic criterion of a wider experience, and in this wider experience he will find that often the percept, as well as the image, is deceptive.

Equally unpsychological is the distinction between image and percept in terms of the functioning of the end organs and the nervous system. Yet this is a favorite distinction employed by many reputable authors. Miss Calkins,³ for example, says that the physiological basis of imagination differs from the physiological conditions of perception . . . in the first place, by the lack of excitation of the peripheral end organs, retina,

¹ See *PSY. REV.*, Vol. XIII., p. 400.

² Wilfred Lay ('Mental Imagery,' Monograph Supplement to *PSYCHOL. REV.*, Vol. II., No. 3, 1898), says, 'Mental images are quite as real as sensations themselves and play quite as important a rôle in our lives.'

³ *Psychology*, p. 187.

taste-bulbs and the rest. Miss Calkins further states that 'all elements of the image are centrally stimulated.' Stetson¹ likewise defines the memory image 'as the appearance in consciousness under voluntary control of images without any sensory stimulus.' James² says in a similar vein, "In common cases of imagination it would seem more natural to suppose that the seat of the process is purely cerebral and that the sense organ is left out."

Granted for the moment that these and similar distinctions between imagination and perception, based on the activity of the end organs and cerebral centers, are valid (and there are reasons, which I shall later point out, that do not seem entirely to justify such distinctions) these distinctions are primarily of no value to the psychologist. The presence or absence of excitation in the end organs and in the central nervous system is not something to be directly observed, but is a conclusion drawn from the nature of consciousness itself. We must be able to make the distinction between image and percept in a given state of consciousness before we can make the reference to its supposed physiological correlate. Therefore to define the mental image in terms of the physiological process is to invert the true relation and to explain the more fundamental and ultimate in terms of the less fundamental and derived.

Not only is this distinction between image and sensation fruitless as a working point of view in psychology, but it further seems to be in conflict with certain well-observed facts. It does not seem to be true that all mental imagery is confined to processes of a purely central nature; on the other hand the peripheral elements apparently play a very important, often a deciding part. Alexander³ observes that some mental images follow precisely the same law as after-images, indicating a similar retinal excitation.

Müller asserts that intense mental picturing of a primary color may so exhaust the retinal elements that the complementary color may be seen when the eyes are open. In this

¹ 'Types of Imagination,' *PSYCHOL. REV.*, Vol. III., 398-411, 1896.

² *Psychology*, Vol. II., p. 10.

³ H. B. Alexander, *PSY. REV.*, Vol. XI., 319-338, 1904.

connection the experiments of Miss Downey¹ are significant. She worked with subjects who knew nothing about complementary color phenomena and reports that in four fifths of the tests a complementary color was obtained as the result of a mental image of a color.

Haines and Williams² found that subjective control played a very important part in the character and course of both after-images and memory images. Their study gave evidence "of the interference of voluntary aroused subjective color impressions (memory image) with the after-image. The imagination product so nearly simulated the retinal product that it was mistaken for it, and this in an individual who is by no means a strong visual." These investigators believe that 'all revival involves the functioning of the peripheral sensory apparatus to some extent.'

In visual *perception* not only is the retinal stimulus involved, but also the motor adjustment to the object seen. There is good reason to believe that in visual *imagery* the same motor adjustment plays an important part; in many instances it is perhaps the chief element in the image. Slaughter³ found in the mental recall of a circle, for example, a decided tendency to move the eyes around, if the attention was fixed on the circumference. If the center of the circle was imagined this tendency disappeared, but then the circumference ceased to be clear in all its parts.

Lange⁴ maintains that all imagination depends on motor adjustment. Thus all the so-called centrally aroused mental processes are nothing more than sensations from motor organs and resultant feelings. The relation between attention and distinctness of the mental image, which some writers point out, is doubtless due in part to the reinforcement of the image by kinæsthetic sensations. Alexander says, "Whenever an image is fixed in attention it becomes distinct in outline and seemingly filled with substance." Again "In imagery subject to voluntary

¹ PSY. REV., Vol. VIII., 42-55.

² PSY. REV., Vol. XII., 18-40, 1905.

³ 'A Preliminary Study of the Behavior of Mental Images,' *Am. Jour. of Sci.*, 1902, 526-549.

⁴ *Philosophische Studien*, IV., 390-422.

attention the vividness is distinctly proportioned to the attention bestowed."

Slaughter, in his study of auditory imagery observes that in the case of his subjects "the most important incentive to the production of sound images is without doubt movement of the organs of articulation, especially the throat muscles." He further observes that the motor element of rhythm plays no small part.

When we consider fields of mental imagery other than the visual, it is even more certain that sensory elements exercise a determining influence. In the writer's own experience, which is strikingly poor in auditory imagery (indeed it is doubtful if he ever experienced a pure image of sound in the sense of a centrally aroused process), various accompanying sensory phenomena, in part those due to motor adjustment and in part those coming from bodily sensations in connection with the emotional accompaniments of tones, are the chief factors. In attempting to identify a tone he is constantly forced to appeal to non-auditory phenomena. High tones are generally recalled as located in the head; low tones as accompanied by a certain specific bodily resonance, but tones as such are not capable of revival without these secondary criteria.

Whipple¹ found in his subjects that clangs aroused "a widespread reaction, adjustment of the organs of hearing, pleasantness or unpleasantness, visual, verbal, and other associations of considerable vividness and detail and organic sets of various kinds. These supplementing processes help to give the auditory image an individuality."

Stetson found in a large number of subjects that sounds were reinstated in motor terms. James has also pointed out the ease with which a 'kinæsthetic image' (?) arising from the vocal organs may be taken for an actual image of sound.

From these and many other similar observations and experiments, it seems reasonable to conclude that kinæsthetic sensations (not kinæsthetic images) and other accompanying sensory phenomena are very important factors (in some individuals perhaps the only elements) in the so-called auditory images.

¹ 'Discriminations of Clangs and Tones,' *Am. Jour. of Psy.*, Vol. XII., 409-457.

When we turn to consider the images belonging to other departments of sensation, we find that their existence apart from a direct sensory experience is very doubtful. The recall of an olfactory or gustatory experience without the aid of a present sensation is by no means established. In taste especially there are often present in the mouth actual gustatory stimuli which set up weak sensations which may readily be taken for images. Distilled water almost invariably gives the writer a bitter or a sour sensation, and in taste experiments with liminal solutions he finds extreme difficulty in judging whether these elements (bitter and sour) are actually present in the liquids tasted, or whether the taste is merely "in the mouth." General olfactory images are quite wanting unless there be some actual odor present that serves as a basis for the recall. In this connection the experience of Titchener¹ may be mentioned. He finds it quite possible to recall various olfactory sensations while smoking a cigar, the odor of the tobacco furnishing a sensory basis for the revival.

Slaughter found that his subjects, when asked to recall certain tastes, gave evidence of experiencing accompanying sensations in which movement of the tongue played an important part. With the attempt to recall salt there was a flow of saliva, with bitter a puckering of the mouth, and setting of the muscles with the movement of the tongue and an organic reaction. Sweet and sour likewise caused tongue movements. In the attempt to recall ammonia Slaughter's subjects gave evidence of tension and feeling of irritation of the nostrils; while with alcohol the breathing was a little irregular.

In the case of dermal imagery it again seems highly probable that the suggestion of the experience is sufficient to initiate actual sensations arising in the skin. Slaughter observed that the recall of the feeling of plush gave a 'creepy' sensation; of a clammy hand, a shudder and a feeling of repulsion; in the recall of hot water, organic and affective elements were present, accompanied by a cutaneous shudder and a shrinking sensation. Hence he concludes "that the existence of dermal images in normal persons is extremely doubtful, and that the non-existence

¹ 'Taste Dreams,' *Amer. J. of Psy.*, Vol. VI., 505-509.

of the taste and smell images is practically certain. There never seems to be anything more than what may be called the *intent* (italics mine). There is a focusing of the associative complex and special emphasis of the distinctive factors that have attended the sense experience."

I have so far aimed to show that the attempt to define the mental image epistemologically, by distinguishing it from the object of sensation, in terms of reality; and the attempt to define it physiologically, in terms of centrally aroused processes, are alike inadequate and of no great service to psychology. It remains now to discuss the third method of defining the mental image, namely, from the standpoint of the experience as such. A considerable amount of introspective analysis has been spent on the internal distinction existing between image and sensation since the time when Fechner¹ drew his classic distinction between the mental image and the after-image. He describes the memory image as indefinite, washed out and lacking corporeality. It possesses no sharp boundaries and is not easily held in attention. The distinction in general has been held by many psychologists, who seem to regard the mental image as a weak and indefinite sensation, differing from the actual sensation in degree rather than in quality. This, indeed, is the view of Wundt, who finds no absolute grounds of distinction between the image and the sensation, and classes them both as the same kind of mental phenomena. Baldwin² says: "We are aware in consciousness of no peculiar marks of revived states by which to distinguish them from percepts, except that they are prevailingly of less intensity. . . . If we try to recall the taste of an orange we seem to have a kind of after taste on the tongue."

"The subjective difference," writes James, "between imagined and felt objects is less absolute than has been claimed." On the other hand, Ziehen holds that images are quite different from sensations. "The idea of the sun is not merely a faded sun. . . . It is not a difference of intensity between the idea and the sensation, but above all a qualitative difference. The sensual vivacity characteristic of every sensation does not be-

¹ *Elemente der Psychophysik*, II., 469.

² 'Handbook, Senses and Intellect,' p. 147.

long to the idea, not even in a diminished intensity." James,¹ looking at this aspect of the question, says: "There is between imagined objects and felt objects a difference of conscious quality which may be called almost absolute. . . . The difference between the two processes feels like of one kind, and not as mere more or less of the same." Both of the views possess, doubtless, a certain psychological justification; yet both cannot be a correct introspective description of the nature of the mental image as distinguished from a sensation. It is true, as Wundt points out, that there are border-line phenomena in which the distinction between the image and the sensation is at the vanishing point. Such states occur when the sensation is very weak or the image unusually vivid. On the other hand, it seems equally evident that ordinarily in most departments of sense there is an actual qualitative difference between the mental image of an object and a sensation of the same. For example, I cannot persuade myself that my mental image of middle C, or of the taste of an orange, is merely a weakened sensation of the musical sound or of the taste of the fruit. In my ordinary experience my mental image of these objects has so little likeness to the actual sensation that I can find no qualitative resemblances. On the other hand, my memory of the color violet is quite like my actual sensation of it. Indeed, I can often get an image of this color so vivid that it might easily pass for an actual sensation.

The seeming contradiction between these two points of view, I believe, is only *seeming*, and can be reconciled by stating the nature of the distinction between sensation and image in another way. The apparent antagonism springs from the fact that there are doubtless two main sources from which mental image arises. Both are largely sensory. In one instance the sensory basis of the image is to be found in the functioning of the specific sense organ with which the mental image is concerned; in the other instance the sensory basis is not in the functioning of the sense organ itself, but in that of other related organs of sense and in accompanying kinæsthetic sensations, due largely to an attempted voluntary control of the image. In those cases where the specific sense organ is involved the mental image partakes

¹ *Psychol.*, II., p. 70.

of the character of an actual sensation, in other cases the sensory nature is less in evidence. Thus it happens that in mental images of visual experiences there may be difficulty in distinguishing the image from the sensation. When I imagine sugar, however, and have as a sensory basis for this experience not an incipient functioning of the taste cells, but merely a sensation of tongue movement or of the flow of saliva due to the suggestion, I am not so likely to find resemblance between the mental image and the actual sensation of sweet.

The true introspective description of the mental image is not to be found in defining it as a weak, hazy and indefinitely localized sensation, although often it may take on this character, neither in defining it as an experience *sui generis* and unique, although at times (indeed perhaps generally) it appears qualitatively different from the corresponding sensation. The definition which this paper wishes to emphasize as the one which offers the least number of logical difficulties and agrees most closely with the verifiable facts of introspection can best be stated in a functional way by defining imagination as *that activity of consciousness in which an object of sensation is experienced as not immediately present to the senses*. In other words in order to have a genuine state of imagination there must be the direct experience of the object not being actually before the senses. If this experience is lacking there is no true imagination and no mental image.

This definition at once gives a clear distinction between imagination on the one hand, and perception, illusion, and hallucination on the other; a distinction which psychology has failed always to emphasize, which failure has led to confusion and contradiction.

The subjective test can always be made. If the experience comes stamped with the quality which functions for immediate sensory presence of the object, then that experience is a perception, true or false. If it is false it must be classed as an illusion or hallucination, but never as an image. It may happen that I know actually that the stamp of sensory presence is deceitful, as for example in the Zöllner illusion. This knowledge, however, does not make the experience imaginary. The

immediate revelation of consciousness in illusions of this character is of the object existing as experienced before the senses. I may reason this experience as false, but the illusion does not vanish. Likewise the victim of an insane delusion may recognize the fact that his experience is false, but this again does not remove the delusion. The true mental image, on the other hand, has in this moment of consciousness that quality by which it is at once recognized that its object is not directly present to the senses. It may be that the physiological cause of the mental state is the functioning of some end organ through external or internal stimulation; it may be the image is due to the functioning of end organs other than those directly involved in the sensory experience of which the mental image is a revival; it may be correlated with kinæsthetic sensations, or possibly with the activity of cortical cells alone; the origin of the experience is not the vital thing for psychology. The significance of the experience as a conscious phenomenon is that which is important. Its value is determined by its meaning, not by its origin.

If we inquire more definitely what is the meaning of the mental image as distinguished from the meaning of the percept, we may find it impossible to state briefly and comprehensively this difference, but that there is such a difference in meaning is evident when we compare the type of reaction aroused by the image with that called forth by the object of immediate sensory experience. On the whole the reaction to the object of immediate sensory experience is more direct, definite and sustained. This is evident when we consider the greater difficulty of holding in attention the object of imagination as compared with the object of perception. But on the other hand, while the reaction to the object of imagination is indefinite and incomplete, the meaning which the image has is more complete and satisfactory than the meaning possessed by the percept. The former fits into my total purpose better; it has as a rule a greater significance in my thinking. It is less fixed, and does not come to me so clearly from without, and it finds its place more readily in the total flow of my consciousness. Still the choice which I exercise in its selection is restricted. It would, however, be a mistake to maintain that the image alone has meaning, although

its meaning is more complete than is the meaning of the direct sensory experience. It is more ideal. Because it thus finds its proper place more readily in consciousness, it has often been considered as finally subjective. This, however, is not so. No mental image is a mere creation of the individual mind. As has already been said, it is not entirely capricious and arbitrary. It has relations to a world of fixed realities, and although its object can be manipulated with greater ease than the object of perception, yet in so far as it has significance, the imagined object relates itself to a world of transmental values. On the other hand, the object of perception must possess to a certain degree the characteristics of the image; it too must in general find a place in the total flow of consciousness, and contribute to a certain extent to the ideal end of the thought process. At the two poles we have the image and the object of sense. The object of sense may be considered as entirely without meaning, while the image (divorced from sensation) would present a world of pure meanings in which thought found its complete internal satisfaction. But we never have in normal consciousness a mere sensation; we have a perception, already partly tinged with meaning through previous experience; neither do we ever have a pure image completely divorced from a world of sensory experience. The image is not absolutely spontaneous, but must to a degree conform to a world of hard facts in which it finds its final validity and justification. The image does not need to relate itself so directly and immediately to this objective world as does the percept, but an ultimate adjustment to such a world is necessary. The great difference is that in one instance the adjustment is immediate, in the other relatively remote. However, eventually both image and percept must justify their existence in a realm of actual, concrete living. The object of perception I must react to now in a distinct and definite way. I cannot postpone the action; I cannot make it conform more completely to my ideal strivings. The object of imagination demands no such complete and decisive action. I may suspend action; I may reform the image in more ideal terms to suit a more ideal reaction; but this postponement of my reaction is merely a *postponement*. The two worlds, the imagined and the real, are not

finally two worlds. Eventually the imagined must be realized, the ideal must be made a part of my concrete achievement.

III. MEANING AS ADJUSTMENT.

BY PROFESSOR T. L. BOLTON,

University of Nebraska.

The problem of meaning comes up in connection with the subject of conception. However no advance has been made when it is shown that meaning and conception are identical. Something more fundamental must be sought. This may be found in the instinctive reactions of the lower animals which reappear in the higher animals as adjustments and attitudes. The instinctive response that objects evoke are the meanings of the objects for the animals. There seems to be little doubt but that human beings tend to assume in the presence of objects attitudes or adjustments that are characteristic of the objects. It is then the attitude that gives meaning to the object. In this way an object may be given many different meanings and many different objects may get one and the same meaning. Let us take a given object and conceive it as fuel; it will then be burned for heating purposes. Let us now conceive this same object as food and it will now be eaten. Again we will conceive it as merchandise and place it upon sale, deliver or ship it to a customer. This object is commonly called 'corn' and it has been conceived in these various ways in the western country. You sit at table and a piece of chinaware before you is conceived as a saucer and it is placed under your coffee cup. A few moments later the same piece of ware is conceived as an ash tray and you knock the ashes from your cigar into it. In each and every case the object becomes what it is conceived to be by acting upon it as you would act upon the object which it is commonly conceived to be. What the object means is determined by the adjustment that is made to it. Let a child be asked what a given thing is and he will show what the thing does or what he does with it. Ask the same question of an Indian and he will give a like answer. Sign language is still in great part an imitation of a movement made by an object or of the movements made by a person in the presence of the object.

It should be mentioned here that Professor Dewey has worked out the view that the sensation is essentially a process of reaction to a stimulus. According to him stimuli get meanings through the reactions they evoke and the reactions are things in so far forth as they awaken sensations. A sensation is a stimulus-exciting-reaction process. The speaker tried in the first of two papers to work out the same idea for perception and in the second paper the same for discrimination. The latter piece of work was the occasion for being asked to take part in the present symposium. This work was upon the relation of passive pressure to muscle sense. The thesis here was that discrimination rests upon getting one combination of peripheral effects from one object and another combination from another object and that these depend essentially upon the attitudes which are assumed in successive acts of discrimination. In lifting weights one adjusts himself suitably to the accomplishment of the work. If a small weight is to be lifted, the preparatory adjustment involves a small number of muscles; if it is a large weight to be lifted, a greater number of muscles participate in the movements of adjustment. The judgment of the heft will depend in considerable degree upon the feelings of adjustment that has taken place. The strains and tensions within the muscles act as stimuli to the various sensitive membranes surrounding them. The point of view is that one weight arouses one set of local signs and another weight arouses a different set. While the conditions are not the same in passive pressure discrimination they are not essentially altered in respect to principle. I quote a few words from 'On the Relation of Muscle Sense to Pressure Sense':

"If, however, one studies the effect of the pressure exerted by the cork used in these experiments from the moment it is applied, he will discover that the pressure is felt now in the skin beneath the cork, now in the increased area of contact of the hand's back with the support through the recession of the hand from the pressing cork. Again, on the skin, there will be no pressure at all, but a stretching of the skin, first in one radius and then in another running out from the cork as a center . . . he (the reagent) will find that the heavier pressure may force

the skin down deeper and so excite new points among the internal tissues. Perhaps the skin is depressed against a bone or against a tendon and so displaces it. Now knowing that this is a heavier pressure or that a heavier pressure is likely to be given, this change in the location of the stimulation will be attributed to the presence of a heavier pressure. . . . If these observations be correct, and they are easily verified, it will be seen that a heavier pressure is different from a standard by the fact that different local signs are excited by the heavier pressure." (*University of Nebraska Studies*, Vol. VII., pp. 187-8.)

The local sign is here made the crucial moment in the process of discrimination. Touches upon different parts of the body awaken reflex movements of retouching or local twitchings, wincings and shrinkings. The local sign arises through a reaction of one part of the body bringing this part into functional contact with the part that has been excited by the stimulus or it arises through the twitchings, wincings and shrinkings of the same part in their functional relation to the stimulus that has set up activity in the part. Thus each part of the body is bound up in its functional relationships with other parts of the body and all parts find their meanings through the reactions they invite in one another. The body may be looked upon as a system of such reactions — a system of local signs — the meaning of one part or point coming out in the reactions of other parts. In such relations of stimulus and reaction as a single process emerges consciousness or such processes are consciousness. Any point of the body — any felt point — is found in the reactions of other parts, but these other parts become conscious through the reactions that must arise in other parts when these parts serve as the points of stimulation. The local sign is the stimulus-evoking-reaction process reduced to its lowest terms. Such a process is an element or unit of consciousness and these units enter into composition in the various acts of discrimination. Every perception arises through a reaction that is characteristic of the object perceived. The meaning of the object, however, is not contained entirely in the adjustment that has taken place, but in other reactions that are about to take place. Each perception creates fresh situations and the

meanings implied in them will be revealed in other adjustments. An attainment of complete or absolute meaning is never possible. This seems to be a general characteristic of consciousness, for it appears again in the behavior of the self.

IV. TRUTH AND MEANING.

BY PROFESSOR J. E. BOODIN,

University of Kansas.

In dealing with truth we are concerned, not with the imagery of the thought process, but with the consciousness of intent or direction. This is the essential aspect of the meaning, the imagery is a means or by-play. This sense of intent or direction is a unique content, not analyzable into mere images and their elements. If so, the meaning would be a subjective compound, as associationism has always maintained. The image, whether concrete or verbal, is a way of fixating or making definite the otherwise vague intent. How far imagery is indispensable to the meaning process is a matter for psychological analysis to determine. The focus of attention may be alternately, now upon the intent and now upon the imagery in varying degrees; and in some of the transitive flights of the process we may be so absorbed in the intent as to be oblivious of the imagery, while in other cases the focus may be just as surely some substantive bit of imagery which symbolizes the meaning. Psychology so far has emphasized the latter cases.

The relevancy of the imagery to the intent obviously varies with the degree the meaning is concrete or abstract. In the concept of humanity, color distinctions cannot be irrelevant. They are part of the concrete meaning. The meaning of a melody can be a true meaning only when it reproduces the melody, while Kepler's squares and Newton's equations must be regarded merely as artificial tools for fixating and communicating the meaning. In the hunt for a forgotten name, the throbbing, restless intent becomes even more important and the suggested imagery even more accidental. But whether the meaning is concrete or abstract, the intent-content is obviously the determining aspect of the process and the only aspect to which the

truth conception is relevant. With this passing notice we must hand the analysis of meaning over to the psychologist.

Having tried to define the concept of meaning, we must next try to fix the concept of truth. Here there is woeful need of differentia. In the first place it is well to keep in mind that truth and meaning are not coincident terms, as a good deal of the discussion of to-day seems to assume. Truth is only one species of meanings. Esthetic meanings, meanings of approval and disapproval, not to speak of the whole class of the more primitive perceptual meanings, do not involve the question of truth, and yet who shall deny that they are real meanings? The enjoyment of the symphony has meaning, as well as the testing of the hypothesis, but the meanings are quite different. What then constitutes a truth meaning?

No greater confusion or lack of logical insight could very well be imagined than that existing at the present time in regard to the definition of truth. We are told that truth is something that has useful consequences. But castor oil, too, has useful consequences under certain conditions. Nor is truth useful under all conditions. We sometimes feel that we have to withhold the truth of his condition from the patient for fear of jeopardizing his chances at a critical time. A father probably would not thank a truthful neighbor for enlightening his son as to his father not being all he is cracked up to be. A child's idealizing of his parent seems, on the whole, a good thing. Only in Leibnitz's best possible universe or within the comprehensive maw of an idealistic absolute does it follow that whatever is is good; and therefore that the true and the useful coincide. In a world as pluralistic and plastic as our social world is, it may very well happen that fiction is sometimes better than truth; and in the absence of idealization most of us would shrink into rather bony shadows. Deception may be an indispensable means to social progress. The fact that the true and the useful so often coincide and that the useful must largely furnish the inspiration for the true, must not blind us to the contradictory instances, such as the satisfying of curiosity or malice. Only the devil would tell the truth under some circumstances. Life is not all comedy. There are the tragic, slap-you-in-the-face

truths too, the utility of which lies at least beyond our ken. We cannot be said therefore to have defined the true by classifying it under the useful.

Nor do we define truth by stating it in terms of 'satisfaction,' even though satisfaction or fluency of some kind should turn out to be part of the nature of truth. I see no inherent wrong in trying to state truth in terms of our affective-volitional nature, as well as in intellectual terms, provided that our term define. We are not concerned here with the question, which is the more fundamental side — whether an hypothesis agrees because it satisfies or satisfies because it agrees; psychologically either may be true. Our intellectual perception influences our feelings; and there can be no doubt that our wishes and feelings influence our intellectual perception. Human nature is not divided into water-tight compartments. In either case we must speak in finite terms — what *seems* to agree and what *now* satisfies. One side of human nature has no more finality than the other. In the long run, no doubt, only real agreement seems agreement and only real agreement satisfies the truth demand. This would of course include the cases where our faith, our affective-volitional nature, is a creative factor in making the agreement come true, as well as cases where the facts are indifferent to our faith, "for who by taking thought can add one cubit to his stature?" But we are concerned now with what makes an idea true. And if we define truth in terms of satisfaction, we should at least state what kind of satisfaction or what sort of fulfilment of purpose, because otherwise we would not distinguish truth satisfaction from esthetic or moral or any other type of satisfaction. In these, too, we have selection, simplification and ideal construction; and yet these are not truth attitudes. What are then the differentia of truth 'satisfaction,' if we state truth in terms of value? It is not merely what our ancestors felt or what our great grandchildren are going to feel, nor is it determined by intensity or duration. It is not enough to state it as social value, because other types of value too are social. Nor must it be merely the satisfaction that truth leads to, because this need not be truth at all. It may be mystical trance or sleep. The value of truth is

not simply its use, as some writers seem to hold ; but the feeling which characterizes truth or accompanies the truth attitude. And this attitude consists in the termination of the idea, purpose or expectancy in its complementary facts, the agreement of the particular hypothesis or suspicion with the reality which it intends or points to.

To call this termination of search, this equilibrium of hypothesis or suspicion, thus terminating in evidence, 'satisfaction,' needs qualification. This implies that truth is always a good. Yet in the uncertainty may lie the only hope, and never to know may be blessed. A man I know was a long time in uncertainty as to the suicide of his son. The alternative hypothesis kept him up, but the hypothesis of suicide finally terminated in facts. The man became a permanent melancholiac. The only 'satisfaction' of such a truth is that it puts a stop to uncertainty ; that one dread alternative with its black emotion finally possesses the field. The intellectual 'satisfaction' here runs counter to any moral satisfaction surely. It condemns the world as evil, so far as that individual is concerned. A man who has become addicted to opiates or passed through certain kinds of vice has a certain knowledge that the normal man does not possess, but such a knowledge is a doubtful good.

The 'satisfaction' of truth, then, is a coefficient of the terminating of an idea in a certain reality which it intends or suspects, hopes for or fears. It may be good or it may be evil or it may be mixed. It takes its coloring from the nature of the situation—the idea and its termination. In general it simply means equilibrium after doubt or intellectual re-adjustment, a termination of search and uncertainty so far as that particular hypothesis is concerned. Truth value gets its tinge from this particular agreement or termination. To speak of such termination as fulfilment and satisfaction is born of the same indiscriminating optimism which exhibited the trophies at Delphi.

Even in using terms of expectancy, as I have above, I feel that I have overstated the subjective 'leading' of truth, for facts may be forced upon our acknowledgment which we can neither be said to have intended nor suspected. They may drop from a clear sky. In our pluralistic, changing world we do not always

have opportunity to plan for the facts nor even to suspect them. The facts sometimes select us instead of our selecting them. In the case of the news of our friend having perished in a railroad accident, the news does not come as fulfilment of purpose. If so, we ought to be tried for murder in the first degree. Truth here means chaos, the defeat of expectancy. The particular ideational setting here is selected or forced by the environment. In most human lives the unwelcome, unintended facts are probably as numerous as those planned for. Satisfied or unsatisfied, we have to accommodate ourselves to the new events. But if the hedonic value of truth is determined by the particular agreement of our idea with its reality, then the nature of this agreement with reality becomes the important thing to investigate for any real light on truth — its relation to its object and the manner of testing, rather than the hedonic tone of the psychological situation. The relation of truth to its object I have dealt with elsewhere.¹ Here I wish to examine what constitutes valid agreement.

Is there an immediate test of truth, the result of the mere inspecting of a meaning or proposition and without any need of examining its relation to a larger world? There always will be people, no doubt, who will insist upon the *a priori* certainty of some propositions or axioms. But what do we mean by such certainty and what guaranty does it have? Some have found such certainty in the authority of the mystical illumination of certain moments. Even Professor James argues that such mystical illumination is authoritative for him that has the experience, even if not coercive over others. But he also admits, at least by his illustrations, that such a feeling of illumination, whether artificially or spontaneously produced, may be the merest nonsense. It would seem to be impossible, so far as the mystical states go, to judge between sense and nonsense; and therefore it is hard to see how such conscious states can be authoritative or valid in their own right in any epistemological sense. They may be satisfying and we may choose to abide by them, but

¹ See 'Time and Reality,' *PSYCHOLOGICAL REVIEW*, Monograph Series, No. 26, Ch. IV., pp. 93, 94. Also 'The New Realism,' *The Journ. of Philos., Psych. and Sci. Meth.*, Vol. IV., p. 533ff.

that does not make them valid. The truth of such states must be found in their being socially applicable, in their ability to meet and organize the data of waking experience. A truth, valid only for the one who has it, can hardly be called truth. Rich as such states may be in emotional meaning; though they do transport the individual who has them to the seventh heaven, yet they are verified only as they agree with further experience, as they permit of being translated into the prose of waking life. Mystical certainty simply amounts to saying that if a man feels that way, he feels that way, though it be the merest nonsense. Luminousness may be a part of the truth experience, but it does not make it valid.

Others again have insisted, according to temperament, upon the dry light or upon the feeling of fitness or upon the categorical character of certain propositions, especially the mathematical and moral. But this intuitional or categorical certainty is simply another name for believing a thing. Our belief may have an instinctive basis or it may be due to indissoluble association; but in either event it does not *prove* anything, except that we have it. Even the categorical vehemence of a Kant is not sufficient to make traditional beliefs valid. The serious inroad upon the mathematical axioms, especially Euclid's list, which seemed for centuries so categorically and dryly certain, should give us warning not to put our trust too implicitly upon traditional certainties. Axioms, after all, are generalizations from experience; and however intuitive they may become in the process of individual and race history, they can be validated only with reference to the procedure of experience, individual and social. The *a priori* certainty of the law of identity and the law of contradiction resolves itself into a hypothetical tautology apart from experience. If a thing or meaning is the same, it is the same; and if it is the same, it is not other. Whether there is such a thing as identity or not must be determined by experience. Even our more positive 'love for the wholeness of things,' which is the root of scientific endeavor, is not valid except as it can be realized, however partially, in experience. The immediate inspection of our ideas, therefore, is not sufficient to establish the truth of those ideas, except as we

are concerned merely with the Cartesian axiom of the *existence* of such facts in consciousness. It cannot furnish a final test of validity.

The impossibility of conceiving the contrary carries us no further. This is true in all real belief. A man recently told me that he was so steeped in the doctrine of the Trinity that he could not conceive anything else; yet on questioning him I found that the doctrine with him was merely emotional, and had no intellectual significance. Sometimes these axioms, the contrary of which cannot be conceived, have taken an entirely contrary form in different minds. Hence the antinomies which men like Zeno, Kant and Spencer have used to discredit finite knowledge. Thus one holds that reality must be finite, another that it must be infinite. One holds that it must be infinitely divisible, another that it consists of indivisible individuals or is an individual whole. One holds that cause and effect must be identical, another that they must be different, etc. Men like Spencer simply lie down and allow themselves to be buried by such venerable contradictions. Each side of the antinomy retained its force for him, and so there was nothing to do but doubt his reason. And Spencer's reason was very inadequate. How many of such *musts*, the contrary of which he cannot conceive, a man has, depends mostly upon his stupidity and lack of imagination.

Validity can only be stated as the agreement of an idea or belief with its reality. The idea may be selective of the reality or the reality may force the idea. The feeling may be one of satisfaction or dissatisfaction, according as the reality we must acknowledge fits or thwarts our conative tendencies, but 'tis true whether 'tis pity 'tis true or joy unspeakable. Nor does the psychological motive or interest, which prompts the search for the particular truth, alter the truth relation. Whether the motive for investigating the chemical properties of strychnine be those of inventing a superior tonic or of finding a new way of committing murder, the truth as regards the properties remains the same. It has often been argued that, because the motive for seeking truth often lies in our affective-volitional nature, therefore the test of truth lies in the satisfaction of this side of our nature. But whether our seeking for truth lies in our instinct

for gain, revenge, or sympathy, the test is precisely the same as though the motive lay in impartial curiosity or 'love of the wholeness of things.' In any case, truth consists in the tallying, whether coercively or constructively, of the idea with its reality.

This agreement may be merely formal, if our cognitive purpose is merely formal. Our syllogistic reasoning is valid if the conclusion agrees, according to logical rules, with the premises. In order to have objective validity, however, more is needed than formal agreement or conceptual necessity. The novel too must be consistent. Nestor and Ulysses are beautifully self-harmonious characters. Truth, in the objective sense, must agree with a prior reality. Consistency with what? becomes the question. And it must be consistency with the reality selected or which selects us. This may be a philological root or a chemical substance or an earthquake. The scientific hypothesis is valid when it terminates in the experiences which it intends, when we must act *as if* it were true. Else it must be revised. But validity in any case means agreement, whether of ideas with other ideas, as in formal reasoning, or with facts of a perceptual and individual kind, as in concrete truth.

When the agreement can be shared with other egos, we regard the validity as to that extent corroborated. Truth is a social institution, if not at the time of its discovery, at least in the long run. We are entitled to no private laws of logic nor to any private perceptions. When therefore the argument or the experiment wins the agreement of contemporary investigators or checks up with social experience, our scientific nervousness is greatly relieved. Social agreement has often seemed the final test of truth. Individual judgment seems insignificant, when pitted against the funded and approved knowledge of the race.

But the individual sometimes proves wiser than the society of his day. What social prejudice prevents contemporaries from seeing, the chosen one of Jehovah sees. And he takes his stand upon his insight—sometimes reasoned, sometimes quite intuitional. Truth, therefore, not only must seem to agree *now* within individual or social experience. Truth must agree with the future. Social agreement, owing to the variable and complex character of human nature, need not cover the

whole field of the inner attitudes of the various individuals; the overtones of individual natures may vary vastly; and sometimes individual variations, such as the great geniuses of mankind, may be prophetic of a higher level of social agreement, moral or intellectual. Individual and social selection are subject to cosmic selection.

While we mean to mean what we mean, while our insight may satisfy us for the time being, this does not prove the ultimate validity of our present meanings. The historic method has emphasized nothing so much as the relativity of our finite view-points, individual and social. The evolutionary process, having set us our program by the categories which it has furnished, reacts upon our rational selection, transforms, eliminates or selects our individual and institutional purposes. The individual or social satisfaction of our meanings does not guarantee their survival, not even with universal agreement, at any one time. No axioms could have been more universal than the geocentric view of the world and that of 'an eye for an eye and a tooth for a tooth.' Yet even these have not proved permanent. The process is ever furnishing new variations and, in its growing social complexity, is enforcing new survival conditions. The old science becomes mythology and the old conceptions of fair play vandalism. An idea or meaning, to be absolutely valid, must be tested by passing through the sifting process of the stream of human natures. Each generation must add its proviso of time. It must not shackle the future. Our present formal demands, growing out of our instinctive and social heritage, must be treated as hypotheses, though not necessarily conscious of themselves, to be tested by the ongoing of human experience, individual and social. This stream of processes, moreover, is not a mere chance affair as regards its ultimate value and meaning, but determined by an objective formal constitution of the universe — the attribute of direction. This I have discussed elsewhere.

Thus cosmic selection, which is responsible for our tendencies and demands, reacts again upon the products of the rational process. It determines what ideals or purposes shall have a place in the process in the long run.

¹ See *International Journal of Ethics*, Vol. XVII., p. 454ff.

KNOWLEDGE AND IMAGINATION.

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I.

In a recent publication,¹ I have traced the development of knowledge, showing the moulding and remoulding of the contents that make up objects, as the mind comes more and more into possession of itself as a principle of inner control and end-seeking activity. We find through the course of mental development a growing mass of assimilating and acknowledging and intending process, calling itself the ego or self, over against a fairly stable, presented, recognized, body of objective stuff. This latter is found from the first to have marks that make it objective and in certain senses 'foreign.' The whole movement is seen to be one of constant redistribution, with the relative dominance for consciousness itself of one or other of these two factors, called inner and outer 'controls.' At one time and in certain modes, the inner assimilating factor seems to be held to the mere recognition of the external as an objective, common, confirmable, and convertible 'thing,' to which thought must be correct or true; at another time and in other modes the inner control factor seems to get the upper hand, and its selections, manipulations, constructions seem so free that little limitation of a foreign sort appears.

The ins and outs of this movement are traced in the volumes cited with such detail that there is perhaps danger of losing the forest for the trees. Apart, therefore, from the relative place and function of these two factors at any one stage of the development, I wish now to signalize certain characters of the movement as a whole. The questions, as to how the variations are possible; what the method of advance is by which the emphasis

¹ *Thought and Things, or Genetic Logic*, Vols. I., II. Cf. the suggestive treatment of Professor A. E. Davies in the *Jour. of Philos., Psych. and Sci. Meth.*, Vol. IV., pp. 645ff. Professor Davies not only admirably states the dilemma of theories with regard to imagination, but also indicates its instrumental rôle in epistemology.

is thrown now to one side now to the other; why the dynamic character is there at all, and in what specific function within the movement it shows itself — these questions may well concern us. Of course if our work has been thorough as well as detailed, we should have a length-wise vista of the movement, and be able to see what is common to the great transition periods through which the objective consciousness normally passes.

Taking the point of view of an outsider who casts his glance along the line of the series of objective meanings belonging to one mode after another, we reach a very striking and, I think, secure result: the result that the objective contents — the objects secured by consciousness — always may be and actually are treated in one or other of two clearly distinguishable ways. Every such object is either one of knowledge, recognized as part of the actual, the external, the true; or it is one of 'semblance' or make-believe, one to be toyed with, sembled or *Eingeführt*, to get satisfaction from, to image for personal purposes and selective handling, with some measure of disregard of its exact place and relations in the sphere of the actual. The *actual* and the *imaginative*, the merely known and the usefully or playfully or æsthetically — in short the semblantly or imaginatively — known, this is the one universal and ever-present contrast in meanings for cognition.

Now a most interesting question is that of the play of these two motives. How does the semblant or imaginative reading differ from the actual or truthful? — and what rôles do the two have in the great movement of knowledge onwards and upwards? What is the relation between 'believe' and 'make-believe'?

II.

Our detailed results leave us in no manner of doubt on this point. We have to say — finding it one of the outstanding results of our detailed genetic research — that every cognitive content, every actual 'thing,' not only may have but must have both renderings. And this not only because we actually find that each one does, but also because the mergings and reversals of one into the other turn out to show the very nerve of the process of development of knowledge. Consciousness finds nothing so fixed and static that liberties of an imaginative sort may not be

taken with it; and on the contrary no flight of imagination can be entertained — even with the slight degree of seriousness that attaches to mere semblance of personal value and interest — unless it be in turn rooted in the actual and established. *Belief motives make-believe and make-believe engenders belief.* The static, the given, the truthful everywhere finds its establishing by those imaginative means of discovery which in turn again accomplish its undoing. The projections of will and desire have both their chance of fulfilment and their very body of meaning and motive only in the actual things that they interpret and idealize.

Now when we formulate this by saying that the imaginative rendering is always the instrumental or dynamic factor, and that the actualizing is always the static or truth-recognizing factor — when this is said, we have not only a result that stands out everywhere in our detailed investigation, but one that throws light into the focus-point of current controversy. The instrumental meaning is always and everywhere *a re-reading imaginatively, purposively, personally of an actual or truthful meaning*, and the truthful reading is always and everywhere *a re-reading as common, stereotyped, actual of an imaginative personal construction*.

In order to point this general statement, we may cite concisely certain of our main results.

We find the earliest and simplest objects to be by no means mechanically made-up and 'set' things. They are shot through with the forming, intending, selecting or neglecting forces of consciousness. To treat them as given and unchanging 'things' is only one convenience — an important one to be sure — among many. The uses made of things give them interest, and the interests mark off and circumscribe their meaning. Memory does about the same — it passes on the coin of such a convenient distribution. But the need of greater control shows itself in the presence of the brutalities of the external when treated thus carelessly. Not to distinguish between a gas-jet and a toy-fish is to invite a certain brutality on the part of Dame Nature. So there arises a way of getting better control, a way never to be again discarded. Images are 'set up' — to make a long story short — 'semblantly,' imaginatively, make-believingly. They

no longer make up just the one set of things. They come to have the likelihood of pliability, of further control for personal ends. What is known is treated freely under the head of varied interests and purposes. The great rôle of imagery appears in the play of imaginative constructions, relatively loosened-up from their actual place and anchorage. So then the fact, the actual thing, *passes into the instrumental image*, becoming a mere 'schema' of further intent now read in and through it, to be again tried-on in the actual struggle with the world.

This is the one and sole method of advance. How else could there be advance? The 'semblant' of the early play consciousness is the great freeing mode; it frees things from their rigid, one-meaning phase, sets them free to mean more, to mean whatever it is interesting and profitable to have them mean. It is also the freeing-mode for the self — the control that grasps the image, reads it as its dispositions, interests, utilities dictate it may or should be read, to bring new meanings to the issue of fact. Now all this experimentation, trying-on, trial-and-error, is the work of imagination, which projects the new selective readings out into the world of the actual. *We make-believe in order that we may believe!*

This method, so conspicuous in the early movements of knowledge, again shows itself, doing precisely the same thing, at the critical stage of development that brings in 'general' meanings as such. The general meaning is one of recognition, of the reading of particular things as having common marks¹; it recognizes actual classes as made up by certain likenesses and difference among things. When we ask how this reading of the actual can be secured, how the classes are established, we must have recourse to the imagination again. The 'knowledges' we already have are used instrumentally under the urgency of our practical habits. The thing found in a relatively novel situation is assumed, imagined, taken to be like other things which it suggests; the net of habit — a vague outline or scheme — is set for the new fact. The new is thus treated as if it were already assimilated, as if the old schema would fit upon it. So the imagination as schematizing, assuming, prospecting, experimenting — in short as 'instrumental' — gets in its work. Only

¹ A type of meaning often ambiguously called 'universal.'

thus, through the response in habitual ways, is the new item reduced and classified. The result is the modification of habit, the achievement of new accommodation, some addition to the fund of knowledge now salted down in the keg of the actual. Hereafter the class in which the object falls is known, the generalization has taken place, *the imaginative has been instrumental to the actual*. The earliest 'presumption' of the actual gives place to the experimental and imaginative 'assumption,' only to pass back into the enlarged and confirmed actual again.

The whole method comes to its critical and momentous rôle in the act or function of judgment. Judgment is just the issue of the same movement on a higher plane and under more advanced pre-suppositions; this higher status and its conditions being so clearly marked that the term judgment should be confined to this case. What we may call the maturation of the contents of the psychic egg shows such remarkable movements then that—with the embryologists—we may describe it as the appearance of new *Anlagen* of meaning. Dame Nature now says in effect: I will place a great burden upon the imagination, I will treat all the objective contents—images, memories, intentions, ideas: everything one can think about—as being within a single and individual mind, and segregate the functional processes, the efforts, strivings, dispositions—standing for inner control—into the 'self' of this individual mind. Let there be a self-object dualism, an individualism of single selves, each having his own 'experience.' This is what actually appears—and appears anew in every person that grows up to be a judging individual. The movement is functionally present in the act of judgment; and on the side of content it is reflection, a dualism of self and thoughts. Each such act of recognizing and acknowledging a content as a thought—that is, as a thought of a thing to which it is to hold true—each such act is an act of judgment. Judgment is movement of actualization, recognition, acknowledgment, following upon an earlier imaginative rendering of a content in the same sense as proposal, suggestion, schema of what may be found actual. When it is found actual, it is held to as true; and that is judgment.

Calling the great bodies of actualities thus accepted 'truths,'

we see that they are simply confirmed imaginings, established prospectings. The imagination is here again instrumental to the establishing of the actual. The two controls are now adjusted to each other *through the mediation of ideal contents or thoughts*.

So then when, in talking about truth, we say that it is 'instrumental,' we are not careful enough. If is not truth that is instrumental, it is the imagination of something that may become truth. In its instrumental stage it is *not yet truth*, for truth is precisely what it is instrumental to.¹ But on the other hand, when we talk about the fixity and absoluteness, the given-quality, of knowledge and of truth, denying its essentially instrumental and human place and rôle, again we are not exercising proper care. Not only is all knowledge due to the imagination, having been in the first place instrumentally and experimentally set up; but it is always in a process of flux and flow. And this gives it its main value; for thus it takes up continually its rôle of feeding the imagination for further discovery of fact and further control by the self. The mere telling over of actualities, the items of true and accomplished judgment, is hardly worth while, save possibly to the intellectual miser who loves the mere glint of his erudition; on the contrary, the real thinker is he who melts up the known in the crucible of hypothesis, of imaginative speculation, and draws out new models for common circulation.

For this method of gaining knowledge by imaginative prospecting still goes on in the mode of reflection; it becomes now the method of inductive and intentional research, the method of science. Induction is nothing more; deduction is never less. As in the early stages it may be called 'schematic' or 'assumptive,' an early sort of imaginative reading that is instrumental to acceptance, and later on it is called 'semblant' or hypothetical, still imaginative in the same sense, so now in the mode of thought, where the method is explicitly adopted by the thinker himself,

¹What we mean when we say that truth is instrumental to action, is that ideas, besides being true—as mediating external control—and in consequence of their truth, also justify action—or mediate inner control. See *Thought and Things*, Vol. II., Chap. XIV., where the contrast between 'knowledge through control' and 'control through knowledge' is brought out.

it may be called, 'proposal,' suggestion, hypothesis, 'postulation'; but it is still the same in its essential place and rôle.

The contrast between the two phases of the entire act of cognition, the 'actual' and the 'imaginative,' is seen in certain other larger results to which our enquiry has led us. It should be emphasized since it enables us to expose a very general and hurtful confusion. We find that the knowledge found to be true, established — treated as in any way given, presumed, or presupposed, and not merely imagined — is always and inalienably for 'common' acceptance. It is 'common' both by virtue of its social currency, which is reflected in the growth of the individual's judgment, and also by virtue of the fact that 'privacy,' or lack of commonness, is a later and more special reading, which presupposes an earlier commonness. The very judgment that asserts a content to be private, also requires that this result be common in the sense that it is to hold for everybody.¹

A similar remark may be made with respect to 'generality.' All judged subject-matter, found to be true and actual — not merely imagined — is a 'general' of some mode of repetition or recurrence of cases. A judgment always embodies a class

¹ One of the single results of my work that might be selected as giving it character is this, that knowledge is essentially and fundamentally common or social, not private. As in my book *Social and Ethical Interpretations*, the sentence 'the individual is a social outcome, rather than a social unit' has been quoted as hitting off its result, so this aspect of the present work is hit off in the sentence 'knowledge is common property, not a private possession.' As the former of these sentences states the truth that is, in my opinion, finally to refute individualism in social theory, so the latter supplies the analogous refutation of individualism in the world of truth. The question 'how do we get together as citizens in a practical world?' is now condemned as unreal and obsolete. We are together and only in social life do we become relatively separate — relatively private and independent selves. So the question 'how can we know things together?' is soon to be similarly outlawed. We do not have to come together to know; on the contrary, we become only relatively competent and independent in knowing things separately. The kingdom of life does not have to naturalize or matriculate its citizens; on the contrary, it is the citizen of no-man's-land who has lost his birth-right. So the kingdom of truth has no matriculation examinations; its process is, on the contrary, the separation from its body of the individual who insists on privacy and eccentricity. The normal citizen in this kingdom is the person whose competent private judgment is also and at once the sign of his social fitness. See *Thought and Things*, Vol. II., Chap. III.

meaning, and acknowledges the particular object or thing as belonging in a class. Even the assertion of the singularity of an object we have found to require at least the generalization of the recurrent appearances of that object, whereby its identity and persistence — meanings requisite to its individuation — are acknowledged.

We see, therefore, that both commonness and generality — the need to be true for everybody and the need to be recurrent and reapplicable to different cases or appearances — always attach to knowledge of the 'actual' and 'truthful' type.

But when we examine imaginative constructions — those defined above as instrumental and prescriptive, those by which the mind does its prospecting for ore in the cosmic mine — we find that both these aspects of meaning, these shadings of intent, disappear. Such a content is imagined just by a return to the individual's personal process. To be sure we imagine a thing 'as holding' — that is just what we mean by calling such a meaning 'semblant': it has the 'semblance' of truth — but that is very different from believing that it does hold. What the individual projects into the world, prescribes for true, intends to secure, is motivated by the impulse to get on further with knowledge. If it were already common and general, established and true, where would be its further instrumental and developmental rôle? The 'will to believe' is very real, and very useful in just this instrumental way; but a content so willed is not a truth generalized and commonly accepted. On the contrary it is personal and selective. Truth is recognized as *what is*, as repeatable, communicable, salted down in the body of tradition, science, language, social embodiment of this sort or that; what is willed, on the contrary, is the imaginative schema charged with the force of that one personality who wills it, finds imagined fulfilments and satisfactions in it, and perchance by faith and enthusiasm sets in motion the influences that secure its final confirmation and acceptance as true.

Imaginative constructions then show the return into personal and prospective form. In the imaginative rendering there is a new moment of personal intention which gives the content further instrumental and experimental value.

It results also that such an imaginative construction has elements of 'privacy.' So far as it is the preferential reading of someone's imagination — a form set up to fulfil personal interest and purpose — it is *the only such*. It is then as a whole playing a rôle that no other, no one's else imagination, can then and there play; and this is part of its instrumental force.

This result, that thinking can not be read in terms of its accepted results alone, that is, as a body of common and impersonal objects or truths, but must also and always be read as "proposed" by a selecting and prospecting function — this result holds all through the operations of logic, as I have tried to show (in Vol. II). Every thought is a personal projection and proposal, no less than a universal and common proposition. An instrumental and utilitarian intent attaches to the most abstruse and seemingly *a priori* principles that the human mind is ever called upon to recognize.¹

We are now in a position to make certain remarks on the relation of the two phases of cognitive process to one another, bearing in mind especially the controversies that are now in the air. It is of interest also to trace this relation in the modes of experience that are in some sense hyper-logical or post-reflective, that is, genetically later and larger than the strictly discursive or logical. With this our published investigation has not so far dealt.

III.

Of course, when we use the word 'instrumental' we raise at once the question of 'ends,' either psychic ends or objective ends; for what is instrumental must be instrumental to something. So another and very important question arises which we may state in somewhat this form: granted that it is by the use of the imagination that knowledge goes beyond what is already

¹I think this method of reaching a thoroughgoing instrumentalism of knowledge is the only one that gives sound results; but it must be admitted that it is a double-edged sword; for the instrumental aspect is what it is just because there is a body of truth, general and universal in its force, which is used as the instrument of advance, and which is further extended by the use of the imagination — albeit, of course, in its origin it also was experimentally established. The truth imagination is instrumental to, is as important as is the imaginative construction that is used as instrument; it takes both to make up the whole.

established, what are the termini, the end-states, the fulfilments to which this process points and which it secures?

Here we come upon the current distinction between the 'scientific' imagination, whose end is the furthering and completion of knowledge, and what may be called broadly the 'artistic' or 'creative' imagination, whose end is some form of appreciation, satisfaction, realization, or fulfilment. The ideal of the former is discovery — the advancement of knowledge, the completion of truth. As to the other, it is not so easy to say in a word what its ideal is; and it is with a view to making certain introductory distinctions that I raise the point here.

If we say that the end of the scientific imagination is 'truth,' describing it and the interest that motives it as 'theoretical,' then over against this there is the exercise of the imagination as instrumental to some form of 'good.' This, with the interest that motives it, we may call utilitarian or in a broad sense 'practical.' Now what is common to both these, as being imaginative, is that they do not terminate on what is established and actual but, by virtue of their imaginative forward reach, go beyond it. They have a certain prospective anticipatory reference. They show in common the development of the control by the self over its materials; not simply the recognition of the several modes of the actual in which the self has to allow and accede to another control apart from itself. The theoretical or scientific imagination prospects for new facts, for additions to knowledge; and the utilitarian imagination prospects for results that may in some way minister to the advancement of appetite, affection, disposition, conduct. The latter is most clearly seen in the use of the imagination in defining the prescriptions of duty and in outlining the policies of economic or other worths. The further question then arises whether these two modes of imaginative procedure exhaust the cases, whether there are other types of cognitive construction which either set up still further ends, or in some way reduce the duality disclosed by these two?

There is a type of imaginative cognition, I wish at once to say, that does not allow of description under either of the two foregoing headings; a type which is motivated not by the interest of

completeness of knowledge or thought, nor yet by the interest of seeking satisfactions or working practical effects. There is a way of treating a content, usually and properly called 'æsthetic,' that we may properly describe as both *over-logical and over-practical*. It is the burden of current æsthetic theory — the involvement of the self with an object in a way that does not deny its truth nor discard its use, but which does not find proper fulfilment either in its truth or in its use. One of the latest and best discussions of the interest involved is that of Mitchell,¹ who calls it 'intrinsic,' as opposed to both 'theoretical' and 'practical.' This mode of imaginative operation calls for detailed investigation. All the recent work on 'semblance' and 'Einfühlung,' on the subjective side, and on æsthetic 'objectivation' and 'socialization,' on the objective side, is grist for the mill of such a research.

The outcome of my investigation,² broadly stated, is that in the æsthetic mode of experience so defined we have the only inkling of the way that the self-reality of inner control which is the postulate of the voluntary, the worthwhile, and the thing-reality of external control which is the postulate of knowledge, of truth, can in the process of experience ever come together. We have seen how they get apart; it is in the development of experience as cognition. Each of the cognitive modes, perceptual, conceptual, logical, sets up, as is its nature to, a reference in which the 'real' for it, *its real*, is found. But in each case *its real*, not *the real*, is postulated or presupposed, since the control that is discovered is the outcome of this or that special stage of psychic function. The protest of the imagination is always against finality, against partiality as among these modes of 'real' meaning. Its own ideal is on the contrary one of completeness, of reunion; it gives us the 'real' which is absolute in the sense that its object is not relative to — does not fulfil — one type of interest only.

In the æsthetic interest and in the constructions it motives and enjoys, certain synthetic characters are evident which show

¹ W. Mitchell, *The Structure and Growth of the Mind*, 1907, Lect. VIII.

² To appear in Vol. III. of *Thought and Things*. Cf. the work of Dr. W. D. Furry, *The Æsthetic Experience, etc.*, Monograph No. 36 of the PSYCHOLOGICAL REVIEW (1908).

at once that a resort to unintelligible feeling, as found in mysticism properly defined, is not justified, nor is a resort to a one-sided rationalistic or voluntaristic postulate — as often seen in the history of thought. The æsthetic content is always conative or appreciative, inasmuch as it is selective and end-filling; but it is also always cognitive and intelligible, inasmuch as it is always semblant and imitative. As being, in its stage and place, the legitimate reading of both sorts of interest, intellectual and practical, it is never a state of pure absorption and loss of personal consciousness in an ‘ecstasy’ of feeling. Nor can it be considered an outburst of the ‘passional nature’ that simply wills its own end, since it is emotionally ‘disinterested’ on the one hand and idealizing on the other hand. It absorbs the content in the self as the principle of realization of both knowledge and will, at the same time that, as being a state of the merging of dualisms, it has the immediateness of feeling. If we use the word ‘contemplative’ to describe the cognitive aspect of the æsthetic consciousness, it should have this full meaning. The self ‘contemplates’ a content when it reads it as ideally truthful and so *real for knowledge*, and also as, in its own mode and meaning, ideally worthful, and so *real for will*; and in this union of controls the earlier mediation of remote ‘realities’ gives place to an immediateness of *the real in feeling*. The object of contemplative interest is thus not only an object, but an object that embodies and fulfils the self. The self is realized in it, and the experience becomes one that may be called absolute in certain senses now to be briefly indicated.

1. The relativity of dualistic controls is abolished in such an act of contemplation, since the reading is one in which both truth and will — the external and the inner control factors — are held in a common fulfilment. This goes beyond the individuation of the self and its object as ‘general’ and ‘common,’ since in it common and general objects come to genuine personal expression, and the singular self both realizes a content that is universal and is realized in it.

The resulting immediacy is one that can be at once dissolved by the shifting of the interest to any one of the partial strands of meaning — the cognitive, the conative, etc. — just as white light

can be resolved into its component colors. On account of this possibility and tendency the æsthetic is difficult to characterize although so rich in actual content. We have here to work out the criteria of the æsthetic commonly known as objectivity, relation, universality, etc., all aspects of the content as derived from knowledge that is common, universal, and externally controlled; as well as its characters as worthwhile, pleasant, self-realizing, which attach in turn to the subjective control factor. The æsthetic is absolute then in the two-fold sense that its object is at once *over-truthful* and *over-worthful*.

2. Again the æsthetic is absolute in that it annuls the finality of the readings of reality given in the several partial modes — presentative, judgmental, volitional, ethical, etc. — while *not denying the relative validity of each*. It represents a form of positing which can be negatively rendered only in a *privative* judgment. 'This and nothing else,' not 'this and not that,' is the formula for negative æsthetic meaning. This indicates that the æsthetic meaning is properly neither epistemological — since it is not subject to logical opposition — nor axiological — since it does not lend itself to specific predications of worth. Of course, the relational exclusions of logical statement apply to æsthetic content when the intellectual interest succeeds the intrinsically contemplative. So too the imperative negative, 'I will this whether or no' of the volition that is less responsible, and the categorical imperative 'it cannot be different' of more responsible volition, may also come forward. But each such interpretation reinstates a *partial fulfilment only*, with a corresponding dualism and mediation. Æsthetic negation on the contrary deprives the object of mediations and attachments of all sorts. It finds the object a detached, ideally truthful, and self-fulfilling whole, whose negative rendering by any positive exclusion would only reinstate the assertion of a partial motive and a relative point of view. Assuming Spinoza to be right in his dictum, *definitio est negatio*, we may convert it and say *negatio est definitio*; and the relativities of logic are upon us. The æsthetic on the contrary is not relative as being thus negative, but absolute as being *over-negative* or completely privative.

3. Finally, the æsthetic experience erects an 'absolute'

object in another sense. Its characters are not found at one stage only of experience. It does not have the limitations that belong to one stage, and lack the motives that are found in other stages. On the contrary the meaning set up in imaginative semblance is that of personal ideality and objective self-completeness at *whatever stage of development the experience arises*. The semblance of play is unifying of the dualisms of its mode; it is also privative of all partial fulfilments; it is thus absolute in intent and force for consciousness. So with the semblance of explicit æsthetic experience; it means the same thing in whatever mode of reference it is found. Its function as being immediate over against all partial and dualistic modes of actuality renders it an experience of what is identical and universal. Whatever new dualisms may arise in the progress of experience, the semblant or imaginative reconciliation is already intended; its rôle is everywhere the same. We may then discard any 'absolute,' which has its justification through the postulate of a single mode — as say the 'rational,' which attempts to reach absolute 'being,' where 'being' is a formal and logical category, or the volitional, which postulates 'absolute' purpose or will which, so long as it remains purpose or will, fails to realize the 'other' or end set by the intelligence. Such efforts destroy the æsthetic absolute as such. The æsthetic object is 'absolute' both in the sense of transcending the relativities created by the postulations of such partial interests and also in the sense of anticipating in its return to immediacy all possible completion or enlargement of meaning. Its meaning is immediate and self-contained and always the same. It is not relative to any mode, but is identical through all; it unifies the progressions of the genetic series as well as the dualisms of the cross-sections or structural contents everywhere. While arising therefore to fulfil a genetic rôle, and as a factor in a dynamic movement, it yet discounts all such movements; in this sense it is not dynamic but 'identical' in its meaning. While the æsthetic object as content is genetic and particular, its meaning for experience is *over-genetic* and universal.

IV.

In conclusion I may venture a remark on the subject of realism and idealism. It is evident that on our method, each meaning found to be, for the process that gets it, in some sense 'real,' is *ipso facto* in that sense and for that mode real. A being having perceptual consciousness only, would have his perceptual 'real world.' So the judgmental consciousness reaches certain 'real' spheres of reference, external and internal; these are real in the sense that objects thought of as really in them *are in them*. The results are true. So the postulates of the moral and religious life, terminating on realities of the sort that higher personal relations require, are 'real' for this mode of function.

Now to try to get back of this and ask what is *really real*, is simply to attempt what each of these modes has already once attempted — to construe all experience in some one mode of the real. The 'ontologically' real is simply that which satisfies the logical or theoretical interest. The 'practically' real is that which satisfies the postulates of ethics and social life, whose worth-system is entered into by activity rather than by thought; it is but another resort to a single mode. Our method on the contrary is the comparative one; it aims to find out why there are all these 'real' modes each doing its own work and setting up its postulate. What do they signify? Does experience itself reach any adjustment of them? What does this scheme of 'realities' mean — this relativity of reals — each of which so clearly stultifies itself by calling itself 'absolute'? Our conclusion is that each of them, despite its pretentions, belongs to a mode of developing experience; each has its instrumental rôle. But this allows us, also, to find the way that experience itself universalizes its partial and instrumental interests in a mode that imaginatively unifies the realities of its knowledge, its will, and its self-feeling in a more modest but more significant 'absolute.' Allowing each mode of psychic function its chance to make out what 'real' it can in its own way, we find that the *æsthetic mode of realizing gets the only meaning that can be called in any intelligible sense abso-*

lute.¹ The word 'realize' as popularly used, indeed, suggests a more adequate experience than the 'finding real' by logical proof, or the 'assuming real' of practical life.

¹The question of philosophy may be put as that of the interpretation for theory — that is, for thought — of the æsthetic meaning. This is our final problem. It is too large to be taken up here. It should be said, however, that such an interpretation again takes us back to the attempt to say something about reality which shall utilize the æsthetic content, and the conclusions just stated are fundamental to further construction in that direction.

DISCUSSION.

GROUP SELF-CONSCIOUSNESS: A STAGE IN THE EVOLUTION OF MIND.

It is said that animals are conscious, man alone is self-conscious. The aim of this paper is to show that between the merely objective consciousness characteristic of the lower animals, and the individual self-consciousness that we find in ourselves there is another type of mentality which may be called group-consciousness, or more explicitly, group self-consciousness. My thesis is that the earliest notion of a self is the group of which the individual is only a member, and that this thought of a group-self, which perhaps has a beginning among animals that live in flocks and herds, comes to be the predominant mode of consciousness among primitive mankind, and that this has served as an important stage in the development of the individualized self-consciousness characteristic of modern man.

My attention was first called to this problem by a passage in E. J. Payne's *History of the New World Called America*.¹ Incidentally in the midst of a lengthy discussion of the similarities between the languages of the Americans and the peoples of eastern Asia, Payne remarks as follows:

"The fundamental personal conception is an 'our' or 'we' in which 'my' and 'I' are included but not distinguished. It is collective; it regards certain human beings as forming a group, and this group as including the members. This natural collectivity of meaning seems to be illustrated in the songs of birds and cries of gregarious animals. Language, we cannot doubt, arose in the group. Its first effects, then, would probably express the relations of things and thoughts common to all members of the group at the same time; and this would be conceived by each member as affecting not merely himself but all his co-members. . . . In general, the personality of language may be regarded as originally collective and its original expression as a collective 'we' or 'our.' . . . All the less comprehensive forms of number, indeed, if we read archaic grammar aright, have been attained not by extension from the 'I,' but by selection from an original collective 'we,' representing the aggregate personality of the

¹ Vol. II., p. 201.

food-group, and thus including the undistinguished 'I' of the speaker for the time being."

According to this view language begins as the expression of the common thought and feeling of a group; the first self to be distinguished from the not-self is the group, the common subject of this common feeling. Payne offers no further justification for his view than such as is found in the probabilities of linguistic origin and certain grammatical peculiarities especially in the pronoun of the first person plural which are widely extended among the early inhabitants of Asia, the Pacific islands and the Americas.

There are, however, many other facts of primitive life which point in the same direction. The modern investigator finds that the savage, far from being the noble freeman of which the seventeenth and eighteenth centuries dreamed, is a member of a tribe completely enmeshed in a web of custom. This tribal custom, in which the savage lives and moves and has his being, is to his mind no man-made code. It is ordained and established by the supernatural ancestor of the tribe and is no more subject to change than the laws of nature. It is not only sanctioned by unwavering public opinion and nameless religious terrors, but conformity to it is necessitated by the very psychological make-up of the savage himself. Born and bred in the tribal atmosphere, the very limitations of his own thinking hold him to the course of life marked out by tribal custom. His imagination and his will can but reflect the common thought and feeling of his tribe. This is his only social copy. Individuality is not yet born and the only self the savage knows is the tribal self. This is shown most clearly in the earliest forms of responsibility of which we have any knowledge. If crime is committed on a member of one tribe by a member of another, the individuals concerned are not considered; the one tribe demands reparation from the other tribe. Numberless instances might be cited from the investigations of ancient law to show that not only among savages is responsibility tribal rather than individual, but well up into the barbarian and semi-civilized races we find a sort of clan or group responsibility occupying the place which personal responsibility holds among civilized and modern nations.

We find a somewhat similar state of affairs with respect to property. The earliest person to hold property is not the individual person, but the group person. The tribe holds its common hunting ground, and the clan holds its flocks and herds and area of tillable land as a common possession. This communal holding of property still prevails in village communities in many parts of the world. As

in legal matters, so in property affairs, the only person that early man seems to contemplate is the group self and not the natural individual.

Again we find the same mental attitude manifested in religion. Primitive religion seems always to have been a tribal affair and never an individual one. A man's religious duties consisted in taking his part in the established rites and ceremonies of his tribe. The god worshipped is the god of the tribe, and the divine favor sought is the good of the tribe. No one is seeking to save his individual soul; he has not yet discovered that he has a soul of his own. As De Coulanges and others have pointed out, the established religions of Greece and Rome were civic rather than individual concerns. But alongside with the established civic religion of the Greek City States, there developed the movement which we now know as the Mysteries. This was the beginning of individualism in religion. Into these religious associations men entered voluntarily and by a process of initiation (it is probable that the word 'mystic' means initiate) while one was born into the established religion of his native city. Not till the Greeks had attained to a high degree of civil liberty and a considerable consciousness of individuality did these mysteries arise. They are interesting to us as the earliest manifestation of the individual spirit in religion. Thus early customs with respect to responsibility for crime, with respect to property and religion, all show evidence of minds dominated by a group consciousness rather than an individual consciousness. It is the tribal self rather than the personal self of which primitive man thinks when he thinks of self at all.

If in the early ages of its career the human mind took the form of a group self-consciousness, should we not expect to find to-day survivals or recapitulations of this primitive attitude? As a matter of fact, we do find abundant survivals of this early mental condition. Such survivals would most naturally be looked for among the less intelligent, less educated, and more youthful part of the community. The gang instinct of the hoodlum element in our cities easily illustrates this. In fact all the manifestations of the mob mind that have received so much study of late may well be regarded as survivals or as an atavistic recrudescence of a primitive mental type. The Freshman in the cane rush thinks not of himself but of his class; he is the true son of primitive man who thought not of himself but of his tribe. Thus the crowd psychosis of to-day is but an occasional reversion to the group consciousness which was the predominant mental attitude of early man.

If, now, as this paper has sought to show, the first form of self-

consciousness was a consciousness of the group self rather than of the individual self, this will help us materially in determining the evolution of the moral nature in man. We may be constrained to many socially useful modes of conduct by instinct, public opinion, the force of the law, the sanctions of religion, but such influences, however useful they may be biologically and socially, are after all not moral. Moral conduct as such is self-imposed conduct. It must therefore involve self-determination, self-judgment, and is possible only in a being who has reached the stage of individual self-consciousness. We need not look then for any instances of the moral consciousness in the lower animals. We cannot even expect to find a moral consciousness in primitive man until the human mind has broken through the cake of custom. Not till it has emerged from its primitive attitude of group consciousness and man has begun to think of himself as an individual, can we expect to find a moral consciousness. With the birth of self-consciousness comes the birth of conscience, for the being who knows himself cannot fail to exercise self-determination and self-judgment. The moral consciousness is a necessary function of individual self-consciousness.¹

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THE PSYCHOLOGICAL REVIEW.

THE NERVOUS CORRELATE OF PLEASANTNESS AND UNPLEASANTNESS.¹

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INTRODUCTION.

With respect to their attitude towards the psychology of feeling psychologists may be divided into two classes, those who regard the feelings, that is, pleasantness and unpleasantness, as sensations, and those who regard them as a class of mental states differing from sensations. Those who hold the former view have in recent years gained in numerical strength and have developed a certain tendency to look down upon the latter class as old-fashioned thinkers who cannot free themselves from the shackles of tradition. But those who classify pleasantness and unpleasantness under a heading differing from that of sensations are by no means willing to give up the fight. The result is that the psychology of feeling has assumed an appearance of the greatest confusion. To show this state of affairs clearly, the writer has collected and shall present a number of abstracts of the views of various writers who have recently expressed their opinion on this subject.

A large amount of the present confusion seems to be due to the fact that psychologists do not sufficiently distinguish pleasantness and unpleasantness from emotion. Theories of feeling are developed with the intention of having them apply as well to emotions as to pleasantness and unpleasantness. To the present writer all such theories seem to be doomed to failure. He will in the following pages restrict himself distinctly to pleasantness and unpleasantness. The present state of the theory may also partly be caused by the difference in temperament of the various writers and their tendency to generalize from their own experiences. For instance, when Sully tells us that anger is pleasant and Spiller that it is not, the probability is that both are right, that is, that anger is sometimes pleasant and sometimes not pleasant.

To a still larger extent the present confusion seems to be due to the fact that few writers on the subject have made any attempt at finding a nervous correlate for feeling. The question whether pleasantness and unpleasantness must be classified with sensations or separately, is of little importance if its answer is regarded as an end in itself. The answer, however, may help us to discover the nervous correlate of feeling. When we have found

this, we shall understand the biological significance of feeling as identical with or different from that of sensation. How little understood this problem of the psychology of feeling is by most psychologists appears from the following incident:

At a meeting of psychologists a paper was read on perception and action. In the course of the discussion the present writer asked the speaker as to his view about the nervous correlate of feeling, since in the paper read the speaker had developed a theory of the nervous correlate of perception. To his astonishment he received the answer that in the speaker's opinion this question was not relevant to the thesis. Is the problem of the relation between feeling and action indeed irrelevant to the other problem of the relation between perception and action?

CHAPTER I. A COLLECTION OF CONTRADICTIONARY VIEWS.

Lagerborg¹ regards a 'feeling' as a weak and unlocalized sensation. As soon as its intensity is increased, it can be localized and is then called a 'sensation.' There are three classes of feelings: Unpleasantness, pleasantness and common feelings. The corresponding sensations are pain, sexual sensation, and visceral or kinesthetic sensations. Itching is, according to Lagerborg, a mixture of cutaneous tension, warmth, tickling and weak (rarely strong) *pain*. It is interesting to note this introspective analysis, since another theorist, as we shall at once see, regards itching as a medium degree of the sensation series *pleasantness-sexual sensation*.

What, then, are the specific causes of these pleasure and pain sensations? Lagerborg gives the following answer. The special pleasure and pain nerves in the various parts of the body can be stimulated, not only mechanically, but also by the chemical changes which constitute the nutritive processes of the tissues. In case of mechanical stimulation we have such sensations as sexual pleasure or cutaneous pain. Stimulation resulting from nutritive processes gives rise to those weaker feeling-sensations which are usually called pleasantness and unpleasantness, and which may accompany any kind of sensation and experience.

¹ 'Ueber die specifischen Ursachen der Unlust- und Lustgefühle,' *Skandinavisches Archiv für Physiologie*, 18, pp. 7-56, 1906.

The nutritive processes which in these latter cases act as stimuli to the pleasure and pain nerves, may be brought about hypothetically in three ways. (1) Stimulation may be confined to the spot where a toxin is generated or where the assimilating processes are unusually vigorous in the tissues. As example may serve local pain resulting from the exhaustion of a muscle or from the application of a hot iron to the skin; local pleasure resulting from the stretching of a limb or from withdrawing the finger from melting snow. (2) If toxins are locally generated or tissues are locally undergoing unusually vigorous processes of nutrition, the constitution of the blood must first locally, soon generally, be changed in one or the other way. Such changes in the chemical constitution of the blood stimulate the visceral centers and produce changes in the irrigation of the body in general. These general irrigation changes, in turn, produce either unusually vigorous or unusually weakened nutrition of the tissues all over the body and a corresponding sensation of either unlocalized pleasure or unlocalized pain. (3) The third case is identical with the second except in this, that the general changes of nutrition are not the result of changes in the irrigation of the body, but the direct result of the unfavorable or favorable stimulation of a special hypothetical 'nutrition center' in the bulb, which has been stimulated by the toxins, etc., locally generated.

Lagerborg then adds that the only requisite of 'a beautiful solution of the total problem' is the proof of Oppenheimer's hypothesis that the vasomotor nerves have both an afferent and an efferent function, giving rise by the former function to the algedonic sensations.

Lagerborg's theory reminds one strongly of Marshall's theory as found in his book 'Pain, Pleasure and *Æsthetics*,' written fifteen years ago. Yet in some respects they arrive at widely differing conclusions. Marshall denies that pleasantness and unpleasantness can be classified with sensations. At the same time, however, he fails to distinguish between unpleasantness and the sensation of pain and is thus in perfect agreement with Lagerborg. Lagerborg's doctrine of the dependence of pleasure and pain on nutritive processes is practically identical with Marshall's theory that pleasure indicates the expenditure of surplus stored

energy, whereas pain indicates an expenditure of energy larger than the possible supply. Marshall distinguishes the pleasure of relief or rest, which is 'systemic, *i. e.*, not connected with markedly fixed or localizable contents' and the pleasure of activity which is thus connected; and similarly the pain of obstruction and the pain of hypernormal activity. This distinction is found again in Lagerborg's theory that stimulation of the algedonic nerves may result anywhere in the body from general irrigation changes, or at the definite spot only where a toxin or assimilated material is generated. But while Marshall denies the existence of algedonic afferent nerves, Lagerborg bases his theory on the hypothesis that there are such nerves. The latter believes that pleasantness and unpleasantness may be brought about directly by mechanical stimulation of the algedonic nerves, as well as indirectly by the nutrition processes of the tissues. According to Marshall pleasantness and unpleasantness can never be the direct outcome of mechanical stimulation, but are indirect results of such stimulation.

Stumpf¹ regards pleasantness and unpleasantness as sensations. Unpleasantness is merely a slight degree of the sensation of pain. Pleasantness, on the other hand, is a slight degree of that sensation which in its greatest intensity results from stimulation of the sexual organs, and of which intermediate degrees are given the names of tickling and, somewhat stronger, itching (see page 22 of Stumpf's paper). He proposes to call this whole group of sensations 'Gefühlsempfindungen' when resulting from direct sensory stimulation, 'Gefühlssinnesvorstellungen' when imagined. As an English term for the group he proposes 'emotional' or 'algedonic' sensations.² He justifies a single

¹ 'Ueber Gefühlsempfindungen,' *Zeitschrift für Psychologie*, 44, pp. 1-49, 1906.

² Page 15, footnote, "Auch der von Baldwin stammende, von Lagerborg akzeptierte Ausdruck algedonische Empfindungen erscheint zweckmässig." Stumpf is obviously mistaken in his statement of the origin of the term algedonic, for Marshall says in the preface of his book, *Pain, Pleasure and Æsthetics*: "I have restrained myself from the temptation to invent terms except in one particular, viz., in the word algedonic." Stumpf, in a footnote on page 24, refers to this book in the words: "Dasselbe oder ähnliches scheint Marshall in der mir unbekannten Schrift *Pain, Pleasure and Æsthetics*, 1894, zu behaupten." We have here a striking example of how little known American scientific literature is im Lande der Denker.

term for both classes of sensations by referring to the temperature sense, which also includes two classes of sensations, those of warmth and of cold. Stumpf quotes with approval the now prevailing views of those physiologists who regard pain as a special sense, but he criticizes one of them, Thunberg, for having described pain as not always unpleasant, but sometimes indifferent or even pleasant. He denies that any degree of pain can ever be pleasant, this being a logical contradiction. Equally unjustified appears to him a similar view expressed by Münsterberg in his 'Grundzüge.' Münsterberg's 'conscious value' of pain is called by Stumpf 'bloss ein Produkt der Theorie.' To say that pain is unpleasant is identical with saying that it is painful; and one might just as well say that a tone sounds, or that an odor smells. Those (Thunberg and others) who speak of pleasant pains are declared to be the victims of the following illusion. Within a rather small area of the skin they have experienced on some points the sensation of pain, on others the sensation of pleasure, and being unable to localize these sensations with sufficient accuracy, they believe themselves to have experienced both the sensation of pain and the sensation of pleasure all over this area. It seems hardly permissible to charge, on purely theoretical grounds, an investigator of such merit as Thunberg with so great a deficiency in experimental and introspective ability. Concerning the evolution of consciousness in animals Stumpf expresses the view that the lower animals possess only sensations, among them what he calls emotional or algedonic sensations, but neither intelligence nor true emotions.

Stumpf tells us that he has been compelled to accept the above theory as the result of the following reasoning. There are only three *clear* views of pleasantness and unpleasantness. (1) Pleasantness and unpleasantness are attributes of the sensations. (2) Pleasantness and unpleasantness are states of consciousness differing in kind from sensations. (3) Pleasantness and unpleasantness are those sensations which in higher degrees of intensity are known as sexual sensation and pain. The first of these views has already been shown by previous writers to be impossible; Stumpf refers here to Külpe. The second view is more complex, according to Stumpf, than the third. The principle

of economy, therefore, compels us to accept the third view, unless those who adhere to the second view can prove that the asserted difference in kind actually exists. They can attempt to demonstrate this, according to Stumpf, only by the use of the following three arguments. (1) They assume that pleasantness, unpleasantness, *and emotions* belong to the same one class of mental states. Those who accept this view are compelled to accept also the conclusion that the kinesthetic sensations of a person starting with fright are no sensations. This being illogical, the first argument is declared to be a failure. (2) They point out that pleasantness and unpleasantness are relatively subjective, sensations relatively objective phenomena. This argument is a failure because the difference here referred to is only a *relative* difference. "The ordinary man, if asked whether the odor is a constituent part of the sausage, would deny this and readily admit that it is merely the effect of the action of the sausage on the subject's nose." (3) Sensations have a spatial attribute, pleasantness and unpleasantness have none. This argument is equally a failure. Sexual sensation is well localized. Pain is well localized — the physician's first question is: "Where does it hurt?" And the pleasantness and unpleasantness which accompany sensations of the higher senses are localized, according to Stumpf, as 'spread out through the head.' "This somewhat vague localization is nevertheless a localization."

Having defeated all the arguments by which the assumed heterogeneity of pleasantness-unpleasantness and sensations could be defended, Stumpf declares that he feels bound to conclude that pleasantness and unpleasantness are simply two special classes of sensations, as described above in some detail.

Stumpf mentions the 'remarkable' fact that certain sensations, as sweet, are in children regularly accompanied by pleasantness, whereas in the grown-up European (Stumpf obviously has in mind the average beer-drinking German) the sensation of bitter takes the place of sweet in this respect. The change here illustrated will probably appear to most students of the problem under discussion as a fact of the greatest significance, which no psychological theory can afford to leave out of account. Stumpf, however, tables the question with the re-

mark: "About the causes and conditions of this change nothing can be said at our present state of knowledge" (p. 45).

Stumpf's paper contains little which cannot be found in Marshall's book. The argumentation of these authors is in some respects similar. But in one respect at least they are decidedly opposed: Marshall concludes that pleasantness and unpleasantness cannot be sensations since there are no algedonic nerves. Stumpf holds that pleasantness and unpleasantness are sensations, and if the histologists have thus far failed to discover the algedonic nerves, so much the worse for the histologists.

Stumpf's theory of 'feeling-sensations' has met with enthusiastic approval from Helen Thompson Woolley,¹ who, however, has not supported it by any new arguments. But it has also found opposition. Feilchenfeld² has recently published an investigation of pain. He rejects the theory of 'feeling-sensations' as developed by Stumpf. Feilchenfeld states his view thus: A visual sensation, *e. g.*, in looking at the sun, may be accompanied by both, pain and unpleasantness. Unpleasantness may occur at an intensity of optical stimulation far too low to produce pain. When pain occurs in consequence of an increase in the intensity of the light, this pain is not merely a higher degree of the unpleasantness existing before. On the contrary, both unpleasantness and pain are experienced now at the same time. The special physiological pain theory of Feilchenfeld does not interest us here so much as his distinction between pain and unpleasantness.

We shall now review a little paper by Fite published several years before the articles by Lagerborg and Stumpf. Nevertheless it is just to consider it after them, because in the writer's opinion, it represents a great advancement in psychological thought in comparison with the theories there presented. It would doubtless have been profitable for the authors just mentioned if they had read Fite's paper.

Fite³ begins his discussion by pointing out that many

¹ *PSYCHOLOGICAL REVIEW*, 14, pp. 329-344, 1907.

² *Zeitschrift für Sinnesphysiologie*, 42, pp. 172-191, 313-348, 1908.

³ 'The Place of Pleasure and Pain in the Functional Psychology,' *PSYCHOLOGICAL REVIEW*, 10, pp. 633-644, 1903.

psychologists, *e. g.*, James, regard all human activity as the outcome of preformed instincts which are modified by experiences of pleasure and pain. He raises the question if pleasure and pain can be regarded as modifiers in a system which refers activity to instinct, and he inclines to a negative answer. "Nevertheless, whatever theory you adopt, pleasure and pain are facts of our psychical life. The question remains then, What is their position in the psychical life, if you accept the functional theory?" The great advancement which I referred to above has its basis in the fact that Fite does not relate pleasantness and unpleasantness merely to a few purely physiological processes of metabolism, as Lagerborg does, or restrict the problem to its purely 'descriptive' phase, as Stumpf does, but considers these mental states with regard to the rôle they play in life, from the biological point of view.

The 'sensation of pain' and the 'sexual sensation' are nowhere mentioned in Fite's paper. It seems that the author regards pleasantness and unpleasantness as mental states different in kind from the sensations, but that he regards those sensations which play the leading parts in the later theories of Lagerborg and Stumpf, the sexual sensation and pain, as no sensations at all, but as high degrees of the feelings of pleasantness and unpleasantness. Here, however, he is bound to encounter the strongest opposition on the part of the physiologists and psychologists who have specially devoted themselves to the problems of the senses. Fite's positive theoretical views, however, are scarcely touched by this controversy, and I shall therefore continue to substitute for his terms 'pleasure and pain' the less ambiguous terms 'pleasantness and unpleasantness.'

Fite accepts the theory, which we shall have to oppose later, that without conflict there is no consciousness. "If the instinct works itself out wholly without opposition, the agent remains unaware of his own action." What is true for other mental states, is also true for pleasantness and unpleasantness: Without conflict of instincts there can be neither pleasantness nor unpleasantness. Fite now studies first the pleasantness and unpleasantness 'of activity,' then 'all the other forms' of pleasantness and unpleasantness. The former may be illustrated by a game of

chess. If your opponent is too weak, struggle is unnecessary: if he is too strong, the struggle is useless. In neither case is there any feeling. Pleasantness and unpleasantness are found in the intermediate cases. If the conflict of impulses turns towards success, there is the consciousness of pleasantness; if towards defeat, there is the consciousness of unpleasantness. The fiercer the conflict, the more intense either pleasantness or unpleasantness, according to the above condition. As soon as success or failure are accepted by the subject as the final outcome of the struggle, neither pleasantness nor unpleasantness are any longer possible. Fite then turns from the discussion of the pleasantness or unpleasantness 'of activity' to 'the other forms,' 'of sense.' "It is not the warmth, but the getting warm, that is pleasant." "We find that nothing is invariably pleasant." The pleasantness or unpleasantness of sense 'is conditioned by the existing state of the organism.' The 'reference to physiological detail' is recommended by Fite to future investigators, who will thus be able to show 'that the existing state is a state of conflict between organized habits and the further demands of organic growth.'

Two 'remoter consequences' of this theory are mentioned by Fite, its bearing upon experimental methods and its consequence for ethics. In Titchener's 'method of impression' the attempt is made to construct a scale of pleasantness among, say, colors, by having the subject decide which of a pair of colors presented is pleasanter. The assumption is that a given feeling-quality is inherent in a given sensation-quality. However, the significant conditions are those of the general culture of the subject, as well as his condition immediately preceding the experiment. It is possible that at no time would a color be pleasant independent of these conditions. The ethical consequence is that it is now inconceivable that we should choose pleasure as an end, and hence, impossible to set up pleasure as the end to be sought.

"While succeeding in certain activities I may be failing in others." The pleasantness attendant upon the success is then 'dimmed' by the consciousness of the failure, so that 'my feeling as a whole' is that of unpleasantness. Fite agrees with the

time-honored theory that pleasantness and unpleasantness behave like a positive and a negative quantity, which symbolically can be represented as simultaneously existing, but actually annihilate each other, leaving in existence only the excess on either side. Coexistence is impossible.

Summarizing Fite's theory, we may say that 'pleasure and pain' are not causes in mental life, but mere indicators of the conflict or harmony between acting causes. The question as to their nervous correlate is left open.

That pleasantness and unpleasantness do not act as causes in mental life has also been emphasized by other psychologists. Lipps has for years been a champion of this view. And Lipps is also one of the few psychologists who have not followed the tradition that pleasantness and unpleasantness are positive and negative quantities of the same substance, that is, that only the excess of either pleasantness or unpleasantness can actually exist in consciousness, never both at the same time.

The laws of pleasantness and unpleasantness, according to Lipps,¹ are the following. Pleasantness accompanies a psychic process to the extent as its efficiency is expanded by the subjective conditions of receiving this process into the totality of psychic life. The intensity of the feeling of pleasantness depends on two conditions: the energy of the process claiming admission and the subjective tendency to submit to its absolute or relative domination. Unpleasantness accompanies a psychic process to the extent as its efficiency is detracted from by the subjective conditions of receiving the process. The two conditions on which the intensity of the feeling of unpleasantness depends are: the energy of the process claiming admission and the subjective tendency to reject it. The transition from pleasantness to unpleasantness, or the reverse, does not necessarily always include a zone, or even a point, of indifference. Pleasantness may gradually become mixed with unpleasantness until the unpleasantness prevails in the mixture and ultimately, perhaps, alone exists. And the reverse.

About the biological significance of pleasantness Lipps does not express any opinion. Of the three hundred and fifty pages

¹ *Leitfaden der Psychologie*, 1903, pp. 259-272.

of his *Leitfaden* less than two are devoted to the 'instincts, and what is said about them on these two pages is meant mainly to convince the reader that the author, as psychologist, does not take any interest in them.

Alechsieff,¹ in a recent experimental investigation, arrives at the conclusion that feelings have no direct relation to peripheral stimulation. They accompany changes in consciousness resulting from the entrance of sensations into the focus of attention. Alechsieff adheres to Wundt's doctrine of the three dimensions of feeling, pleasantness and unpleasantness representing one of these dimensions. From twenty-nine experiments in which simultaneously quinine solution was applied to the tongue and oil of rose to the olfactory organ, the author draws the conclusion that pleasantness and unpleasantness can never coexist in consciousness. The actual fact stated by the observers was this. There was a frequent change of attention. When the odor was attended to, there was also pleasantness; when the bitter taste was attended to, there was also unpleasantness. The causal relations within this complex of mental states are thus described by the author (p. 262), in a manner just the reverse of that which the present writer would expect: "Pleasantness and unpleasantness cannot coexist; therefore they occur alternately. The pleasantness in this case belongs to the odor of rose oil, the unpleasantness to the taste of quinine; therefore this odor and this taste cannot be attended to simultaneously." The present writer would describe the same facts thus: The subjects were unable to attend to the bitter taste and the odor of rose at the same time; therefore they did not experience pleasantness and unpleasantness at the same time.

Among the psychologists who do not accept 'Gefühlsempfindungen' is Miss Calkins.² "It is not easy to realize that painfulness is quite distinct from disagreeableness or unpleasantness. Half the experiences which we ordinarily call 'painful' are probably merely unpleasant. It is unpleasant, for example, but not painful, to mistake an ice-cream fork for an oyster fork

¹ 'Die Grundformen der Gefühle,' *Psychologische Studien*, 3, pp. 156-271

² *An Introduction to Psychology*, 1905, pp. 71 and 117.

at a dinner-party." Miss Calkins has attempted to work out a definite theory of the nervous correlate of pleasantness and unpleasantness, which it is best to represent here in her own words. Her theory is based, like most others, on the principle of cell nutrition. "Pleasantness and unpleasantness are occasioned by the excitation of fresh or fatigued cells in the frontal lobes of the brain, and this frontal lobe excitation is conveyed by fibers from the motor cells of the Rolandic area of the brain. When the cells of the frontal lobes, because of their well-nourished and unfatigued condition, react more adequately to the excitation which is conveyed to them from the Rolandic area, an experience of pleasantness occurs; when, on the other hand, the cells of the frontal lobe, because they are ill-nourished and exhausted, react inadequately to the excitation from the Rolandic area, then the affection is of unpleasantness; when, finally, the activity of the frontal lobe cells corresponds exactly to that of the excitation, the given experience is neither pleasant nor unpleasant, but indifferent."

As one of the supports of this theory is mentioned the probable fact that injury to the frontal lobes is accompanied by derangements of the emotional life. This argument, of course, can appeal only to those who regard 'pleasantness and unpleasantness' and the 'emotional life' as synonymous terms, among whom the present writer is not to be found.

Another support of the theory is said to be the fact that pleasantness is accompanied by 'more vigorous movements.' But, is it actually true that unpleasantness is distinguished by weakness of motion? The present writer cannot overcome the suspicion that Miss Calkins' theory of pleasantness and unpleasantness is of the kind which will suit anybody and explain anything provided only its author is given time and opportunity to trace hypothetical nervous paths far enough backward from the Rolandic area and forward from the frontal lobes. The tendency to find 'the nerve centers' for every mental state has fallen into disuse in recent years. Miss Calkins tries to revive this tendency by introducing to us the frontal lobes as 'the center' of pleasantness and unpleasantness.

Far in advance of all the authors mentioned seems Pikler,¹ who several years ago published a theory of the fundamental law of life which has been noticed much less than it deserves. It is true, his theory is vague in certain respects, but the author is perfectly aware of this fact and tells us so in his preface. However, he seems to be the only writer who has clearly conceived pleasantness and unpleasantness as states of consciousness differing in kind from sensations, and who has — at the same time — observed the necessity and possibility of finding a correlate of these mental states in a functional property of the nervous system, differing in kind from the nervous correlate of sensation.² In this respect the present writer gladly acknowledges his indebtedness to Pikler, although in many further details his own ideas have developed along somewhat different lines.

Pikler starts from the view that all organic life may be regarded as a *mechanical process in one definite direction*. The term 'mechanical,' of course, must not be taken in too narrow a sense. This process, which is about identical with the vegetative life of an animal, depends for its continuance on the im-

¹ Julius Pikler, *Das Grundgesetz alles neuro-psychischen Lebens*, Leipzig, Barth, 1900, pp. xvi and 254.

² It is interesting to note the progress of psychological thought which is apparent in the following quotation from Pikler, criticizing James' *Principles of Psychology*: "Dieses in der Wahrnehmung von Fragen und in seiner Kritik ausnehmend scharfsinnige, und in seinen positiven Ausführungen auch so lehrreiche und oft originelle Werk führt Begreifen, Aufmerksamkeit, Denken und überhaupt alles psychische Leben immer auf 'Interesse' zurück, findet aber kein neurales Korrelativ dieses fundamentalen subjectiven Begriffes, ja leugnet sogar ein solches und fasst Interesse als etwas Spirituelles und Transcendentales auf, und *entbehrt jeder Theorie von Lust und Unlust*. Dieser hervorragende Denker sieht sich gezwungen, der Oeffentlichkeit Principien der Psychologie zu übergeben, in denen — unglaublich, doch wahr — Lust und Unlust garnicht behandelt wird. Da er erkennt, dass die temporären materiellen Kräfte die Auswahl der Bewegungen nicht erklären können, sondern dass diese durch Lust und Unlust bestimmt wird, fasst er die Wirkungen dieser letzteren als Wirkungen einer kein mechanisches Korrelativ besitzenden geistigen Kraft auf, welche über die mechanischen Bewegungsantriebe 'applaudierend und zischend' Urteil sitzt. Die das psychische Leben bestimmende stete Kraft ist aber keine übernatürliche, sondern eine mechanische, nämlich die *von den steten Einwirkungen unterhaltene stete Lebensbewegung*, und ihr 'Applaus' und ihr 'Zischen' haben ihr mechanisches Korrelativ im Gleichgerichtetsein und Widerstreit dieser Bewegung und der temporären Einwirkungen."

pression made constantly upon the animal by the physical world surrounding it. A part of the process occurs in the nervous system, another part in the rest of the body. To force this process into its opposite direction means to kill the animal. But temporarily this process may, in some of its parts, be forced into the opposite direction. When this occurs in the nervous system, it is accompanied by consciousness; when it occurs only in the non-nervous parts of the body, it is of purely physiological significance.

Pikler denies — without sufficient reason, it seems — that the selection among many possible movements can be explained as the result of mere anatomical structure. When one of the arms of a starfish is touched, this arm reacts, the others do not. Pikler assumes that any stimulation diffuses all over the nervous system and thus all over the body, causing reaction movements in all parts of the body. But in all parts but one they are quickly suppressed, because the new impressions upon the nervous system resulting from them are opposed to the general nervous activity going on all the time. The only exception is in the arm which has been touched. Here the general nervous activity has just before been disturbed through the opposing process set up by the touch. And the new process which results from the movement of this arm, far from causing opposition to the continuous, general nervous activity of the body, rather restores this activity to its former integrity, which has been interfered with by the touch. This same principle is applied by Pikler to the explanation of *all selective movements of the body*, simple or complex. The movement selected is the one which does not oppose, but aids the general nervous activity going on at the time. When the body no longer makes this selection, when opposing activities are thus permitted to exist permanently, death must of necessity result.

What is the nervous correlate of pleasantness and unpleasantness? It is this relation just spoken of between temporary nervous activities and the continuous nervous activity. The relation of opposite direction is the nervous correlate of unpleasantness, the relation of equal direction that of pleasantness.

It is necessary to emphasize that Pikler does not regard pleas-

antness and unpleasantness as mental states which accompany physiological processes of cell nutrition — good, bad, or indifferent — as for example Lagerborg does, following herein Marshall and others ; a view also adopted by Miss Calkins. Pikler regards pleasantness and unpleasantness as having a definite nervous correlate, but one which is of a kind differing from that of sensations. Sensations depend on local differences of nervous activity in so far as in a small part of the nervous system equal direction, in all others opposite direction of the nervous processes is to be found. Accordingly sensations are localized in definite parts of the body. Pleasantness and unpleasantness are unlocalized because their nervous correlate is not the local difference of equal and opposite processes, but the fact of equal or opposite direction itself. Pleasantness does not, as in Fite's theory, presuppose opposition of nervous processes. It can easily happen that a nervous activity resulting from temporary stimulation is of equal direction with the continuous nervous activity. This would be a case of pleasantness without any preceding opposition.

(To be concluded.)

STUDIES IN ÆSTHETIC VALUE.

BY PROFESSOR H. HEATH BAWDEN.

ARTICLE I.

THE NATURE OF ÆSTHETIC VALUE; WITH A CRITIQUE OF MISS PUFFER'S THEORY OF ITS ALLEGED ABSOLUTENESS.

Philosophy and science as well as ordinary speech recognize a distinction between a world of values and a world of facts and relations. It is an old saw that there is no disputing about matters of taste. Science is continually compelled to make allowances for the personal equation. And philosophers have even gone so far as to insist that the world of appreciation and the world of description are fundamentally distinct and opposed in their attributes. What does such a fundamental distinction signify, and what is the place and function of value in human experience?—such is the problem of the present discussion.

A superficial inspection reveals the following commonly recognized types of value: utility—usefulness (practical value); truth—error (so-called logical value); the good—bad or wrong—right (ethical value); and the beautiful—ugly (æsthetic value). Besides these well-defined spheres of value there is a vague outlying area of value experience which is often referred to loosely as spiritual values among which the religious values may be adduced as an instance. Whether this is a distinct field or falls properly under one or more of the foregoing heads is a question which admits of difference of opinion.

1. *Psychological Analysis of the Value Consciousness.*

Value seems always to involve relation to consciousness; it is not a term primarily applied to things apart from consciousness. Psychological study discloses the fact that it consists essentially in the reference to a subject, *i. e.*, to a need, want,

or desire of some sentient being. Value grows out of the satisfaction or failure to satisfy tendencies or cravings. Such terms as interest, wish, preference, and choice express this subjective connotation of the term. Lipps insists that all feelings of value are feelings of personality.

The essential element in the value experience has been construed in different ways. According to one school of writers, value is that which meets a need or want, it is what satisfies, or is capable of satisfying a desire. The emphasis here is upon some attitude or conative tendency, some striving, some preference, or volition on the part of the conscious being. This is called the voluntaristic theory. Thus Ehrenfels says that the value of anything consists in its being desired or in its desirability, and this, in the last analysis, means that it calls out and meets, or is capable of meeting certain needs or wants represented in the organized instincts, appetites, impulses, and habits of the sentient creature. For the economist, value exists where there are persons, and consists in the want-attracting power of a thing. "The value of a commodity is the amount of its power to attract wants; the amount of its property of being wanted."¹ A variant of this theory is to hold that value is essentially teleological; it is of the nature of purpose; anything has value because and in so far as it is conceived fulfilling an end.

Another view holds that the essence of value is to be found in the experience of pleasure or pain which it contains. Value means emotional satisfaction or dissatisfaction. This is the emotionalistic theory of value. Thus Meinong maintains that the value consciousness consists of judgment-feelings which accompany the reflective process of cognition in which an estimate is placed upon some reality or truth. But if, as current psychology holds, the difference between emotion and desire is simply the difference in the degree of opposition offered to the expression of an impulse, these two views need not necessarily be incompatible. A value appreciation would always represent a total reaction of the subject on an object. Whether the affective or the conative phase becomes more prominent will be deter-

¹ Hicks, *Lectures on Economics*, p. 32.

mined by the degree to which the mediative cognitive process has introduced control into the response. That is, to desire a thing and to think of it as pleasant, are but different phases, or at most stages, of the same fact.

Professor Urban, in his timely discussion of the value consciousness (in Baldwin's Dictionary, in the *Philosophical Review* and in the PSYCHOLOGICAL REVIEW) combines both views by defining value as 'the selective funded affective-volitional meaning' of an object for a subject.¹

By 'selective' is meant that the worth or value of an experience or object is its meaning for a subject, with the emphasis on the subject as selective, *i. e.*, meaning determined by the affective and conative predispositions of the appreciator. For example, the perception of a wooden settee in the shade of a tree would ordinarily be of indifferent value, but if it were the place where the absent lover sat, it would have a certain so-called sentimental value because it would arouse the emotional and volitional side of the percipient's psychophysical nature.

'Funded' has reference to the accumulated sub-conscious or semi-conscious affective and conative predispositions, desires, interests, — the 'set' of the preferences of the subject toward certain aspects of the object rather than others; and implies a vague and indefinite consciousness of the implications of these predispositions. The sentimental value of the settee is determined by race instincts or individual habits not immediately contained in the situation — the capitalized results of former experiences.

'Affective-volitional' expresses the fact that the meaning, in the case of value, is present only in the vague, total, unanalyzed way of feeling and desire rather than in terms of the clear and definite discriminations of the cognitive consciousness. The settee has not only an objective meaning to the lover, but this is swamped in the subjective personal appreciation.

2. *Value and Meaning.*

But values, while affective and conative rather than cognitive, would nevertheless seem to be meanings; Professor Urban calls them 'appreciative meanings.' It would seem to follow from

¹ PSYCHOLOGICAL REVIEW, January, 1907, p. 2.

the simple fact that 'value' may be made the subject-matter of discussion, that it is meaning in some sense or other. Meaning implies relations. Value, in any discussion of value, is considered in its relationships. Hence value belongs in this sense, to the world of meanings. When, accordingly, in our discussion of value, we distinguish between value and meaning, we must not be understood as distinguishing between meaning and something which is not meaning or without meaning, but simply between two kinds of meanings, meanings on different levels or in different phases.

The problem, therefore, is this: How does that kind of meaning which is called value, differ from what is commonly called meaning, how does value-meaning differ from meaning-as-such, from what might be called pure meaning? Urban's answer to the question is contained in the terms of the first part of his definition: value is the 'selective funded affective-volitional' meaning. That is to say, value is meaning apprehended or experienced in the way described in the definition: it is meaning experienced in a vague, total, unanalyzed, relatively pre-reflective way; it is personal as contrasted with abstract or impersonal meaning. But this is a relative difference only, since to be a meaning at all signifies at least some degree of mediation in reflective consciousness. No absolute distinction, therefore, will hold; such as that between a world of appreciation and a world of description. The difference is one of degree rather than of kind, a relative not an absolute difference.

But these writers might reply: "You have confused the issue by an ambiguity. You have not distinguished between the first and third persons' points of view. Value as immediately experienced is not a meaning but an indescribable something directly felt; it is only value viewed as the content of reflective thought, from the point of view of the spectator, that is meaning." The objection is a relevant one, and must be met. What is immediately felt is certainly different in important respects from what is arrived at by processes of mediative thought. But the problem is this, involving two questions: (1) Is an absolutely immediate experience possible, and (2) If it were possible, would it be properly described as value? Could it indeed be

described at all, or even remembered, without thereby ceasing to be immediate?

All will probably agree, in answer to the second question, that an absolutely immediate experience (like all mysticism) must be speechless. To speak, to be named, to be communicable, is to be describable, and thus not *merely* appreciated. But more than this. To even be intelligible, to be cognized (as opposed to directly felt) is to be the object of thought and therefore referred, related, and thus mediate. Therefore, even if an absolutely immediate experience were possible, it could not properly be described as value, since value is mediated at least to the extent of being in this very paragraph distinguished from other things. Any *discussion* of value is *eo ipso* a refutation of the idea that by value we may mean an absolutely immediate experience. (It is interesting to note, in passing, that by the same reasoning, an absolutely mediate experience is equally impossible; like universal scepticism, it would be suicidal.)

What has been said in the preceding paragraph is an implicit answer to the first question: Is an absolutely immediate experience possible? The answer, of course, is No! To be absolutely immediate, an experience would have to be absolutely isolated, unrelated: there could be but *one* absolutely immediate experience. But this would mean that there would be no memory, and that is tantamount to saying that there would be no experience at all, since a certain persistence or overlapping of impressions is essential to any experience whatsoever; and this overlapping by retention of previous stimulations introduces a factor of mediation. Furthermore, one wonders what would be the significance of an immediate experience except as a high-light against a background of mediacy; the very word *immediate* suggests the relativity of the relation. In other words, the distinction of the mediate and the immediate is a functional one.

Value, as such, is therefore the first person's point of view, while meaning represents the third person's point of view. Value is experience as personal, experience regarded from the point of view of the experiencer; meaning is experience as rela-

tively impersonal, *i. e.*, the situation or object viewed in abstraction from any particular experiencing center. And since thought is the instrument of abstraction, it follows that meaning is associated chiefly with the cognitive or intellectual faculty, while value is connected with the emotional and volitional nature of man.

In popular speech, the term 'value' is used indifferently, sometimes referring to the subjective appreciation and sometimes referring to the objects which are appreciated. Value is transferred to the object or is regarded as residing in the object somewhat as common-sense naïvely regards the color and other qualities as permanent attributes of the object in an external world. Thus values come to be spoken of as independent of the appreciator. Strictly speaking, we should use the term 'meaning' for the significance which objects have in relation to each other, and reserve the word 'value' for their meaning in relation to personal interests of the subject. We shall see, however, that pure meaning and pure value are equally abstractions; a meaning, however bare of human relationship, has always at least a tinge of emotional color, while a value always implies at least a minimal amount of objective relationship or meaning.

There is a certain ambiguity in the use of the terms 'value' and 'meaning' here. It is true that in popular speech the terms are often used interchangeably. But careful writing would make a distinction between 'meanings' which are comparatively impersonal, objective, and emotionally indifferent, and 'values' in which the subjective personal emotions of the individual play a prominent part. Values may perhaps be regarded as indeterminate or total meanings, meanings which are coming to consciousness for analysis and revision. The comparison of values yields ideals; the comparison of meanings yields laws or principles. Evaluation always rests largely upon unanalyzed subconscious instincts and intuitions; logical valuation proceeds in accordance with determinate rules.

Most writers agree that the value experience is of a relatively immediate character as contrasted with the mediate nature of cognition or thought. Values are apprehended intuitively or intuitively rather than reflectively; they belong either to the pre-

reflective or to the post-reflective stage of experience. Yet there are those who deny this and assert that value is a category of reflective consciousness, since evaluation is a conscious, and may be a deliberate process. This view, held for example by Witasek and Stuart, may be known as the intellectualist theory. But this theory rests upon a verbal confusion. Judgment is a logical process which as such deals with meanings. There are, to be sure, emotional accompaniments of all logical processes, but what distinguishes evaluation or the value-judgment so-called, from a scientific or purely logical judgment (supposing such to exist) is just the presence of the affective-volitional factors which figure determinatively in the former.

Value is the category of concrete individuality. Meaning is the category of abstract relationship by which we pass from one value experience to another. Value is always a relatively immediate emotional appreciation, while meanings are the relatively cold, intermediate machinery of thought by which the transitions are made. Experience, as Professor James suggests, may be likened to the flight of a bird; it is a series of flittings and perchings, a round of substantive and transitive phases. And if it be objected that strictly speaking value is not a 'category' at all, it must be remembered that the distinction between value and meaning is only a relative one, that in order to remain value it must have some meaning, just as meaning in order to maintain itself as meaning must have at least some degree of personal value. It might be said, perhaps, that 'value,' like 'habit' and the 'sub-conscious,' is a category of the reflective consciousness for describing the facts of the pre-reflective stage, in so far as these admit of description at all.

3. *Appreciation and Description.*

Value comes to consciousness in the process of the reconstruction of values. Perfectly adequate values cease to be recognized as such; they lapse into the unconscious, organized background of experience as habits. It is when one is about to lose something that he gets the keenest sense of its value. It is when one value is compared with another that the value consciousness becomes acute. Value, as the term is employed

here, is therefore a phase of conscious or reconstructive rather than of unconscious or habitual experience. But it is not reconstructive experience at its climax in reflection, for there we are dealing with clearly analyzed facts and meanings, not with vague totals such as the value consciousness presents.

The distinction between appreciation and description which has become current, corresponds to this distinction between values and meanings; description representing the machinery by which values are progressively appreciated in their new meaningful relationships. Description is a distinctively cognitive process by which a medium of communication is found for a relatively unique individual experience; it is the machinery by which we pass from one unique and immediate experience to another. Objects, events, situations, first come to us as values, as total immediate experiences of an indeterminate and indefinite character. Then, as certain emotional and volitional attitudes become differentiated from others, they come to stand out as ends to which the rest are means, and finally a definite system of ends and means is organized, represented by the various fields of immediate interest, such as industry, art, religion, society and morals, on the one side, and the various sciences and philosophy, on the other.

Art is commonly taken as the purest instance of the realm of value appreciation, while science is taken as the type of pure description. But, as we have intimated, the categories of appreciation and description represent a functional and not a fixed distinction. In general it may be said that in value experience the emphasis is predominantly on the end. The idea of value is connected primarily with the ends of life and only with the means if and in so far as they stand for these ends. In the social or ethical (including the religious values in the primitive sense of religion) the emphasis is obviously upon certain ends represented by the group-consciousness, with only a very crude development of the means. In the economic values the emphasis is more upon the means, *i. e.*, as much upon the means as is consistent with its being still predominantly on the end (which is essential to its remaining a value experience). In the so-called logical values, means and ends are held in a state of

balance with a tendency for the emphasis to shift over to the means; and is therefore not properly included in the category of the value experiences. This gives us validity as contrasted with value. Value becomes validity to the degree of analytic detail with which the appreciated object is apprehended. In the æsthetic experience the emphasis is again on the ends, but now with the maximum organization of means into these ends, *i. e.*, the maximum compatible with its still remaining a value experience.

It is sometimes said that in the value consciousness, in appreciations, means and ends are fused into a totality in a way in which they are not in the cognitive or reflective consciousness with its descriptive analysis of factors. This is otherwise expressed by saying that the value of a thing is its intrinsic as contrasted with its instrumental meaning, or by saying that in the world of appreciation an activity is its own end. Considered in this way, the purest case of value appreciation would be found in the æsthetic experience. But it must be remembered that the state of æsthetic absorption is only in a relative sense distinguishable from the reflective type of experience. A state of absolute emotional saturation is never actually realized any more than a state of purely unemotional intellectual cognition. These represent limits within which experience moves; limits which if ever reached would mean the destruction of consciousness. Value represents a meaning either as it is first emerging in consciousness as impulse, or as it is just toppling over into the automatism of habit.

Professor Santayana, in his *Sense of Beauty* says that "to feel beauty is a better thing than to understand how we come to feel it" (p. 11). But this is to set up a false antithesis between reflection and appreciation. Reflection and description are necessary processes in progressive appreciation. Pure appreciation would be speechless, idealess, contentless and static. It is through description that appreciation becomes enhanced, and it is the failure to realize the fullest appreciation that stimulates fresh description. It is only when we fail to appreciate that we stop to describe, and then we set up this distinction between a world of description and a world of appreciation. The

distinction has only a functional significance, in other words, in relation to the reconstruction of values: describing is trying to appreciate. As Mr. Alexander says, "The whole worth of life is its endeavor to realize what seems to it most beautiful." "Beauty is as much in the aspiration as in the ideal image." "All realization is but in renewed aspiration."¹

4. *Beauty as Value Par Excellence.*

If by the value consciousness, then, is meant an experience in which are combined the maximum of descriptive analysis compatible with its being a total, integral, and immediate experience (and this seems to be compatible with the popular normative conception of value) then the æsthetic experience furnishes the purest type of value. For here the end has become intrinsic; beauty is its own excuse for being, art is for art's sake; these expressions, while untrue when taken absolutely, representing the tendency of the value category as illustrated in the æsthetic experience. Our problem, therefore, may be narrowed down to the question: What is the place and function of æsthetic appreciation in relation to the rest of experience?

Assuming that value experiences are of the total and implicit character set forth in the preceding pages, the problem, now, is whether this represents a pre-reflective or a post-reflective immediacy. Are value experiences a survival of primitive modes of reaction to situations, or do they represent a higher level of rapid intuition arrived at only as the result of previous ratiocination? Is description, which is the product of the reflective consciousness, set up within the concrete immediate values of experience as instruments of their mediation, or do the values result from reflective judgments which arise in the process of description? This problem comes to a sharp focus in the discussion of æsthetic value. Does the æsthetic experience represent something less than clear cognition (a vague, total, instinctive perception of the situation) or something more than ordinary cognition (something beyond knowledge, of an intuitive character)? That is, is æsthetic appreciation attuitive or intuitive, at-sight or in-

¹ *Poetry and the Individual*, pp. 231-232.

sight, pre-reflective or post-reflective, primarily or secondarily immediate, *i. e.*, is it immediate in the sense of *unmediated* or in the sense of *mediated*? Is it the first crude indeterminate glimmerings of meaning which scientific analysis then criticizes and improves upon, or is it a sort of emotional second-sight which follows, and is superior to, scientific methods?

One theory holds that æsthetic values are pre-reflective or that they usher in the reflective stage. Professor Santayana says that æsthetic value "is the survival of a tendency, originally universal, to make every effect of a thing upon us a constituent of its conceived nature."¹ That is, as Professor Tufts (restating the theory) says, "emotions, pleasures, pains were thus all regarded as objective by an animistic and primitive consciousness. We have now transferred most of these elements to the subjective side of the account, but the æsthetic pleasures are still objectified."²

Professor Fite says that the sense of beauty "appears with the dawning conception of a form or meaning." "Whether an object be apprehended as a work of art or as a fact of science depends upon the extent to which it is apprehended in analytic detail."³ If one "could carry the process of analysis so far that there would be no effect the ground of which he did not fully understand there would also be, for him, no beauty." Appreciation of beauty ceases to be æsthetic appreciation 'with a complete apprehension of the meaning.'

Professor Lloyd says that the æsthetic attitude shows "man not yet free from himself, although his fear has changed to awe . . . 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."⁴ "Conception would then be definable as a sort of greatly deepened and spiritualized æsthetic experience, while scientific instruments may be regarded as the dehumanized metaphors of the æsthetic consciousness."

¹ *Sense of Beauty*, pp. 44-49.

² *Genesis of the Æsthetic Categories*, p. 5.

³ *PSYCHOLOGICAL REVIEW*, March, 1901, p. 136.

⁴ *PSYCHOLOGICAL REVIEW*, January, 1907, p. 48.

This may be called the survival theory of the æsthetic consciousness. Another theory defends the post-reflective character of the æsthetic experience, and will here be called the consummation theory of the æsthetic consciousness. Thus Miss Puffer defines beauty as "that which brings about a state of harmonious completeness, of repose in activity."¹ In Chapter II. on 'The Æsthetic Repose,' Miss Puffer implies that the æsthetic experience is post-judgmental, since in it the 'feeling of personality' has faded (cf. p. 63).

Miss Adams describes the æsthetic experience as 'the consciousness of the attainment of control.' It is therefore post-judgmental. "It is of the nature of an 'intuitive' or individual, rather than an instrumental or reflective judgment."² "The æsthetic experience represents a certain degree and kind of co-operation among various activities; it does not derive from any one type; and it represents an advanced stage and not a primitive kind of reaction" (p. 81).

Professor Rogers says that 'feeling as it is aroused by poetry or art,' is 'not something which is opposed to reason, but its highest, most immediate exercise.' "Through thought we get from an immediacy which is limited and partial, to one which is truer, richer, and more inclusive."³

But there is no necessary antithesis between the survival and the consummation theories of the place and function of the æsthetic in experience. According to the survival theory the æsthetic represents a primitive attitude and one which antedates and ushers in the other attitudes. According to the consummation theory, the æsthetic represents the culmination, the flowering and ripening of industrial, scientific and philosophical thought. According to the first view, it is the initial wonder and mystery and luxury of things that constitute the essence of the æsthetic attitude. According to the second theory, it is the final adequacy, interaction, relevancy, and organic congruity of things which is the essence of the æsthetic. But both theories are true: the one is but the negative counterpart of the other.

¹ *Psychology of Beauty*, p. 283.

² *The Æsthetic Experience*, pp. 64, 67.

³ *Modern Philosophy*, pp. 13-14.

The mechanization of the luxuries of life into utilities is the condition of the rise of the plane of the æsthetic consciousness from the level of mere agreeable sensation to that of intellectual and ideal pleasures. Both are æsthetic in a sense, but on different levels. Values are either instincts breaking up in impulse or conscious meanings culminating as habits. The break-up of a primary immediacy brings to consciousness the inherited modes of response in the form of total appreciations of an unmediated character. The mechanization of intellectual processes by reason of familiarity or superior insight results, likewise, in total appreciations of a secondarily immediate character which partake of the character of value experience because here, too, the cognitive becomes reinforced by the emotional and volitional context.

Æsthetic appreciation, accordingly, may be regarded (1) as a spontaneous semi-instinctive frame of mind or a semi-automatic habitual state in which we tend to see facts and situations in a certain emotional context, without any detailed analysis of why we see them in this context rather than in another. It represents a relatively vague, total, immediate and implicit reaction to a situation rather than the discriminative reaction of the cognitive consciousness. It is therefore largely in sensuous terms; there is always a rich background of organic and tactile-kinæsthetic imagery (which is the imagery of emotion) even if the content be formally presented in auditory or visual terms.

(2) Æsthetic judgment and the æsthetic criterion represent this semi-instinctive mode of interpreting situations in the act of being brought to consciousness for intellectual reconstruction, and to this extent is a deviation from the appreciative attitude as such. Yet such cognitive and descriptive analysis of the æsthetic moment is essential, since the appreciation of value comes to full fruition only in connection with the reconstruction of values. Value in consciousness, therefore, always tends to become intellectual meaning. What keeps it a value is simply the margin of emotional indeterminateness and implicitness which surround even the most abstract analysis. The æsthetic judgment, so-called, differs, not necessarily in being less intellectual, but in dealing with the situation, describing and evalu-

ating it, in terms of the more concrete sense imagery; as was suggested above, in terms of the organic and tactile-kinæsthetic imagery lying at the basis of the emotional consciousness, rather than in terms of the visual and auditory imagery which are the chief instruments of the logical and abstract intellectual processes.

(3) This throws light on the statement that the æsthetic attitude is contemplative and disinterested rather than actively investigative or applicative in its point of view. It is free, not in the sense of being independent of all non-æsthetic ends, but in the sense of being free from bondage to any particular non-æsthetic end: it represents these ends in a state of very intimate and organic interaction. This is what is meant, too, by saying that æsthetic values are intrinsic rather than instrumental or transgredient, and by saying that they represent a simultaneous rather than a successive type of association. In the serial type of experience-process the steps or means by which the end is achieved are abandoned, as Miss Adams says, as they fulfill their purpose 'without contributing materially to the total consciousness of the end,' whereas in the immediate or simultaneous type the various stages of the process of evolution of means are taken up into the end and become an integral part of the result: the means are subsumed into the end, not discarded as soon as they have performed their function. While, of course, neither type of experience is independently possible, yet in a rough way it is true that the economic and ethical values seem to conform to the first, and the æsthetic more to the second type.

(4) Judgments of æsthetic valuation are determined, not merely by the fact that they satisfy a craving, need or tendency of the organism; it is not merely a matter of the satisfaction of personal preference, although this element is prominent, but the æsthetic value represents the liberation and organization of other values; it represents other values becoming adequate, becoming relatively intrinsic rather than merely instrumental. All values in this sense tend to become æsthetic. "Æsthetic satisfaction," as Professor Santayana says, "comes to perfect all other values; they would remain imperfect if beauty did not supervene upon them, but beauty would be absolutely impossi-

ble if they did not underlie it.”¹ And as he says elsewhere, “All values must be ultimately intrinsic.” “Somewhere we must reach the good that is good in itself, and for its own sake, else the whole is futile.” ‘This reduction of all values to immediate appreciation,’ means that æsthetic values are ultimately ‘the only pure and positive values in life’ (p. 30).

(5) The æsthetic criteria are ultimately social in character, as are the criteria of intellectual life, but they are more open to alteration by personal preferences because less closely bound up with objective utilitarian, scientific and ethical considerations. This is evident from the affective-volitional basis of æsthetic appreciations as contrasted with the predominantly intellectual control of the other types of so-called value judgment, such as the economic and ethical. The ethical value experience stands closest to the æsthetic in this respect.

5. *The Alleged Absoluteness of Æsthetic Values.*

There is an opinion current among recent writers on æsthetic theory that there are certain æsthetic appreciations or judgments which are ultimate and self-evident, which, in other words, are not derived. Let us examine the arguments of the most recent exponent of this view.

Miss Puffer in her *Psychology of Beauty* (pp. 31, 34) says that the attempt to approach the problem of æsthetics from the point of view of an analysis of beautiful objects cannot yield any result because “the field of beauty contains so many and so heterogeneous objects,” and because of the difference of opinion as to what elements are beautiful. And she throws out the genetic or historical inquiry as to the evolution of æsthetic objects and art forms because she says such a study, while describing the conditions and accompaniments, does not explain the essence of beauty.

She admits the possibility of an analysis on the subjective side. The psychologist is able to ‘select the salient characteristics of his mental state in presence of a work of art,’ and by experimental study to see ‘how the particular sense-stimulations could become the psychological conditions of these salient charac-

¹ *Philosophical Review*, XIII., p. 326.

teristics.' "Such elements as can be shown to have a direct relation to the æsthetic experience are then counted as elements of the beauty of the æsthetic objects, and such as are invariable in all art forms would belong to the general formula or concept of beauty" (pp. 33, 34). But even here, she maintains, "the essential elements are hard to isolate" (p. 34), so that she thinks an empirical treatment of the subject must necessarily fail. There must be 'an absolute standard somewhere' (p. 35), and hence a 'philosophical foundation' is 'the first condition of a true æsthetic' (p. 36).

She goes on to say that while the 'end of beauty' is 'fixed by philosophical definition' (p. 37), the means by which this end is realized, *i. e.*, the constitution of beauty, are a matter for scientific investigation. For, she says, "to determine what anything does, or fulfils, or exemplifies, is not the same thing as to determine what it is in itself." "To ask *how*, is at once to indicate an ultimate departure from the philosophical point of view; for the means to an end are different, and to be empirically determined" (p. 37). "Philosophy must lay down what beauty has to do; but . . . psychology must deal with the various means through which this end is to be reached" (pp. 37, 38). "The nature of beauty must be determined by philosophy; but the general definition having been fixed, the meaning of the work of art having been made clear, the only possible explanation of our feelings about it . . . must be gained from psychology" (p. 39). "Our philosophical definition of beauty has thus taken final shape. The beautiful object possesses those qualities which bring the personality into a state of unity and self-completeness." "The nature of beauty is indicated in the definition; the origin of beauty may be studied in its historical developments; its reason for being is simply the desire of the human heart for the perfect moment" (p. 49).

The foregoing passages indicate in a general way the *a priori* method Miss Puffer follows in finding a philosophical foundation for her æsthetic theory. In her first chapter on 'Criticism and Æsthetics,' she sets forth her reasons in detail for rejecting the genetic and historical considerations. She calls attention to the two traditionally opposed schools of literary

criticism: the impressionistic and scientific. The former aims "to bring a new piece of literature into being in some exquisitely happy characterization; to create a lyric of criticism out of the unique pleasure of an æsthetic hour. The stronghold of the scientist, on the other hand, is the doctrine of literary evolution," and the aim is "to show the history of literature as the history of a process and the work of literature as a product; to explain it from its preceding causes, and to detect thereby the general laws of literary metamorphosis" (pp. 3, 4).

But a new point of view meanwhile has arisen; that of the appreciative critic. "His aim is, primarily, not to explain, and not to judge or dogmatize, but to enjoy . . . and to interpret this charm imaginatively to the man of his own day and generation." (Gates, quoted by Miss Puffer, p. 4.) It is 'imaginative interpretation.' The purpose of the appreciative critic is "the illuminating and interpreting reproduction of that work, from material furnished by those other forms of critical activity," the personal reactions of the impressionist and the explanations of the scientific critic.

Miss Puffer says that the 'real weakness of appreciative criticism' is that "it possesses no criterion"; "it can never tell us what we are not to like" (p. 6). It, no more than impressionism, can tell us what to appreciate. And she rules out scientific criticism on the ground that historical or genetic considerations have no bearing on the question of value. In Chapter II., on 'The Nature of Beauty,' she says that the study of the genesis and the development of art forms 'leaves the essential phenomenon absolutely untouched.' She admits that the various types of artistic expression have been shaped by social forces, religious, commercial, domestic, but she denies that this throws any light on 'the reason why beautiful rather than ugly forms were chosen.' To discover the *totemic* origin of a decorative motive does not account for its 'essentially decorative quality.' "These researches, in short, explain the reason for the existence, but not for the quality, of works of art" (p. 33).

Scientific criticism views history literally as a process. "But how can the conception of values enter here?" "If the horse of the Eocene age is inferior to the horse of to-day, it is because, on M. Brunetier's principle, he is less horse-like. But who shall

decide which is more like a horse, the original or the later development? No species which is constituted by its own history can be said to have an end in itself" (pp. 8, 9). The work of art, as a thing of beauty, says Miss Puffer, "is an attainment of an ideal, not a product, and, from this point of view, is related not at all to the other terms of a succession, its causes and effects, but only to the abstract principles of that beauty at which it aims" (p. 9). "As little as the conformity of the fruit to its species has to do with our pleasure in eating it, just so little has the conformity of a literary work to its *genre* to do with the quality by virtue of which it is defined as art" (p. 10). "The defining characters of the work of art are independent of time" (p. 10). "The world of beauty and the world of natural processes are incommensurable, and scientific criticism of literary art is a logical impossibility" (p. 11). "The standard of value is the canon of beauty, not the type" (p. 11). "The very possibility of a criticism . . . must stand or fall with this other question of a beauty in itself . . . an absolute beauty" (p. 12).

This absolute standard she finds in 'the eternal properties of human nature,' the 'original constitution of mankind,' which is 'subject to no essential metamorphosis' (p. 16; cf. p. 25). "This is the essence of beauty, the possession of a quality which excites the human organism to functioning harmonious with its own nature" (p. 15). "The cause of the production of a work of art may indeed be found by tracing back the stream of thought; but the cause of its beauty is the desire and the sense of beauty in the human heart" (p. 17). "A master work, once beautiful according to the great and general laws, never becomes, properly speaking, either more or less so" (p. 20).

But what are these 'laws of beauty?' grounded in 'the original constitution of mankind' which, as Miss Puffer says, are 'practically changeless,' if they are not just the funded contents, the capitalized culture-reactions of the past history of the human race? And what is this but saying that the standard of value is not a fixed timeless absolute one, but rather the type? It is no adequate basis for rejecting the point of view of the appreciative critic, that he 'seeks a further beauty outside of the object, in his own reflections and fancies about it' (p. 19), since he too is a member of the human race and plays his part, be it

great or small, in helping to mould this type or social standard which is the ultimate criterion of beauty.

It seems to be assumed by Miss Puffer, and by many other writers on æsthetics, that if the æsthetic consciousness can be shown to be derived from preëxistent non-æsthetic elements, there is reason for doubting its truly æsthetic character; while if, on the other hand, it can be shown to be an original endowment, its distinctive character is vindicated. But origin can only mean an unanalyzed priority; it is not different in kind from that part of the temporal series whose derivation or developmental process has been ascertained. Mere ignorance of conditions cannot therefore be a guarantee of the nature of the content evolved. The fact that the æsthetic consciousness has been evolved, *i. e.*, is continuous with some other series of events which we do not call æsthetic, is no proof that we do call by that name is not what it purports to be. A reconsideration of the nature of that content because of this connection may be necessary, but this principle will operate equally in the opposite direction; these other facts will likewise require to be reinterpreted in the light of the æsthetic phenomena to which they are related.

But if it be admitted that all æsthetic judgments and appreciations are equally derived, it seems evident that this characteristic alone cannot serve to invalidate any one of them. The criterion of æsthetic values must be determined by some other principle than their conformity to some ultimate and absolute, because underived, standard. Does it follow that because æsthetic ideas and artistic standards have changed with the change of social conditions and social environment, that there is nothing absolute in the sense of relatively stable in the æsthetic criterion? "Is the only way to get anything absolute to get a static thing that will not change? Or can you combine the conception of absoluteness with a continuous process of change?" asks Professor Dewey. That is, is it not possible to find an objective standard in the type, by a study of the social content of art at different stages in its history, *i. e.*, in just the considerations which Miss Puffer rules out as irrelevant? In this sense there may be found an æsthetic principle or criterion of taste; "there is a certain proportion that remains the same." It is the absoluteness of a

ratio. "If one of the terms varies, the other must vary." The æsthetic law expresses a certain relation of the individual to the social and of the social to the individual. There is, as it were, a relative fixity of the principle of change, a law of the process of continual movement, a symmetry and order in the progressive metamorphosis. It is not a question simply of comparing the early and late or the higher with the lower, but, through the consideration of these various stages, to see something of what the law of the development is. If there is any absolute and permanent principle, it must be found, not in any particular definition of beauty, but in the relationship of beauty to the conditions out of which it has grown. It does not follow that because the consequences are not to be reduced to the antecedents, because beauty is not to be reduced to utility or truth, for example, that therefore the practical or intellectual origin of these things has no bearing on questions of æsthetic value. On the contrary, derivation supplies the only terms in which value can be intelligibly stated.

It is a common defence of the absoluteness of value considerations to say that "position in time has nothing whatever to do with authoritativeness." But this isolating and fixing of the criterion makes it absolutely formal and therefore valueless as a concrete test in the particular case. Its absoluteness and universality are gained by abstracting from reference to the specific occasions in which the experience of beauty arises and in which it functions. As Professor Dewey says of the formal logician, "the very denial of historic relationship and of the significance of the historical method, is indicative only of the unreal character of his own abstraction. It means in effect that the affairs under consideration have been isolated from the conditions in which alone they have determinable meaning and assignable worth."¹ What Professor Dewey says of logical theory applies equally well here that it "waits upon a surrender of the obstinate conviction that while the work and aim of thought is conditioned by the material supplied to it, yet the *worth* of its performance is something to be passed on in complete abstraction from conditions of origin and development."²

¹ *Studies in Logical Theory*, p. 14.

² *Ibid.*, p. 64.

AN IMPORTANT ANTINOMY.¹

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It not seldom occurs that the presence in an individual's mind of cognate problems leads by slow process of assimilation to a new view-point in which what was before separate, gathers fresh import in a larger whole. Such is, undoubtedly, the genesis of all constructive inference; the hewing of wood and drawing of water being but preliminary to the synoptic vision without which the weary task-work avails little. It is in the hope that I may indicate a fruitful synthesis to others with keener or more trained perceptions that I undertake the labor of the following presentation of the relationship of the mind-body problem and an antinomy.

In his chapter on nature² Mr. Bradley discovers an insoluble contradiction which leads him, not unwillingly, to the altar of the Absolute. Without calling in question his other journeys to the same shrine, I must acknowledge that this one seems unjustified. Before going further let me state the antinomy and its meaning as nearly as possible in his own words. “(a) Nature is only for my body; but, on the other hand, (b) my body is only for nature.” A slightly different form of this antinomy including the traditional Kantian emphasis on man's reason as the law-giver to nature is given by Professor Royce:³ “But we, of course, all recognize a sense in which man is to be conceived as a part of nature; while, on the other hand, nothing is clearer than that for us, all our beliefs about nature are determined by conditions which belong in one respect to the mind of man.” Preparatory to the development of the two sides of his dilemma, Mr. Bradley points out what may be called the natural realism of common sense. We get the notion of a world consisting of primary and secondary qualities and extended in space and this world strikes us as

¹The MS. of this article was received May 3, 1908. — ED.

²*Appearance and Reality*, ch. 22.

³*The World and the Individual*, Vol. II., Lecture IV., p. 158.

not dependent on the inner life of any one. Our bodies with their organs are taken as the instruments and media which should convey it as it is and as it exists apart from them (p. 262). But as a result of the antagonistic growth of the physical and mental sciences doubts arise, the physicist and the psychologist being forced by the pressure of their data and methods to pass far beyond this naïve position. The result is the conflict between impersonal scientific objectivism which knows no peculiar starting-point, such as the individual's body and the tendency to a pluralism, on the part of the psychologist, who deals perforce with individuals and their perceptions and ideas as mediated by their bodies. In brief, this conflict is due to the fact that physics knows nothing of the individual whereas psychology does.¹ To sum up the difference antithetically: while things are looked upon as at least relatively permanent collocations of matter, consciousness is considered a flux of presentations somehow cognizant of these things; while physics deals with the extended in space, psychology has to do with the unextended; while, in the external world, individuality is unknown, the distinctive characteristic of consciousness is its unity; while in nature, as the term is used, mechanism seems provedly to rule, mind is teleological; while matter in motion gives no heed to values and ideals, this heedfulness and selectiveness is markedly true of mind. These groups of science, dealing respectively with what is usually called mind, on the one hand, and matter and energy, on the other, have developed naturally enough, nay seemingly inevitably, different norms and categories which clash relentlessly when brought in contact. And this antinomy of Mr. Bradley seems to me to express this contrasted development.

Examining the two sides of the dilemma, we discover that "the proper consequence of (*a*) appears to be that everything else is a state of my brain" (p. 263). This brings out the prerogative character of the brain as in some, so far unexplained, way the center of *my* physical universe. It would be possible to use the metaphor of a hub from which spokes radiate in all

¹ "The material world shows us no real individualities; these are first known to the psychological standpoint from which inner centers of memory, action and endurance are discovered." Höffding, *Psychology*, p. 66, note.

directions, or of a spider's web whose strands run inward to where the spider awaits.¹ But if the world is my brain-state, then what is my own brain? "To me my own brain in the end must be a state of my own brain," or, combining the two sides with Mr. Taylor² "the physical order as a whole, must be a 'state' of my nervous system which is itself a part of that order." Turning now to the second thesis, facts as obvious and undeniable confront us. "Most emphatically, my organism is nothing but appearance to a body. It itself is only the bare state of a natural object. It is clear that for the existence of our organism, we find the same evidence as for the existence of outer objects. . . . Both nature and body exist necessarily with and for one another" (p. 265). Body and nature, then, are on the same level for this position, and naturalism might easily take the bit in its mouth, were it not for the warning voice of the psychologist who stands sponsor for the earlier thesis. We are obliged to include our own body as a member in this impersonal and common world of things which we have constructed in social intercourse, and the prerogative which attached to our bodies while we were looking at the first side of the antinomy disappears. For our perceptual experiences, nature focuses itself in our bodies; a certain perspective is shot through all our immediate experiences of the world; there is a definite 'here' and 'now' as a point of departure and this 'here' is where my body is situated at the time. Logically this is witnessed to by the difference between perceptual and hypothetical universal judgments. Moreover, physiology, and in particular that of the sense-organs, emphasizes the rôle played by the organism as the hero of the piece. In the distinctively conceptual view of the physical world, on the other hand, the 'meanings' of 'common' and 'independent' attach; the 'here' and 'now' has been largely abstracted from and the impersonal scientific 'I' rules

¹ "The consciousness of self is a relatively permanent factor of our experience and that important constituent of it, the consciousness of the body, is perceived to be a condition of the occurrence in consciousness of other experiences. . . . The body — a something of which we are conscious — is perceived to be a condition of our having other experiences." Fullerton, *Metaphysics*, p. 199, note.

² *Metaphysics*, p. 199.

the outlook with the fixed stars as points of reference and even our body is engulfed in this continuous, all-embracing world.

To what conclusion does this antinomy, which seems so suggestive, lead Mr. Bradley. He infers that the "physical world is an appearance; it is phenomenal throughout." Again, "the physical world is an abstraction which for certain purposes is properly considered by itself but which if taken as standing in its own right becomes at once self-contradictory" (p. 267). To me this is no satisfactory resting-place. Certain questions arise inevitably. Does it not signify that the physical world *as we perceive it* is not self-supporting apart from our perception of it, yet that we have strong motives to make such an hypostatization? On the one hand, the body is simply one thing in the world with no special primacy; on the other hand, for me the world can well be considered the adjective of my body, especially of my sense-organs and brain. Is it possible to do justice to both sides of this antinomy? I think it is. Suppose nature to have a different meaning in the two statements; they would, then, no longer contradict one another.

"Nature is only for my body." This judgment has its *raison d'être* in the fact that *my* conscious experience is, in some sense, an ultimate for me. On the basis of perception, by means of constructive inference and memory, I laboriously build up what I call my world. A great deal of this construction is either unconscious or else socially mediated, coming to me not in the raw but in a prepared condition. The facts of communication must be accepted but we must also never forget that each individual is active, that he must interpret what he receives through the eye and ear. The recognition of this apperceptive function is the achievement of logic and psychology which can be least disputed. Consequently, though each individual is aided in the formation of his world by others, yet he must be the main factor in the work and the final result, giving the perspective of his peculiar purposes and selective interests, has always a unique character which proclaims this fact.¹ The logic of value is especially insistent on this uniqueness of each individual's experience. "Nature is only for *my* body," then,

¹ Cf. Stuart, in Dewey's *Studies in Logical Theory*, p. 319.

stands for this pluralism of experiencers. Nature, here, must be looked upon *idealistically* as a construct of mine, based upon, and growing out of, my experience, which seeks to include all my experiences of physical things and all my possible experiences as indicated by the statements of others. The desert of Sahara forms part of my nature because I have read about it and have no reason to disbelieve that it is continuous with the soil on which I now stand. That the extent of each man's 'nature' varies directly with his education and training or, to put it succinctly, with his development scarcely needs detailed elucidation. But while the analysis of the obvious is not required the import of the obvious is. And if evolution has any epistemological significance, it lies here, in the fact that the increasing complexity of the brain runs parallel with increasing intelligence and intelligence with the organization of the individual's experience in space and time, or, in other words, with his 'nature.' But what can this mean, if not that each individual has its own kind of nature? That of the fish gazing out of the pool must have hardly a semblance to ours, and the dog's 'nature' constructed so largely on the data of scent, must also even in its elemental character differ widely from that of the fish or from ours. Cannot comparative psychology with all its labor force philosophy to a wider prospect in which human egotism may sink itself? Surely Buddhism would be more hospitable to this truer humility than Christian thought has shown itself, except, perhaps, in the mystic love of St. Francis for his brothers, the birds. The relativism, then, that comparative psychology teaches carries but to a more scientific expression the first thesis of our antinomy, "Nature is only for *my* body."

In this idealistic sense, then, there are as many 'natures' as animals even though in the more highly developed consciousness of man the meanings of 'commonness,' 'betweenness' or 'independence' may attach themselves so that nature is thought of as independent *in some sense* of *my* nature. It is this struggle of realism to be born from idealism that has so puzzled philosophers who could see only one side of this antinomy or who, seeing both sides, could not reconcile them. Not only does the solution

of this apparent contradiction lie in the two meanings of 'nature' but it focuses in the mind-body relation giving an additional proof of what I have called the fourth progression.¹ By a study of the mind-body relation in connection with this antinomy, moreover, I think we can convince ourselves that realism involves personal idealism and that personal idealism would be meaningless without realism.

"My body is only for nature." It seems impossible to exclude my body from nature just because I learn of its existence in the same way that I learn of the existence of other things and other bodies. Furthermore, as the conceptual view of the world grows clearer, the impersonal standpoint, that of 'experience-in-general,' supersedes the concreter outlook, at least in certain reflective attitudes, and (may philosophy pardon my vulgarity!) the food question prevents hesitation. Every dish of porridge bears witness against any *alibi* for my body. More seriously, and with more academic dignity, let me refer to the exact experiments of Rubner and Atwater on the conservation of energy in the human organism. Admitting, then, nature's right to take my body unto herself in pursuance of her universal imperialism, we shall do well to ask ourselves some of the formal characteristics of this nature which engulfs the body. First, it is continuous. My body is in functional relation with the things around it and these, also, are in unceasing interaction with each other. Only the fairy-hand of science can reveal much of this delicate interplay and interdependence and only the eyes anointed by her can witness the subtle weaving of nature's living garment. The vital equilibrium of the organism with its surroundings, its stern struggle for ever fresh supplies of energy, its purposive self-maintenance, and, still more impressive, because more inclusive, the reciprocity of all part of nature with all, deserve recognition better accorded in the term *dynamic continuity* than in that of monism with its vague idealistic inclinations or number symbolism. Second, conservation of energy, capacity or power of doing work, obtains in the transformations that unweariedly occur. This conservation makes meaningless any question of absolute origin. Third, nature is a universe in the

¹ Cf. PSYCHOLOGICAL REVIEW, September, 1907.

sense that it is self-sufficient, no influx nor efflux being required or thinkable. Though Mayer and Helmholtz, perhaps Joule and Atwater, have proved this as far as experiment can reach, yet only if this formally-conserved universe can include consciousness will its complete self-sufficiency be assured. But how can this be done? Even while we are duly impressed by these tremendous and apparently proved facts, personal idealism as representative of the other side of our antinomy whispers doubt in our ear: "It cannot be the body as an experience of yours which is swallowed up in this 'macrocosm' called nature nor can this nature be identical with your construction which you have labelled with the same name." Harkening to this voice, must we not take a realistic attitude towards the body and towards nature in the second thesis of this dilemma? "My body is only for nature," yes, but for nature as 'macrocosm,' as reality. Does not this satisfy our antinomy and resolve the contradiction? But this was precisely the conclusion of a former study of the mind-body relation, where we saw that, corresponding to the psychical attitude towards another's mind, a realistic attitude towards his body must be taken.

What, however, is realism, and what is a realistic attitude towards a thing? This we are in a position to define more clearly. Starting, as I believe metaphysics must, from an individual's conscious experience, realism signifies that things are independent for their existence of his experience of them. In short, my experience does not affect the things around my body in any way unless it leads to an overt action on the part of my body. I may think about the book before me in any manner I choose but, until I take it up, an act mediated by my body, it is not changed. This does not mean that the book is as it is experienced as independently of my experience of it. That would be naïve realism, which, like idealism, is a stuff-theory of reality. Realism, as I have defined it, is not concerned, at least at first, with the character of the stuff of reality but with the relationship of the 'microcosm' of the individual's experience with the 'macrocosm' of reality, and the conclusion we have been forced to arrive at from a study of the dilemma is that nature has two meanings, my nature, a construct in my experience, and nature as *other than* my experience.

Now these 'microcosms,' or minds, seem to be intimately associated with certain peculiarly differentiated and organized nodes of this 'macrocosm.' This primacy of the brain was expressed above in the first thesis, "the proper consequence of (a) appears to be that everything else is a state of my brain." Consequently our problem has changed into the brain-mind relation, for, in the brain, microcosm and macrocosm meet. Can any clue be found to rede the riddle? I think so — *consciousness is a variant*.¹ An experience, once gone, is gone forever. The Heracleitean flux is surely true of the stream of consciousness. My approach, then, has led me to a possible solution of the old problem of change and permanence, or change and conservation. Reality is a process but a stereometrical and conserving process and a careful reflection finds no reason why activity should involve destruction of the capacity for action on the part of reality, every reason, however, why activity should imply changes. As a matter of fact, conservation of the capacity of reality (conservation of energy) exists and there is also change, since transformations of energy are as evident as quantitative identity. Now change involves variability of some sort. But consciousness, as we have seen, is a variant. Does this not lead us to the position that consciousness is the variant of the change-process of that part of reality called the pallium or cortex? The macrocosm thus embraces consciousness, does not reject it as alien. This result is further enforced by the facts of death and sleep. When the brain ceases to function, consciousness disappears. Such a functional identity is hinted at by Höffding though his double-aspect theory prevented his realization of it. "Sensations, thoughts and feelings are mental activities which cannot persist when the definite individual connection in which they occur, has come to an end. *They correspond to the organic functions* (italics mine), but not to the chemical elements. If the organism is resolved into its elements, organic function is impossible."

It is highly probable that a question may arise in some reader's mind with respect to the relation of variant and in-

¹ Cf. *Journal of Philosophy*, etc., Vol. V., No. 9, 'Consciousness and Conservation.'

variant, so I hasten to make my position clearer on this point. It is, in a certain sense, the application of a double-aspect theory to reality. Reality is a process, everything in modern science cries this aloud, but it is somehow a self-conserving process. Dynamics precedes statics. "From motion we attain the notion of force or energy, by means of which equilibrium becomes intelligible."¹ But dynamics in no wise precludes change nor does it negate permanence and lawfulness. The category of process, then, contains in itself both attributes in peaceful contiguity. The invariant is not a thing somehow related to another thing called the variant in a most paradoxical fashion, it is not an atom or a piece of so-called energy, and any question as to whether the variant or invariant is effective in the process of reality is, therefore, absurd and results from a misunderstanding. Reality, as a process, may be regarded from the side of conservation, and this gives its invariant aspect, for us stated in terms of phenomenal energy; or from the side of change or variancy and here we are, fortunately, direct participators, we experience change immediately. We are, in short, dealing with distinctions, not with things, and there is no reason why we should reify these aspects of the reality-process and thereupon bewilder ourselves in the attempt at their relation.

What, however, is the consequence of this doctrine of functional-identity or variancy? It is that the question of the efficacy of consciousness has ceased to contradict the principle of conservation of energy. Conservation having become a formal characteristic of reality and this reality including consciousness, there can be no objection raised of influx or efflux. The first movement is towards what I would call temporal 'parallelism.' The old way of raising the problem of the effectiveness of consciousness was dualistic. Interaction was dualistic. The physical and the psychical, really abstractions of the impersonal scientific logic and methodology of physics and psychology, glared sullenly at each other across a yawning chasm. Even in so stating it I overreach myself and lapse into spatial imagery for the gulf between mind and matter was one of quality like that between the king and beggar-maid and the marriage could

¹ Höffding, *The Problems of Philosophy*, p. 91.

be consummated only by God (Cartesianism). A restatement is now possible in this monism which I have advanced. We may ask, Is consciousness efficacious, has it any function? And this launches us upon the hitherto treacherous sea of ontological or real causation. I realize how impossible it is to treat adequately this extremely technical problem in brief space, so I shall content myself with a condensed outline.

Are there any facts that point toward the efficacy of consciousness? If so, an analysis of these may give us a hint of great value. First, evolution seems to demand the effectiveness of consciousness. Thus Darwin speaks of the sense of hunger and the pleasure of eating as, no doubt, first acquired in order to induce animals to eat.

He also thinks we may safely infer that the parental, filial and social affections have to a large extent gained place through natural selection.¹

Second, the relation of consciousness to habit seems to be that of changing function to fixed function. Consciousness, like attention with which it is closely related, attends the reorganization of habits. It thus allies itself with function-in-the-making and, at the present, the inclination of biologists is towards the temporal priority and moulding character of function in relation to structure. Function, in the higher and more complex organizations precedes structure and makes it possible. But, as we saw, consciousness as a variant corresponds to function.

Third, consciousness is selective and practical in its primary character. So much is this the case that everything points to its adaptive character and work in the economy of the organism, only the impersonal logic of science, which, at the expense of an infinite series, negates individual initiative, could for a moment believe that blind mechanism could react so effectively to a continually changing environment. Biology with its doctrine of 'organic selection' reveals this necessity,² and modern sociology demands the play of intelligence even more earnestly.

Fourth, "it is a well-known fact that pleasures are generally associated with beneficial, pains with detrimental experiences.

¹ *Descent of Man*, Vol. I., p. 8 ff., quoted from J. Ward.

² Cf. Baldwin, *Development and Evolution*, p. 117.

But if pleasures and pains have no efficacy, one does not see (without some such *a priori* rational harmony as would be scouted by the 'scientific' champions of the automaton theory) why the most noxious acts such as burning, might not give thrills of delight and the most necessary ones, such as breathing, cause agony."¹ So strong is this argument when examined carefully that so stern an upholder of the so-called physical world and its laws as McDougall concludes that "the evolutionist finds himself confronted with the following dilemma: Either pleasure and pain are efficient causes of appetite and aversion and therefore have played in biological evolution a part of incalculably great importance, or we must postulate divine interference with the course of evolution at some early stage of the development of the animal kingdom."² Those who know McDougall recognize how much this admission means.

Fifth, the development of the trial-and-error theory in connection with excess-discharge or uncoördinated functions demands teleological selection.

We have gleaned two things, at least, from this enumeration. There are weighty reasons for belief in the efficacy of consciousness and the clue seems to rest in the relation of function and structure and thus to growth and organization. But death and disease or disintegration of any kind show that *organization is also a variant in the process of reality*. What could be more natural than to conclude that these are related directly? What stands in our way? Not conservation of energy, for we have surmounted that, but mechanism. And here is where the doctrine of grades of causal relation comes into use.³ Reactions are undoubtedly selective in organisms, enzymes⁴ and even in chemical elements. I have not decided yet whether resonance in physics can be brought under the same idea. The type of causal process depends apparently on the organization of the interacting nodes of reality. This is what one would expect, and only the atomism of mechanical

¹James, *Principles*, Vol. I., p. 143.

²*Physiological Psychology*, p. 160.

³Cf. 'Consciousness and Conservation,' *Journal of Philosophy*, etc., Vol. V., No. 9.

⁴Cf. *Science*, February 14, 1908, Chittenden.

theory can have prevented its recognition for so long. Man, of course, with his tremendously delicate and complex functional organization presents the highest type of causal reaction, ordinarily called teleological. If we look at the process temporally and call the antecedent, conceptually delimited in a continuous process,¹ the cause, and the consequent, the effect, there is of course in such a system no loss or gain of energy or capacity. But this is true of any such system and represents the aspect of conservation in a process. It, therefore, misses some vital aspect since it has no qualitative differentia for different processes, only differences in time coming to the fore. But if we pay attention to space and to the time during which certain amounts of energy are transformed and to the organization of the interacting 'nodes' of reality in any causal process system, marked differences appear. Ostwald, quantitative mechanicalist that he is, cannot see this, though he has his hands upon it time and again.² Höffding also has this view almost in his grasp when he says, "Maxwell himself recognizes that geometrical as well as dynamic concepts are indispensable to the explanation of nature. In contrast to the dynamic, the geometric denotes simultaneity."³ This explains in part why I have always called reality a stereometrical process with grades of organization and kinds of differentiation and, hence, degrees in selective reaction and influence. This in no wise conflicts with conservation, which is a temporal idea. Here is, I believe, a theory which may give articulation to the dissatisfaction with mechanism so widely current in late years among scientists themselves.

To sum up. By means of a study of an antinomy and the mind-body relation, I have sought to prove that we can handle reality as it is about our body even while it is independent for its existence, of our consciousness. This position affirms that the true starting-point for metaphysics is the individual and his experience, not experience-in-general, and that in the mind-body problem nearly all the critical questions can be seen to

¹ Cf. Bradley, *Principles of Logic*, p. 488.

² V. *Vorlesung über Natur-Philosophie*, p. 325, 'Regelung der Reaktionsgeschwindigkeit durch räumliche Bedingungen.'

³ *Problems*, p. 93.

focus. The realism we obtained is not a stuff-theory and is perfectly compatible with personal idealism, since consciousness is embraced by reality. Just because it is not a stuff-theory, in the old sense, it cannot be called materialism or energism, for these are logical realisms, *i. e.*, result from the reification of concepts. It is not an idealism, in the old sense, also, *because there may be kinds of variants* of which consciousness is but the one concomitant with that peculiarly organized and differentiated part of reality called the nervous system. Furthermore, this position is pluralistic in regard to the acknowledgement of separate centers of the experiencing. The doctrine of functional identity or variancy implies this. I cannot have your experience, *i. e.*, my experience cannot be numerically identical with yours, any more than my body can be your body. This position makes *communication on the basis of interpretation* possible. The monads, if one wishes so to call these 'micro-cosms,' thus get their windows through the body and its dynamic relations to other bodies. This agrees with logic, apperception, language and comparative psychology.

ON SEEING IN THE DARK.¹

REMARKS ON THE EVOLUTION OF THE EYE.

BY DR. OSKAR NAGEL.

In my investigations on certain properties of illuminant substances, I have had to study to some extent the anatomy of the eye and the optical functions in colored light and in the dark (beginning of brightness). I have arrived at certain conclusions relative to distinct optical perception in the daylight and in the dark, which possibly are of interest for comparative anatomy and physiology, and also for the theory of evolution.

First of all I may mention the anatomical and physiological facts upon which my conclusions are based.

The fibers of the optic nerve end in cylindrical rods (about 120 millions) and flask-shaped cones (about 60,000). The light-rays from an object, upon which our eyes are fixed, strike upon the fovea centralis, which contains cones only and no rods. The further we go away from the yellow spot, the more rods are found, and at the circumference they are in the majority. At the place where the optic nerve enters the eyeball, neither rods nor cones are present, hence this point is entirely insensitive to light.

When we fix our eyes upon an object, its image falls upon the yellow spot (foveal vision); hence during the action of direct (foveal) vision the rods are entirely out of action, while in indirect (peripheral) vision the rods come into action together with the cones.

In 1887, H. F. Weber found² during his investigations on the relative economy of incandescent lamps, that a carbon filament emits a ghostly gray light before the red-glow starts. This first trace of a misty gray light appears to the eye as something unsteady and glimmering. As the temperature rises, the brightness of this light rapidly increases, going over from gloomy

¹The MS. of this article was received March 13, 1908. — ED.

²See *Sitzber. d. Berliner A. d. W.*, 28, p. 491, 1887; *Wiedemann's Ann.*, 32, p. 526, 1887.

gray into ash-gray, yellowish gray and finally into fire-red. When the first trace of the red light appears, the last trace of glimmering, trembling and vibrating, which was present in all the stages of the gray-glow, disappears. According to H. F. Weber and E. Emden¹ the first emission of light is visible with gold at 423° C., with German silver at 403° C.

These observations led O. Lummer² to the following conception relative to the nature of our eye, wherein he ascribes following the theories of modern physiology, entirely different functions to the two sensible components of the retina, namely the cones and the rods, by considering same as two separate optical apparatus.

If we observe in a dark room the gradual increase of the temperature of a body, according to Lummer, our eye feels twice a sudden change, first from darkness to gray-glow and then from the latter to red-glow. In both cases this sudden change or transition corresponds to the transgression of the limit of sensibility of our optic nerve (the so-called threshold of sensibility). The arising of the gray-glow corresponds to the threshold of sensibility of the rods, the one of the red-glow however, to the threshold of sensibility of the cones. Hence the sensation of the gray-glow is effected by the rods, of the red-glow by the cones.

“Based upon the new physiological researches relative to the vision at low brightness and the influence of the purple pigment in the retina, the function of our two retina-organs was gradually separated and their separate tasks ascertained.”

J. v. Kries³ solved the still existing difficulties and contradictions by the hypothesis, that the cones form our color-capable ‘bright-apparatus’ and the rods our totally color-blind ‘dark-apparatus.’ According to this theory the cones enable us to see at great brightness and their irritations by the light-waves causes in the brain the sensation of color, while the rods which are totally color-blind, come into effect only at very low brightness and have the faculty of intensely increasing their sensi-

¹ *Wiedemann's Ann.*, 6, pp. 214-236, 1889.

² *Wiedemann's Ann.*, 62, pp. 14-29, 1897.

³ *Zeitschr. f. Psych. und Phys. d. Sinnesorgane*, 9, pp. 81-123, 1894.

bility in the dark. This property is called by Kries 'dark adaptation.' Before the cones react upon colored light, the rods cause in the brain the sensation of colorless brightness.

Hence we have at very low brightness a contest of the two optical apparatus which, at sufficiently low brightness, is settled in favor of the color-blind rods, so that then everything appears gray in gray, *i. e.*, in colorless brightness.

We can now understand why we do not see distinctly in a dark gray light (at low brightness); it is because, if we fix our eyes upon an object (*i. e.*, have an image produced on the fovea centralis), we have no apparatus that is affected by such image or light; the rods which are able to receive this light are absent from the fovea centralis and thence only a glimmering restless image is produced by an object in gray light. If we would have a sufficient number of rods among the cones around the fovea centralis, we would see much better in the dark than we actually see. This enables us to explain why a large number of animals see very distinctly in the dark. The cause of this most probably is, that in their eyes, which are of nearly the same construction as the human eyes, rods and cones are uniformly intermixed. It can be proven that a horse sees very distinctly in the dark, by simply taking a ride on a very dark night over country roads. The horse will trot and gallop as safely as in daylight, while sometimes the rider will be afraid, that the horse may stumble over a root or fall into a ditch. But there are even animals in existence which we positively know see much more distinctly at very low brightness than in the daylight: owls, etc. Here we have a case where, very probably, rods and cones have exchanged locations, as compared to the human eye. The rods are around the fovea centralis and the cones at the periphery. Hence with these eyes a distinct vision is effected at very low brightness, while at a greater brightness only a restless, glimmering sensation will be produced. While we see ghostly lights in the dark, the owl probably sees ghostly lights in the daylight. For physically a ghostly apparition is nothing else but a bright point which we cannot get into the foveal vision and which whenever we try to do so, is naturally vanishing, thereby causing the impression of motion.

We can infer, that as soon as the eye of about the construction of the mammalia—or aves-eye—was developed in the course of evolution, rods and cones were uniformly intermingled, or rather became uniformly intermingled by natural selection. Thereby the animals were adapted to the light in the daylight and in the dark. In such animals that are now procuring their food mainly during the night and in the dark, the cones were gradually driven back by the rods. In the human eye the opposite process took place; the rods were driven back by the cones. We only see a restless glimmering light, a ghostly apparition, where a horse will distinctly see an object.

Another question is whether we have simply lost the faculty of seeing in the dark or whether we have exchanged same for a higher faculty; we have lost one faculty which is of no use to us now and have gained one that is extremely valuable for our development. By driving back the rods we have concentrated and increased the strength and sensitiveness of our cones; we have developed and are still further developing and refining our sense for color and for light, our capacity for distinguishing the closest shades of colors. Whether we look at it practically or symbolically, we find that the driving back of the rods makes us masters of light and colors.

We can observe the development of the human eye within the historical times. Homer does not distinguish black from blue, but his heroes find their way as well in the dark night as in daytime. And now take a modern silk-dyer or cotton-printer who clearly distinguishes thousands of different shades, though he is not able to find his way on a dark country-road.

Rivers states¹ that some Australian tribes have but three expressions for colors, one for red, purple and orange, another for white, yellow and green and the third for dark blue and indigo. Some primitive races cannot distinguish blue from green, nor blue from violet. Tintometric tests have proven that in these races the threshold of sensibility is very low for red, much higher for yellow and very high for blue. Lobsien² has found that violet is frequently taken for brown by children; he

¹ *Popular Science Monthly*, 1901, p. 44.

² *Zeitschrift f. Psych. und Phys. d. Sinnesorg.*, 1904, p. 29.

shows that at the age of thirteen to fourteen years violet, orange and indigo are still struggling for their development.

We have reason to believe that this evolutionary contest between rods and cones does not require a long period and that adaptation is effected in a comparatively short time. Generally people that have lived in the country for generations and have to use their eyes in the dark, are in this respect very much superior to the inhabitants of the cities. In a few generations of city-life, however, this faculty is lost or rather exchanged for a higher faculty, which makes our eyes, from the standpoint of evolution, superior to the eye of the eagle or owl.

If we would know as much about the work and action of the different parts of the ear as we do of the eye, we would probably be enabled to form an idea about the limits of sounds perceived by the different species of animals.

DISCUSSION.

SOME RECENT DEFINITIONS OF CONSCIOUSNESS.¹

The problem of consciousness, like the poor, is ever with us. Every new departure in philosophy is marked by its own peculiar theory of consciousness, and it is therefore no particular occasion for surprise that in the present upheaval of old landmarks such theories should appear in unusual abundance. The central character of the problem makes repeated effort indispensable, but it also inevitably raises a presumption that each individual solution is at best but tentative and partial. But even if none of the definitions that are offered should win our unqualified approval, their significance as a stimulus to thought and as an index to the trend of things may remain indefinitely great.

If we take as our starting point the fact that consciousness may come and go in relative independence of objects, we reach at once the most fundamental disagreement among current theories when we ask whether this 'independent variable' consists of a unique and irreducible element, different in kind from all other existences, or whether the facts are susceptible of explanation without a hypothesis of this kind. The issue becomes still more sharply defined when we note that the theories which we propose to consider are all agreed in the classification of experiences such as desires, emotions and expectations under the categories of objects. These experiences are by common consent placed on exactly the same footing as all other objects, in the sense that they involve no peculiar stuff or material whereby they may be contrasted with other objects. The fact that such objects are less stable or permanent than physical objects is a circumstance which, however significant it may be for other purposes or from other points of view, has no particular bearing on the problem of consciousness. This use of the term object being agreed upon, the debate turns entirely on the question whether or not objects, plus relations which taken abstractly are not identical with consciousness, will suffice for the formulation of a tenable definition of consciousness.

According to the view advocated by Professor James, nothing further is required. Consciousness is adequately defined as a certain context or grouping of objects. "The peculiarity of our experiences,

¹ The MS. of this article was received April 6, 1908. — ED.

that they not only are, but are known, which their 'conscious' quality is invoked to explain, is better explained by their relations — these relations themselves being experiences — to one another.”¹ As a given experience originally occurs it is ‘a simple that,’ to which subjectivity is imputed, not by virtue of what it is, but by virtue of what it does or of the relations in which it stands. “Its subjectivity and objectivity are functional attributes solely, realized only when the experience is ‘taken,’ *i. e.*, talked-of twice, considered along with its two differing contexts respectively, by a new retrospective experience, of which that whole past complication forms the fresh content.”¹

While the given experience which thus functions in two contexts is necessarily a part of some individual experience, the contexts themselves are apparently distinguishable by the fact that one of them — the subjective — falls wholly within, and is thus identical with, ‘individual experience,’ while the other is mainly outside. Speaking of the contexts in which the perceptual experience of a room may appear, Professor James says: One of them is the reader’s personal biography, the other is the history of the house of which the room is a part. The presentation . . . is the last term of a train of sensations, emotions, decisions, movements, classifications, expectations, etc. . . . On the other hand the very same *that* is the *terminus ad quem* of a lot of previous physical operations, carpentering, papering, furnishing, warming, etc. . . . and the *terminus a quo* of a lot of future ones, in which it will be concerned when undergoing the destiny of a physical room.”²

It is obvious, however, that this differentiation cannot be our final word. To contrast the experienced as such with the unexperienced as such would require some more inclusive experience to which the two were presented. The key to differentiation must be found in the materials which enter into the personal experience. Accordingly Professor James distinguishes the two contexts also by a criterion which the personal experience furnishes, *viz.*, by the difference in behavior between the physical and the psychical. “Mental knives may be sharp, but they won’t cut real wood. Mental triangles are pointed, but their points won’t wound. With ‘real’ objects, on the contrary, consequences always accrue; and thus the real experiences get sifted from the mental ones.”⁴

¹ ‘Does Consciousness Exist?’ *Journal of Phil., Psych. and Sc. Methods*, Vol. I., p. 486.

² *Ibid.*, p. 485.

³ *Ibid.*, pp. 481-2.

⁴ *Ibid.*, p. 489. Cf. also Vol. II., p. 282.

It appears, then, that the concept of subjectivity also has two contexts, and that its meaning depends upon the context in which it occurs. In one connection it relates to personal experience as a whole; in the other it is a name for certain selected portions within the total experience. And as the meanings vary so their criteria vary. When the personal experience as a whole is identified with the subjective, the peculiarity of this order is placed in its 'sensible' or 'felt' continuity. As Professor James says, "There is no other *nature*, no other whatness than this absence of break and this sense of continuity in that most intimate of all conjunctive relations, the passing of one experience into another when they belong to the same self."¹ But when we come to distinguish the subjective from the objective as one of the constituents of personal experience, the criterion, as we have seen, is not sought in felt continuity, but in behavior.

This two-fold meaning of the concept of subjectivity naturally gives rise to the suspicion that all is not well with the theory. This suspicion appears to find justification as we proceed. The problem, we may remind ourselves, is to explain consciousness in terms of relations among objects. We have discovered so far three types of relationship; the first being the relation of felt continuity, whereby the individual experience as a whole is differentiated from other facts, while the other two are the relations of 'inner' and 'outer' as discovered or constructed within experience. It seems clear that consciousness is not to be identified with the first of these relationships, for the reason that, being coextensive with the experience of the individual, this relationship can not serve to differentiate between the two contexts which are involved in the situation. It is as much present in the objective as in the subjective context, in so far as these come within the individual experience. And while personal experience may perhaps be properly regarded as a context of objects, the felt continuity of the context need not itself be reducible to terms of context. But, on the other hand, it seems equally clear that consciousness cannot be identified with either of the other relationships, since these presuppose a conscious situation. It is only on this presupposition that the criterion of behavior has any significance. Precisely because the felt continuity or the 'conscious quality' is everywhere it is localizable nowhere. Explanation on this ground inevitably becomes limited to behavior, that is, to terms of context.

This ambiguity in the concept of subjectivity not only invalidates the position, but makes it fairly easy to account for the apparent co-

¹ 'A World of Pure Experience,' *ibid.*, Vol. I., p. 537.

herence of the theory. From the standpoint of personal experience as a whole it is evident that certain elements function in other settings besides those of which the experience becomes cognizant. If, then, we shift our attention to the distinction between 'outer' and 'inner' as it occurs within experience, we find ourselves unable to discriminate upon any basis save that of behavior. This change in point of view is the reason, as it seems to me, why the real problem fails to come clearly into view. If the felt continuity is the differentia of personal experience as a whole, the solution of the problem must be sought at this point, and the claim that felt continuity is not itself a matter of context but rather a unique and irreducible fact retains, at least for the present, an appearance of validity.

In the position taken by Professor Perry we find what is essentially the same attempt to interpret consciousness in terms of context. His presentation, however, while clear and stimulating as far as it goes, seems to meet the issue even less satisfactorily than does that of Professor James. "The field of consciousness," it is stated, "comes into view only when an incomplete experience is recognized as such from the standpoint of an experience regarded as objective. The corrected or discredited experience so determined in an experience of things, is regarded as merely my experience, and may be analyzed as such. But we must have passed beyond the psychical to become aware of it. These psychical data cannot be called things or reals in the same sense as the standard objects, for they are completed and replaced by the latter. We therefore provide a radically different category for them, and recognize that their content is common to themselves and to things, while their specific character is given them by their limitations and context."¹

Viewed as a solution of the difficulty urged against Professor James' theory, this exposition seems to suffer from obvious inadequacies. Indeed, the difference, so far as we are at present concerned, between the two arguments lies mainly in the fact that in the present instance there is not the elaborate shifting in the point of view, because there is not the same effort to meet the demands of the problem. Our attention is directed exclusively to the differentiation between subjective and objective as found within experience, to the neglect of the problem presented in the fact of felt continuity. Professor Perry's statement of the process of differentiation may be accepted *in toto*, but this does not necessarily commit us to any 'definition of consciousness in terms

¹ 'Conceptions and Misconceptions of Consciousness,' *PSYCHOLOGICAL REVIEW*, Vol. XI., p. 289.

of relativity.' Within a given experience we do, no doubt, differentiate by means of behavior or of context, but this in itself argues nothing as to the character of the differentia whereby my experience as a whole is distinguished from other facts. And I may add that an explanation in terms of context is to me a very unenlightening procedure. The objects which I experience are conjoined with each other and with other objects in innumerable ways, of which the set of conjunctions experienced by me is but one. Unless I can point out some specific differentia, whether it be a unique principle of linkage or a unique fact of some other sort, the problem of consciousness seems to remain about where it was at the beginning.

In view of the fact that Professor Perry shows so well the ambiguities that cluster around the term consciousness, it seems a great pity that after routing these enemies of clear thinking in a front attack he should admit them to the very heart of his camp, and even extend to them the comfort of his protection when they present themselves collectively under the guise of the term experience. So long as we do not differentiate unmistakably between the thing of which there is experience and the experience of the thing; or to put it differently, so long as experience is a term which is made to do duty as a name both for the thing and for my knowing of the thing, the precise nature of the difference between these two facts is not likely to stand out in relief. And I submit that this difference is precisely what we are after in the attempt to define consciousness. When an object becomes known, what is present that was not present the moment before? To apply to the object as such a term which connotes the presence of knowing or awareness is to stultify the whole undertaking from the start.

If such a use of the word experience is justifiable at all, it is so only on the basis of a theory which leaves no room for the distinction in question, and is, therefore, under no obligation to take it into account. In at least some of his utterances Professor Dewey appears to maintain a theory of this kind. The first four chapters of the 'Studies in Logical Theory' repeatedly represent the distinction between subject and object as purely functional in character, created by a specific need and existing only during the process of adjustment. The experience that is corrected and transcended, or the experience that is problematic and clamors for a solution, is classified as subjective; but it is so classified, not because it is a unique element, but because it fulfils a unique function. Similarly the concept of object is explicable completely in terms of function, and it has no significance

apart from a determinate experience. At any rate, it is stated that "It is a case of the psychologist's fallacy to read back into the preliminary situation those distinctions of mere conjunction and of valid relationship which get existence, to say nothing of fixation, only within the thought-process."¹ And again, "In so far as the conviction gains ground that the earth revolves around the sun, the old fact [sun revolving around the earth] is broken up into a new cosmic existence and a new psychological condition."¹

In this way it is possible to get along without resort to any heterogeneous element called consciousness. But this result seems to be achieved by the elimination of everything that falls outside of human or infra-human experience. It is true that Professor Dewey attempts to avoid this conclusion. While holding fast to the doctrine that objects apart from the experiential situations in which they function are abstractions, he also maintains that we must and can recognize a reality which antedates the existence of conscious organisms. The object as it is previous to experience is held to be in continual-transformation-in-the-direction-of experience; *i. e.*, this process of transformation is a fact, even though it is not a fact in or for a contemporaneously existing experience.

This explanation, however, seems to surrender all that is significant in the theory. If the functional theory of knowledge is true then time is as much a functional element as is any other constituent of experience. But if time is able to survive this abstraction from the experiential situation; if, in other words, time is essentially the same apart from experience as in experience, then it is not at all evident why the same might not be true of any other constituent of experience. Here, if anywhere, such distinctions are out of place. But if the privilege here accorded to time be extended to other constituents as well, we are at once obliged to admit the existence of objects conceived in the spirit of common sense realism; and the distinction between pre-experiential objects and these same objects as experienced is a problem which recurs once more.³

The foregoing considerations will perhaps serve to create a certain presumption in favor of the theories which explicitly affirm that consciousness is not reducible to something else, whether to relations in the sense of Professor James or to an intra-experiential function. It

¹ Page 37.

² Page 52. Cf. also pp. 42, 75 and 76.

³ The difficulties inherent in the position are excellently shown by Professor McGilvary, 'Pure Experience and Reality,' *Philosophical Review*, Vol. XVI., p. 266.

must be admitted, however, that the elaboration of these theories has not been particularly successful. The view recently put forward by Professor McGilvary is succinctly stated in the following quotation: "There is no object of consciousness, in the usual sense of the word object, which is 'made, and felt to be made, of consciousness exclusively.' . . . What consciousness is made of is consciousness, or in other words, awareness — which is not a very informing sentence, but is meant in the same sense as when one should say that red is just made of red, denying that you can probe deeper into the essence of it; it is to be taken at its face value."¹ With the exception of awareness, Professor McGilvary agrees that all experience may be treated as object. As regards the relation of awareness to its objects, it is held that awareness simply reports what it finds; whether the object existed previous to the finding is a question to be settled in each case by an appeal to empirical criteria, and never on the basis of its immediate relation to the awareness, *i. e.*, never by an attempt to determine whether or not the awareness is constitutive of the object.

While this theory is in appearance quite in accord with the spirit of our present-day empirical temper, its tenability becomes doubtful when we proceed to apply it to the facts. Common sense would agree that relations such as those of space and time exist or may exist independently of awareness. What it would say in the case of the relations of resemblance and difference is perhaps not quite so certain. When we come to the relations of meaning, however, the judgment would in all likelihood be reversed. Such a relation, it would be insisted, not only does not, but cannot, exist apart from consciousness. Here, then, it is necessary to take position. A printed symbol, for example, may mean the City of Washington or it may mean the North Pole; shall we say that this relation between symbol and symbolized might be conceived to exist, like space relations, in the absence of awareness or consciousness? Or are we justified in maintaining that the awareness or consciousness constitutes the relation and that, therefore, the suggestion of independent existence is unmeaning?

This question doubtless raises the issue squarely, but so far as I am able to see it cannot be answered definitively on this plane. For the sake of greater clearness we may distinguish between two aspects of the problem. The theory under consideration is committed to the support of two distinct though related propositions: (a) That within experience the distinction between meaning and awareness of meaning

¹ 'Realism and the Physical World,' *Journ. of Phil., Psych. and Sc. Methods*, Vol. IV., p. 685, note.

is everywhere present as a conscious fact (for otherwise we have lost our differentia for personal experience); and (*b*) that awareness is as readily separable in theory from relations of meaning as it is separable both in theory and in fact from relations of space.

The first of these propositions is obviously a question for introspection. If different observers disagree, there is so far forth no higher court of appeal. In my own case I am unable to verify the assertion that the distinction is present in all types of cases. With regard to the second proposition the personal equation is likewise very prominent. If a person asserts that he can contrive to conceive of meaning relations as existing apart from consciousness, it is not easy to see by what direct method the claim may be shown to be baseless. There remains, to be sure, the right to have it explained why it is that others should have so much difficulty in this same undertaking. An explanation on the basis of habit would scarcely suffice, because in all cases that could fairly be considered parallel to this the fact that an element is found variable or detachable in certain instances makes it possible to conceive of it in this way universally. I may never have experienced fire without heat or human beings without heads but the detachability here involved having been established in other fields, to think the one apart from the other is in neither case difficult.

It will perhaps prove more satisfactory, however, to approach the subject from a different angle. In Professor McGilvary's luminous exposition of James' 'Stream of Consciousness' it is suggested that the great psychologist "was after the 'transcendentalist' as well as after the facts, and in his endeavor to prove that introspection does not reveal an unalterable, time-neutralizing ego, he went to the extreme of asserting the existence of little egos, constantly neutralized by time, and transmuted each into its successor."¹ But however unjustifiable, on logical grounds, this procedure may be deemed to be, the instinct which led straight to the stronghold of transcendentalism seems to have been tolerably accurate. If it be true that "the speciously present consciousness continues flowing down the stream of time, always comprehending some past object as past, but, at every moment, itself so much of a unity that at no time in its steady flow can it be, except by a violent abstraction, spoken of as a new ego coming to birth immediately on the decease of its predecessor,"² the awareness can scarcely be prevented from taking on a metempirical and time-

¹ 'The Stream of Consciousness,' *Journal of Phil., Psych. and Sc. Methods*, Vol. IV., p. 230.

² *Ibid.*, p. 229.

neutralizing character. Our awareness during the waking day is said to be 'sensibly a unit as long as that day lasts.' This unitary character can scarcely reside in the qualitative sameness of the 'parts,' since such a unity would obviously account for nothing. We must, therefore, conceive of this unity as being of a kind which, for lack of a better name, may be termed a numerical unity. But it seems fairly clear that if the awareness of the morning be numerically identical with the awareness of the evening, in spite of the fact that the events of the morning no longer exist, the awareness itself cannot be considered as an event in the same sense, as being on a level with the events which constituted its objects. The awareness and its objects differ from each other as regards their respective relations to time, the relation of awareness to time being of such a sort that a considerable temporal interval is compatible with the numerical identity of the awareness. The main difference between this view and that of the traditional transcendentalist seems to lie in the degree of inclusiveness, the transcendentalist employing but a single 'time-form,' whereas in the present case the number of successive awarenesses, separated from each other by time-gaps, may be indefinitely great.

The first of these contentions, viz., that relations of meanings are constituted by consciousness, finds explicit recognition in the view advocated by Professor Woodbridge. These peculiar relations or connections of meaning, moreover, he considers to be the sole proper connotation of the term consciousness. Consciousness is nothing but a distinct kind of relationship, which is coördinate with other types of relation such as those of time and space. Over and above spatial, temporal and other non-conscious relations, we find that objects possess connections whereby they are enabled to represent one another in the peculiar relationship called meaning — connections which "hold the things in such a network of immaterial groupings, that their presence is other than spatial temporal or specifically qualitative."¹

The claim that consciousness is a specific type of relation is based on the results of a comparison of consciousness with other form of relation. We find, for example, that "space is distinguished from the things in it, not by taking these things in isolation, but by taking them together as different things in space";² and the same is true, *mutatis mutandis*, with regard to time and species and consciousness. Again, consciousness is like the rest in that it possesses its own unsharable na-

¹ *Studies in Phil. and Psych.* Garman Commemorative Volume, p. 161.

² 'The Nature of Consciousness,' *Journal of Phil., Psych. and Sc. Methods*, Vol. II., p. 110.

ture. This function of representation can be performed by no other kind of relation. Bread means nourishment, ice means that it will cool water, water means that it will quench thirst, whether the objects in question are actually put to these respective uses or not. Moreover, meanings may change or may be condensed, without any corresponding changes in the other relations of the objects, as when the meanings of the solar system are condensed in a book.

As has already been indicated, the identification of consciousness with meaning probably contains an important truth. That it is the whole truth is, however, much open to doubt. If consciousness is merely a name for the relationship of meaning, the task of maintaining a status of equality and amicable independence among the various forms of relationship becomes about as difficult as in the case of the Spinozistic attributes. In both instances consciousness persistently disturbs the balance of power. The fact that consciousness is a continuum within which all objects whatsoever may find a place is fundamentally incompatible with the requirements of the situation. While it is true that space and time likewise make provision for all manner of fact, it is not true that in order to occupy their appointed places these facts must first divest themselves of all properties which are not specifically spatial and temporal in their nature. To say, however, that consciousness is relationship of meaning seems equivalent to the assertion that a fact can become a fact for consciousness *only* in so far as it is a relation of meaning. If the fact happens to be a spatial or temporal fact this must be interpreted in the sense that its meaning is of the kind describable as spatial or temporal. And the same holds, of course, for qualities. Either, therefore, a fact upon becoming a fact for consciousness transforms itself from an unknowable something into a relation of meaning or it undergoes no such transformation. In the former case the distinction between what is consciousness and what is not is inept, since all is consciousness; while in the latter we have again on our hands the difficulty that no differentia is furnished whereby a given personal experience is distinguished from other facts.

Whether an adequate definition of consciousness can be obtained seems a matter for legitimate doubt. If interpreted in the sense of agnosticism such a doubt would indeed be unwarranted. But if taken as an expression of intelligent scepticism, it has, I think, sufficient standing-ground. The solution of this problem is too intimately bound up with all our 'fundamental' problems to render a satisfactory solution at all likely.

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THE PSYCHOLOGICAL REVIEW.

STUDIES IN ÆSTHETIC VALUE.

BY PROFESSOR H. HEATH BAWDEN.

ARTICLE II.

THE NATURE OF ÆSTHETIC EMOTION; WITH A CRITIQUE OF MISS PUFFER'S THEORY OF STIMULATION AND REPOSE.

We have dwelt upon the immediacy of the æsthetic consciousness in our consideration of the nature of value. We there discovered that one of the distinguishing marks of the value experience is its strongly affective and conative character. In the present discussion we must come to close quarters with the meaning of the statement that the æsthetic experience is predominantly emotional in character.

In the first place, it must be recognized that æsthetic emotion, like all feeling, is directly connected with the functioning, or with the inhibition of the functioning, of those deep-seated conative tendencies of the organism called instincts and habits. These instincts have been inherited from our animal ancestors, in some instances with but slight modification, in other cases with large modifications by the grafting upon them of acquired traits. There is usually a large increment of habits built up in the lifetime of the individual which, in the case of man, particularly, give the peculiar or characteristic turn which the emotions take in the particular person.

Emotions, in other words, are connected organically with the latent vestiges of originally useful facts. Fear, anger, shame, surprise, joy, grief, each has its characteristic emotional expression which is, for the most part, an involuntary and often unconscious change in both the hidden and overt activities of the organism. In general, instinctive action tends to be automatic when it functions in a free and unimpeded manner.

Feeling and emotion emerge when such function is obstructed or inhibited for any reason. Instinct then becomes impulse which on the conscious side is known as feeling.

The emotional reaction is an impulsive reaction. It differs from the instinctive reaction in being a vaguely total conscious response to the situation rather than a definitely accurate automatic response. It is on this account likewise that emotion is the bearer of the value consciousness. It comes to us in terms of that vague background of unanalyzed and unlocalized organic and tactile-kinæsthetic sensations which, while inarticulate as knowledge, are of supreme importance in constituting that core of psychophysical identity known as the empirical ego.

Without going into a discussion of conflicting theories of the nature and conditions of pleasure and pain, the theory may here be stated which seems to explain most of the facts. It was first formulated by the late Professor C. L. Herrick,¹ who named it the 'summation-irradiation' theory from the two processes which are the fundamental conditions of the feeling consciousness.

6. *The Summation-Irradiation Theory.*

Aristotle long ago defined pleasure as the perfect energizing of sense by its appropriate object, and modern writers have only re-phrased his doctrine when they connect pleasure with organic activity lying between the extremes of excessive and deficient stimulation. Pleasure, it is affirmed, is connected with the anabolic, constructive, building-up process; pain, with the katabolic, destructive, tearing-down process. Thwarting a habit is painful. Exploiting a habit is pleasurable. Encountering resistance is pleasurable only if it results in the final triumph of a habit. Or, as Dr. Marshall puts it, pleasure and pain are determined by the relation between the energy expended and the energy received at any given moment by the physical organs which determine the content of the moment. That is, pleasure is experienced whenever a surplus of stored energy is discharged in the reaction to the stimulus; pain whenever a stimulus claims

¹Cf. *Supplement to Wood's Reference Handbook of the Medical Sciences*, Vol. IX., 1893, p. 270 f., and *Journal of Comparative Neurology*, Vol. V., p. 18 f. (March, 1895), and Vol. VII., p. 155 f. (March, 1898).

a greater development of energy than the organ is capable of affording.

Reformulating these ideas, Professor Herrick's theory holds that the conditions of pleasurable feeling are irradiation (1) along lines of habitual response (2) of stimuli whose summation and discharge fall within the limits of the normal functioning of the organ or organs involved. Such reactions as laughing, sneezing, tickling, itching, inflammation illustrate this twofold principle. As long as these processes fall well within the limits of normal habit, they are not painful and may be positively pleasurable. But let the summation exceed these limits in the case of any one of them and it becomes painful. Thus one may laugh till he cries. Sneezing which ordinarily is accompanied by a pleasant feeling of relief may become painful. Tickling readily passes the limit of pleasure. Itching is pleasurable only when the stimulus is diffused as by rubbing or scratching the part. And the pleasurable glow of local hyperæmia soon passes over into the painful processes of pathological inflammation.

The mechanism of irradiation in the case of the higher pleasures such as those of the æsthetic consciousness is to be found in those elaborate habits of attention described in the psychology-books under the rubrics of association of ideas, apperceptive systems, psychical dispositions, etc. These intellectual habits all have a physiological basis, of course, differing from the recognized sense-habits only in the remoteness and subtlety of their operation. Professor Herrick finds the mechanism for irradiation, in the case of the higher emotions, in the associative centers of the cortex with its myriad paths and intricate mesh-work of conduction-pathways, corresponding to the complex ramification and the terminal arborizations of the nerves in the erectile tissues of the body in the case of the more intense of the sense pleasures. But doubtless it is inaccurate to connect the intellectual pleasures exclusively with the switch-board connections in the cortex; they, too, ultimately, involve vascular and other metabolic changes in the peripheral sensory and motor apparatus. Just what these peripheral changes are in the case of the higher emotions it is difficult to specify with certainty in the present state of our knowledge, but that the most abstract intel-

lectual processes involve peripheral sensory-motor adjustments no physiologist now doubts. It is simply a question of detailed investigation which students of physiology and psychology are bound in time to solve. Indeed, the question is already beginning to be solved by the studies which are now being pursued into the phenomena of motor control, voluntary attention, the physiological conditions of emotion, movement-sensations, and so-called imageless thought.

The emotions then, are like the sympathetic vibrations of a musical instrument. If there is a conflict of vibrations, dissonance, pain, results. If there is reinforcement of the fundamental (habit) by overtones, by connected systems (other habits), we have harmony or pleasure. In the case of æsthetic emotion there is the maximum of stimulation compatible with a final reinforcement by the corresponding intellectual habits or apperceptive systems.

Stimuli are experienced as pleasurable in proportion as they relieve existing strain or overcome resistance and give control, in each case the pleasure being due to the fact that relief and control represent the reorganization of the experience in terms of fundamental instincts and habits of the organism. Discharge, expression, irradiation of the energies of the organism within certain limits, *i. e.*, relaxation and favorable stimulation are pleasurable; because they take place along the familiar and easy paths, the line of least resistance, of habitual response. Stimuli are experienced as painful in proportion as they fail to relieve such strain or to overcome such resistance, *i. e.*, when the summation of stimuli or inhibition of impulses reaches a point beyond the capacity of the irradiative controlling apparatus of habit to cope with it.

In other words, stated as a general principle, with the limitations just noted, it may be said that pain means congestion, contraction, obstruction, disadaptation, a 'disproportionateness of stimulus to the conveying power of the organ.' Pleasure means diffusion, expansion, irradiation, discharge. In both cases there is summation of stimuli, inhibition and conflict of impulses, but in the case of pain this summation finds no overflow or the process of inhibition is carried to the point where the subsequent

discharge results in a further mal-adjustment because it exceeds the normal irradiative capacity of the habits involved.

Fear and grief are good illustrations of summation which becomes painful. The sudden transformations of wit and humor illustrate the principle of irradiation. When we seek to divert the attention of the hurt child or take a trip to Europe to escape the torture of a consuming sorrow, we are unconsciously employing this principle: we seek a normal irradiation for the congested stimuli and impulses by calling into play a different set of habits, a greater variety and range of apperceptive systems. Why is rest after hard work pleasant? Whence the glow of pleasure which accompanies the consciousness of success even when one is fatigued? It comes from the fact that the energies which have been with effort directed along less accustomed lines are suddenly released into the more habitual channels of familiar and easy response. Pleasure is connected with moderate stimulation, with the normal functioning of organs. But it must be remembered, that what is moderate and normal varies with different conditions. Tension is the condition of consciousness everywhere, but this tension is *relative* to the situation and to the needs of the organism.

7. *The Relativity Doctrine.*

There are two sets of facts in apparent opposition to this law of pleasurable emotion, which must be considered if this law is to become an accredited principle of æsthetics. In the first place, there are all the facts of the relativity of pleasure and pain. What is painful to one person may be only agreeably stimulating to another, and the same is true for a given individual under different conditions of health, nervous irritability and fatigue. In other words, summation or irradiation is painful or pleasurable only under certain conditions of intensity; it is relative to the existing state of tension or equilibrium in the organism. If pleasure meant merely ease of adjustment, habit should carry with it the greatest pleasure and pain should be in direct ratio to difficulty of adjustment, neither of which is uniformly the case. Up to the limit of normal functioning only, does pleasure increase with summation and subsequent irradia-

tion ; beyond this point pain supervenes. What this limit is, in the particular case, is determined by all sorts of conditions, hereditary and environmental, permanent and transitory. So that while the general principle holds, that when summation and irradiation lie between certain limits of intensity normal to the individual organism it is pleasurable, yet these limits are a sliding scale even in the experience of the individual, and of course much more so in the comparison of different individuals.

Within certain limits summation, inhibition, stimulation, tension, antagonism of impulses, serves only to heighten and enhance the pleasure, and conversely beyond certain limits irradiation, discharge, diffusion of response, expression of impulses tends to weaken the pleasurable emotion.

This relativity doctrine perhaps explains why it is that we seem able actually to take pleasure in certain painful experiences, such as tragedy, the emotions of pity and fear, and what has been called 'the enjoyment of pain.' All excitement, up to a certain point, tends to be pleasurable. Hirn¹ speaks of the stimulating effect of acute pain, of a heightened sense of life due to mental suffering, of "a yearning after increased consciousness, which leads us to pursue, even at the risk of some passing pain, all feelings and emotions by which our sensation of life is reinforced and intensified" (p. 37), and cites the self-woundings of the saints and orgiastic self-lacerations of the Bacchanalian phrenzy in evidence.

The truth is that, as Miss Puffer says, these pains which we enjoy are not really like the pains of real life, since they leave us in control of the situation ; the situation is finally resolved along the line of some habit-system, whereas the genuine sufferings of actual life remain unresolved ; the breach in the habit-system is not healed over. For this reason we must assume that æsthetic emotion is always and necessarily pleasurable. A work of art must please, no matter how repellant the subject. Even in case of tragedy and the ugly in art and this so-called enjoyment of pain, there must be a preponderance of pleasurable emotion or the object or situation does not fall within the æsthetic sphere.

¹ *Origins of Art*, Chapter V

In the second place, it is recognized that while within certain limits expression enhances pleasure, it is also true that beyond certain limits this same expression diminishes the pleasure. The explanation is simple: The irradiation of the stimulus to wider areas and neighboring organs results in a greater diversification and intensification of the stimulus, calls into play a richer background of apperceptive habit-systems. What is thus called the initial expression of the emotion viewed from the outside is really a continuation of the summative process of rolling up the stimulus until it has called into operation the widest range of relevant reaction-systems. The extent to which this irradiation or so-called expression of the emotion serves thus to enrich rather than to reduce its pleasant quality is determined by the resources of latent or stored energy in the individual which is capable of being released by this overflow to adjoining areas. Only within such limits is it true that "pleasure feeds and nurtures itself by expression."¹

On the same principle it is true that pain grows deeper and more wide-spread if and to the degree that it progressively implicates adjoining areas and organs so that these too become 'tied up' in the total inhibitory process. It is a commonplace that pain is at its keenest when the outward expression is at its lowest, but it is equally well recognized that pain often stimulates intellectual activity. This is true, however, only as long as it does not pass beyond a certain degree of intensity, and is due to the fact that in the attempted readjustment, a part of the inhibited energy is directed into relatively unused channels. This is the explanation of the so-called chance hits or extraordinary insights—more properly described as the unexpected relevancies—of genius. And just as the extreme of expression reduces pleasure, so, at last, inhibition, if it leads to immobility and depletion of the vital forces, leads to the reduction of pain, resulting in a comatose euthanasia.

It is not an accurate analysis which distinguishes two kinds of pleasure: one in which the satisfaction springs out of habitual, customary easy lines of activity; and another the satisfaction which springs from following fresh stimulating,

¹ Hirn, p. 41.

novel lines of activity, with their potential possibilities of success. The same principle holds for both. Just as it is not habit as such, so it is not stimulation as such, which gives pleasure: it is the relation or proportion between these. The 'novel' element liberates and exercises deeply ingrained instincts and habits whose function within normal limits is pleasurable. It is the relative freeing of these habits by the novel element and their tensional functioning within these limits which constitutes the pleasure.

8. *Æsthetic Pleasure.*

But while all æsthetic experiences are pleasurable, not all pleasures are æsthetic. What, then, as Dr. Marshall asks,¹ 'are the bounds of the æsthetic within the hedonic field'? His answer to the question is that "that object is to be considered beautiful which produces a psychosis that is permanently pleasurable in revival . . . and that object is to be considered ugly which produces a psychosis that is permanently disagreeable in revival" (p. 110). Only the permanently pleasurable can be æsthetic. Pleasures are characteristically fleeting. They are not classified as æsthetic unless they last, unless they are revivable. Many pleasures which are pleasant while they last are not pleasant in revival, *e. g.*, the pleasures of the so-called lower senses. "For each person the æsthetic field to which he refers in making judgments as to beauty is his relatively permanent pleasure-field of revival" (pp. 152, 153).

"The artist," he goes on to say, "must employ all possible means leading to the attainment of immediate pleasures so far as these are compatible with the production of pleasures in revival. He may add much in the way of mere presentative pleasure which perhaps may not bring us pleasurable effect in revival; and all such added pleasure in presentation is a gain to the work as art, provided it neither bring pain in revival nor swamp with resulting indifference the revivals that are pleasant. He may even go further, and add elements which give decided active painfulness in the direct presentation produced by the examina-

¹ *Pain, Pleasure and Æsthetic*, p. 125.

tion of the art work, provided the result in revival be on this account made more permanently pleasurable."¹

There are two prerequisites, he says, of producing pleasure-permanency: The first is width of field. The artist groups together as large a number of means of pleasure stimulation as he can combine without conflict. This gives the context, background, system, a variety unified into a totality (cf. pp. 173, 174). The second is a shifting focus. This gives the definite object in the foreground, a center to the system. As Lotze and Volkmann insist, "beauty requires the grasp of the ideal through some definite object." Variety must be particularized in individual objects.

"In general, therefore, we may say that the conditions of pleasure-permanence are the shifting of the focus in consciousness over a wide pleasure-field" (p. 173). This shifting may be regularly recurrent; and this gives us the great principle of rhythm. In accordance with this principle Dr. Marshall says that the arts of literature and music are of preëminent importance because they involve the stimulation of successive mental states and thus a shifting of points of interest over wider fields than in the case of the other arts (cf. pp. 188, 189).

"On the whole, it appears that the safest means of producing lasting æsthetic results will be reached if we choose that succession of elements, each of which is naturally led up to by those which have preceded; or to put this in psychological language, we will gain our best result if we choose such successive impressions as will stimulate organs that have been best and fully prepared for action by the associative nutrition (if I so may speak) connected with the previously stimulated activities." This he calls the principle of the satisfaction of expectancies (pp. 185, 186). This principle will explain the function of the dominant lines and figures in composition, the combination and harmony of colors, the rôle of rhythm in music, poetry, and the dance, the significance of symmetry, proportion, balance in plastic art, the use of plot in fiction, etc., these forms representing the objective equivalents of habit systems which fall within the limits of pleasurable functioning. But this leads

¹ *Æsthetic Principles*, pp. 115, 116; cf. 127, 189.

us to the whole problem of the cognitive element in the æsthetic consciousness; the imagery necessary to give the basis and framework of permanency to these otherwise fleeting emotional experiences, which must await a subsequent occasion for fuller consideration.

9. *Stimulation and Repose.*

Assuming for the present that the æsthetic consciousness is always pleasurable, our conclusions as to the nature of æsthetic value have prepared us for a statement of the general law of the æsthetic consciousness: the maximum of intellectual meditation compatible with its remaining a pleasurable value experience, or in other terms, the maximum of stimulation compatible with repose. The implications of this law may be brought out by a critique of Miss Puffer's theory of the æsthetic repose in Chapters II. and III. of her *Psychology of Beauty*.

We have seen that, according to Miss Puffer, instead of grounding the definition of beauty in the empirical investigations of psychology, these investigations are to be squared up with the 'imperative of beauty' (preface, p. vi). In the chapters to which we now turn, Miss Puffer characterizes æsthetic feeling as 'a combination of favorable stimulation and repose' (p. 50). "The diffusion of stimulation, the equilibrium of impulses, life-enhancement through repose; this is the æsthetic experience" (p. 55). It is 'the union of repose with activity' (p. 50). "Æsthetic emotion . . . consists just in the union of a kind of stimulation or enhanced life, with repose; a heightening of the vital energies unaccompanied by any tendency to movement, in short, that gathering of forces which we connect with action, and which is felt the more because action is checked" (p. 244).

Let us examine this conception. Miss Puffer starts out by distinguishing between a state of unity which is static, mere congealment or emptiness without tendency to change (p. 49), and a state of unity which is the result of the balance of antagonistic impulses and therefore dynamic. In the latter instance the organism is 'at the highest possible point of tone, of functional efficiency, of enhanced life' (p. 50). The latter alone is the condition of æsthetic repose. Répose does not mean immobility but the balancing of opposed forces; it is a dynamic equilibrium —

the basis of that unity in variety, that proportion, harmony and symmetry of form which have always been regarded as essential to beauty.

Thus far all is clear. The æsthetic repose is a dynamic and not a merely static equilibrium. But note, now, the terms in which this dynamic repose is described. She elsewhere recognizes that stimulation and repose are contradictory concepts, but here maintains that in the æsthetic experience "the stimulation resulting in impulse to movement or action is checked or compensated for by its antagonistic impulse" (p. 50). The effect (in the immediate context of the passage just quoted) she describes as the 'inhibition of action, or action returning upon itself, combined with heightening of tone.' "The perfect equilibrium, that is equilibrium with heightened tone, will then give the perfect moment" (p. 51).

10. '*Repose in Excitement.*'

In another place (p. 207), she says: "The end of beauty is always the same, the perfect moment of unity and self-completeness, of *repose in excitement.*" The words which we have italicized express the truth of her theory better, if anything, than her more formal statement which combines 'favorable stimulation and repose' (p. 50), in which, if our analysis be correct, there is a redundancy in the use of the two words 'favorable' and 'repose.'

On p. 52 she writes: "The positive toning of the experience . . . is due not only to the favorable stimulation, but also to the fact that the very antagonism of impulses which constitutes repose heightens tone while it inhibits action. Thus the conditions of both factors of æsthetic emotion tend to produce pleasure." Now, we would inquire, Is it the 'antagonism' of impulses which produces repose or is it the 'favorable' character of the stimulation? She attributes the repose to the antagonism: 'the very antagonism of impulses which constitutes repose.' Is not the effect of the antagonism of impulses to intensify, to heighten the tone, to use her phrase, rather than to produce a state of repose? Is not this the law of consciousness everywhere: that change, tension, conflict, antagonism of impulses,

is the condition of consciousness? This 'antagonism of impulses' is really a description of the consciousness which the stimulation calls out; it defines the character of the particular stimulation in question; it is one which produces such and such conscious conflict. On p. 285, she describes æsthetic pleasure as a physiological equilibrium, a 'coexistence of opposing impulses which heightens the sense of being while it prevents action.' The truth is that the coexistence of opposing impulses 'heightens the sense of being' *because* it prevents action; it is the inhibition of overt action which produces the inward excitement known as consciousness.

The element of repose is to be connected not with the fact of the antagonism of impulses, but with the 'favorable' character of the stimulation. And Miss Puffer virtually admits this in certain passages where she approximates a definition of what she means by this phrase. In her chapter on 'The Beauty of Fine Art,' speaking of the beauty of the serpentine line as 'leading the eye a kind of chase,' as Hogarth says, she says that "sharp, broken, starting lines might be the basis of a much more vivid experience, but it would be æsthetically negative. 'The complete sensuous experience of the spatial' is not enough, unless that experience is positively, that is, favorably toned. Clear and vivid seeing made possible by the form of the object is not enough. Only as *favorably* stimulating, that is, only as calling up ideal reproductions, or physical imitations, of movements which in themselves were suited to the functions of the organs involved, can forms be found positively æsthetic, that is, beautiful" (p. 104). "Whatever in sense stimulation gives the condition for, helps, furthers, enhances the natural function, is felt both as pleasing and as furthering the particular activity in question" (p. 163).

Now note, the 'ideal reproductions or physical imitations' are not called up because the stimulation is *favorable*; they are called up by the bare fact of the *stimulation*: ideal reproductions and imitative responses would be called up if the stimulation were unfavorable, and perhaps to a greater extent. The favorable character of the stimulation is found in the fact that the movements which are thus ideally reproduced or physically

imitated are 'suited to the functions of the organs involved,' *i. e.*, falls within the normal limits of their functioning, *i. e.*, are habitual, and therefore familiar and smooth and easy, and therefore pleasurable. This is the true explanation of the element of repose in the æsthetic experience; it is found in the favorable character of the stimulation, not in the antagonism of impulses which accompanies the stimulation.

"Let us consider once more the concept of equilibrium," says Miss Puffer. "Inhibition of action through antagonistic impulses, or action returning upon itself, we have defined it" (p. 55). Commenting on Guyau's 'famous drink of milk among mountain scenes,' which she explains by a swift consciousness of 'general stimulation,' she says that "this diffused stimulation is likely to come from such exercise as is characterized by the mutual checking of antagonistic impulses producing an equilibrium. The diffusion of stimulation would be our formula for the æsthetic state only if interpreted as stimulation arresting action" (p. 55). "The diffusion of stimulation, the equilibrium' of impulses, life-enhancement, through repose! — this is the æsthetic experience" (p. 55.)

Let us look into this. The 'diffusion of the stimulation' certainly results from the mutual checking of impulses, but the immediate result of such 'mutual checking' is not equilibrium; it is rather the disturbance of equilibrium, since impulses are seldom or never exact equivalents. It is the manner of the 'diffusion' rather than the fact of the arresting of action that produces the state of equilibrium or repose. It is the fact that the inhibited stimulation diffuses along habitual lines, *i. e.*, becomes a favorable stimulation, which produces the pleasurable reposeful state.

There is no desire on the part of the present writer to beat at a man of straw of his own fabrication; the aim throughout has been a truly immanent criticism. But he has been unable to escape the conclusion, from a careful comparison of different passages in Miss Puffer's book, that there is a real contradiction, or at least a confusion, of issues.

In her chapter on 'The Beauty of Music' she says, "Rhythm is undoubtedly favorable stimulation," and she explains this by saying that "expectation is the 'set' of the

attention. Automatism is the set of the motor centers. Now, as attention is parallel to the condition of the motor centers, we are able to equate expectation and automatic movement. Rhythm is literally embodied expectation, fulfilled" (p. 165). A rhythm once established has both retrospective and prospective reference. "It looks before and after, it binds together the first and the last moments of activity, and can therefore truly be said to return upon itself, so as to give a sense of equilibrium and repose" (p. 166).

Here we have an unmistakable description of the basis of the repose of rhythm in the facts of automatism and habit. The repose of rhythm is due to favorable stimulation, not to antagonism of impulses. She goes on, of course, to show that this element of antagonism is not wholly absent from rhythm; it is indeed essential, being represented in the variation, alternation, syncopation, accent, etc. But if this is its office, it can scarcely at the same time be said to be the factor which is responsible for the pleasurable sense of repose.

Once again, in the latter part of this same chapter on music, she says that everything has gone to show that music possesses to the very highest degree the power of stimulation. Can we attribute to it repose in any other sense than that of satisfying a desire that it arouses? We can do so, she says, "in pointing out that music ever returns upon itself—that its motion is cyclic. The æsthetic emotion for music is then the favorable stimulation of the sense of hearing and those other senses that are bound up with it, together with the repose of perfect unity" (pp. 200, 201).

Here we have the same confusion of the two factors. Surely a cyclic motion, one that returns upon itself, is an habitual reaction, and to the extent that the fact of repose rests upon such facts, it can scarcely be due to antagonism of impulses. And it is the favorable character of the stimulation, the fact that the stimulation falls well within the limits of such cyclic or habitual organic response, that makes the experience reposeful. What gives music its heightened tone is the relatively large amount and range of impulses which it is capable of exploiting while yet remaining a pleasurable reposeful experience.

II. 'Confrontation.'

Miss Puffer's theory of the drama is a test of her principle. She agrees with most writers that conflict is an essential element in the drama, whether tragedy or comedy. The tragic, springing doubtless from the fundamental fighting instinct in man, and the comic, springing it seems from the sense of superiority — both of these imply the encountering and the overcoming of obstacles. "Every drama must be the artistic presentation of a conflict," says Shaw.¹ "The end may be reconciliation or destruction, or, as in life itself, there may be no end; but the conflict is indispensable; no conflict, no drama."

But, as in the case of the general theory of the æsthetic repose, so here she seeks to interpret the conflict or 'confrontation,' as she calls it, in terms of the emotional rather than in terms of intellectual process. She starts out with the perfectly sound statement of the principle, that the æsthetic experience "consists just in the union of a kind of stimulation or enhanced life, with repose" (p. 244), but then goes on to say that the peculiar characteristics of the drama is 'the face to face confrontation of forces.' 'Confrontation, and not action' is the dramatic principle. The dramatic conflict is an 'equilibrium of impulses' (p. 244); 'a balance of emotions' (p. 245); it is an "æsthetic 'arrest,'" a 'tension of confrontations' (p. 257).

We encounter here the same confusion as in her general theory of æsthetic emotion. Is it the confrontation or the equilibrium and repose which constitutes the drama a pleasurable emotional experience? It scarcely may be both, since the condition of pleasurable emotion is irradiation after summation within such limits of habit functioning as to produce a sense of control. Confrontation as such, antagonism of impulses, makes directly against equilibrium, not for it. It is the intellectual element, the element of diversity, in the æsthetic experience, not the emotional element, the principle of unity. This is obvious from the effect of confrontations in the tragedies of real life. The true statement of her principle would be that the enjoyment of tragedy is due to the *relatively high degree of summation*, tension, conflict, balancing of antagonistic move-

¹ *Plays Pleasant and Unpleasant*, II., p. vii.

ments and situations, *combined with irradiation along habitual lines*. The discharge takes place along general lines, general diffusion through avenues or motor organs which would be involved in an actual tragedy. The rhythm and the meter, as Wordsworth says, give the pleasure, and only thus are we able to endure the painful content.¹ Miss Puffer does not recognize the necessity of a mechanism of irradiation or alleviating discharge to keep the spectator's contemplative attitude from passing into one of real tragedy. Her only suggestion of such a necessity is found in her discussion of 'the illusion of the triumphant will' (p. 251).

Miss Puffer therefore is on the wrong track when she regards the 'confrontation of forces' as furnishing the peculiar conditions of the emotion of tragedy and of the mysterious katharsis (p. 244). Instead of 'the peculiar katharsis, or pleasurable disappearance or alleviation of emotion in tragedy' being based on the element of confrontation, it is based rather on the retention of this open channel of irradiation represented by what she calls the conscious self-illusion of the theater-setting. The confrontation of forces is the condition of the intellectual character, the enhancement of life, the stimulating character of the drama, not of its pleasurable emotional character.

Confrontation is not a 'balance of emotions' (p. 245), but the balance of emotions means the beginning of ideas, and this gives rise to the fact of confrontation. Tension, conflict (her word 'balance' here is unhappy) arises when the more immediate habitual and emotional types of reaction come into conflict — and such conflict calls out images and ideas. Instead of its being true that "two opposed movements cannot take place at the same time" (p. 243), this conflict of nascent movements is just what constitutes an idea. It is impossible to have two opposed emotions, but it is quite possible, she says, for ideas to 'dwell together in amity' (p. 243). But just to the extent that ideas do thus dwell together in amity, they cease to be ideas and become habits: ideas exist only as long as conflict or confrontation or antagonism of impulses lasts. Amity is the one

¹ Preface to the second edition of his poems. Houghton, Mifflin & Co.'s edition, 1904, p. 786.

character that ideas, as such, never present. When "the spectator has a vivid picture of Othello and Desdemona together" his emotions are not properly described as having 'neutralized each other' or as 'in abeyance': they have passed into the phase of ideas.

Nor would it be true, if our criticism is pertinent, that "the unity given by the confrontation and tension of simultaneous forces belongs to the drama alone" (pp. 250, 251). In the first place, as we have seen, the confrontation introduces diversity, not unity, into the æsthetic experience of the drama and is thus, in the second place, only a striking example of the principle of stimulation or diversification which runs throughout all æsthetic experiences. The æsthetic 'arrest' (p. 257) and what she calls the 'unique independent emotion of tension' (p. 259) is the principle of diversification, not the principle of unity and repose.

The whole matter may be summed up in the following way: The context or setting of the theatre (the stage, footlights, darkened room, sitting at ease, etc.), all predetermines that the experience is to be a pleasurable one emotionally: there is, if you like, a conscious self-illusion which means that certain channels of irradiation, certain physiological overflows, are kept open to drain off the effects of the excess stimulation in case of the portrayal of scenes calculated to arouse painful emotions. Within the limits of this predetermined 'set' of the organism the drama then proceeds to exploit certain primitive deep-seated instincts and habits whose stimulation and summative discharge within the aforesaid limits yield pleasure—and yield the greater pleasure the more intense and diversified the stimulation compatible with its not passing the limit thus set. Duels, murders, intrigues, plots, revenges, escapades, adventures, in a word the appeal to pity, fear and love—these all vicariously function such modes of activity as once were seriously significant in the phylum. The finer deploying of the more delicate types of social and intellectual adjustment represented by the problem play and, for example, by Henry James' novels, only illustrate the principle in its more subtle application. This functioning of older and more familiar habits of response, whether it be in witnessing the survival of the primitive scrimmage of savages

at a football game or following the complicated motivation of what Mr. James calls a 'relation' in one of his novels — it is this which even in the case of tragedy, makes the experience an emotionally pleasurable one. In both the tragedy and the comedy the spectator must be left in control of the situation; in the latter case by the inner logic of the drama as well as by the illusionistic psychological 'set' of the organism; in the former case the control element residing exclusively in this latter factor. There is no reason why one should not weep at a tragedy as well as laugh at a comedy.

12. *Katharsis and the Conscious Self-Illusion Theory.*

A correct understanding of the law of stimulation and repose makes intelligible two doctrines which have long been the subject of controversy in æsthetic theory — the Aristotelian Katharsis, and the Conscious Self-Illusion Theory.

Aristotle's theory of katharsis was an attempt to explain how it is possible in such æsthetic experiences as the tragedy to 'take pleasure in painful experiences.' Miss Puffer rejects Aristotle's view that every emotion, be it ever so painful, contains an ecstatic, and hence a pleasurable element. "Pity and fear are never anything but painful down to the vanishing point," she says. "Pity and fear do not in themselves produce pleasure, relief and repose" (pp. 236, 237). "It does not give us pleasure to have painful emotions or to see other people's sorrow." "If we feel pleasure, excitement, elevation in the representation of the tragic, it must be due to some other element in the experience than the mere self-realization involved in suffering." "For the immediately pleasurable æsthetic effect of tragedy, a certain kind of pity and fear, operating in a special way, are required" (p. 239). There must be 'an entirely new element.'

This 'new element' which transforms the painful pity and fear of real life into the pleasurable emotions implied in the enjoyment of the drama, Miss Puffer finds in the 'peculiar character of the emotions aroused' (p. 239). She asks two questions: (1) "How can we feel any emotion at all in watching what we know to be unreal," and (2) "why do we feel *with*, rather than toward or about, the actors?"

Certain writers insist that the essence of art is to give the illusion of reality, which means that it must call into operation the deepest-lying habits of our nature in an emotional experience. Others hold that there is always a conscious self-illusion, that the spectator never really forgets that the artistic representation is not the actuality. The distinction between the emotions aroused in the æsthetic experience of tragedy, Miss Puffer says, lies in the fact that in the drama those emotional responses are inhibited which in real life would be directed toward the actors in scene. In lieu of an emotional attitude taken by the spectator *toward* the actors there is substituted an emotional attitude sympathetic *with* that of the actors in the play. The emotions are sympathetic or imitative instead of having an objective reference. "The artificial conditions of the spectator at a play, which reinforce the vivid reproduction of ideas, and check action, stifle those emotions directed toward the players" (p. 240). "The depth of æsthetic feeling lies not in the worthy countryman who interrupts the play with cries for justice on the villain, but in him who creates the drama again with the poet, who lives over again in himself each of the thrills of emotion passing before him, and loses himself in their web." "The complex of the ideas and associations of the persons of the play is ideally reproduced" (p. 242), says Miss Puffer, as well as the 'emotional movements of the actors.' "Are not the organic reactions belonging to these set up too? — not directly, in response to a situation in which the spectator may act, but indirectly, by reproduction of the mental contents of one who may act, the person of the drama? The final answer to this question contains," she says, "the whole kernel of the dramatic mystery, and the starting-point for an æsthetic theory of tragedy" (p. 242).

A correct interpretation at this point clears up the difficulties of both the katharsis and the conscious self-illusion. If a tragedy is so well acted that you forget completely that it is only acting and take it for the reality, does it not cease to be art and does not your attitude cease to be æsthetic? It is true, on the one hand, that we feel *emotion* 'in watching what we know to be unreal' just to the extent that we forget that it is

unreal, yet, on the other hand, it becomes and remains a *pleasurable* emotion because we do not wholly forget. It is only because, by this so-called conscious self-illusion, a drainage channel or opportunity for irradiation is kept open, that the stimuli never become summated to the point of pain. That this is the true explanation of the reposeful or pleasurable character of the æsthetic experience even of the drama, Miss Puffer virtually admits when she connects the inevitability, the slipping into its place, the 'coming true' of the action of the drama, with the 'illusion of the triumphant will' (p. 251).

Down beneath the action, the movement, the plot, and the confrontations of the drama in tragedy there must always be this predetermined 'set' of the emotions, this presupposition or predisposition, this element of make-believe or æsthetic Schein, which in physiological language, as we have said, means that the sluice-ways of certain habit-systems are kept open. This is the significance of the insistence of all writers that, even in the case of tragedy the spectator must be left with a sense of control, with the illusion of the triumphant will. Thus it is not true, in a strict sense, that the emotions of the drama aroused are the *same* as those of real life. "The sorrow felt for the suffering hero in the story is unlike real sorrow,"¹ just by virtue of the fact that all the emotions of the drama are discounted by this predetermined 'set' of the emotional habit-systems.

It is not necessary that this presupposition of the æsthetic experience should be continuously in the focus of consciousness. On the other hand, within the limits thus set it seems necessary to the full æsthetic experience that we should get a genuine illusion of the real in the details of the artistic production, so that within these limits we actually "abandon ourselves to its claim to be real, and forget its conflict with our real world."² This is the 'illusion in which alone the truth of art resides' of which Howells speaks.³ "Reality must be suggested, but not so strongly as to destroy the distinction between it and the artistic representation — the beholder must not be hypnotized into belief

¹Thorndike, *Elements of Psychology*, p. 81.

²Hoernle, *Mind*, Vol. 49, p. 17.

³*Criticism and Fiction*, p. 76.

in its reality.”¹ “We have here the curious pleasure of being deceived and yet a party to a fraud. If the deception were perfect, it would be mere trickery; and yet, too, if there were no deception, we should lose some subtle charm.”²

And this supplies the key to the true interpretation of the doctrine of katharsis. This means neither purification of the emotions in an ethical sense nor purgation of the soul *from* the emotions, but, as Miss Puffer suggests, it is like being vaccinated instead of having the small-pox (p. 234). But even this metaphor is defective inasmuch and in so far as even the milder form of the disease is disagreeable, whereas the whole process called by Aristotle katharsis is an essential part of the æsthetic experience and therefore pleasurable. But how this may be, is clear from the foregoing analysis. What makes the æsthetic experience pleasurable, as we have seen, even in the case of the portrayal and arousal of the painful emotions of pity and fear in tragedy, is the fact that by reason of the predetermined ‘set’ of the habit-systems the summation and irradiation of stimulation and response are kept within the limits of the pleasurable functioning of these habit-systems. By the principle of katharsis, therefore, is meant that the elements of stimulation, of variety, excitement, of tension and conflict, the antagonism of impulses, which are contained even in pity and fear, are pleasurable as long as they function within these limits. Katharsis then means the vicarious experiencing of the exciting, stimulating, enhancing effect of any emotion provided it keeps within the limits of habit-functioning which yield a result of pleasure.

13. *The Alleged Loss of Self-Feeling.*

If the contention in our criticism is sound, it involves a limitation on Miss Puffer’s extreme emphasis on the principle of unity and self-completeness, and gives a positive and paramount importance to the principle of variety, the intellectual factor, in the æsthetic consciousness. The constructive side of Miss Puffer’s treatment is almost wholly in terms of a discussion of æsthetic emotion; she has no explicit theory of æsthetic imagery,

¹ Tufts in Baldwin’s Dictionary, I., p. 72.

² Stratton, *Experimental Psychology and Culture*, p. 118.

of æsthetic judgment, in short, of the intellectual element in the æsthetic moment.

Miss Puffer says: "Now a beautiful object is first of all a unified object" (p. 77). "In it all impulses of soul and sense are bound to react upon one another, and to lead back to one another." 'Thus the unity of a work of art makes' a 'closed circle,' a 'balance,' an 'impregnable and invulnerable circle' (pp. 77, 78).

All this is true only if it first be admitted that in order for the experience to be conscious experience at all, there must be the variety, the stimulation, and antagonism which come from the intellectual or cognitive side. It follows, of course, that her principle cannot be taken absolutely. This she tacitly admits on p. 56 by saying: "Beauty is not perfection, perfect repose, adjustment or habit, but the beauty of the object lies in its permanent possibility of creating the perfect moment."

The extreme to which Miss Puffer pushes the principle of unity is best illustrated in her chapter on 'The Æsthetic Repose,' in which she relates this experience to the phenomena of the mystic and hypnotic trance. Like these experiences, the æsthetic experience is marked by the disappearance of the sense of personality. "Can we deny," she asks, "that all our sweetest hours are those of self-forgetfulness? The language of emotion, religious, æsthetic, intellectually creative, testifies clearly to the fading of the consciousness of self as feeling nears the white heat" (p. 60). "In proportion to the intensity and value of the experience is its approach to the objective, the impersonal, the ecstatic state" (p. 62).

Assuming for a moment the truth of the assertion made by the author that moments of æsthetic absorption and of creative production are accompanied by the 'extinction' of the feeling of individuality (p. 80), let us examine the psychological grounds upon which she bases her argument. The consciousness of self, she says, is the feeling of transition between the foreground and background of consciousness. "I know I am a self, because I can pass, so to speak, between the foreground and background of my consciousness. It is the feeling of transition . . . and this feeling of transition, hunted to its lair,

reveals itself as nothing more nor less than a motor sensation" (pp. 64, 65). "While the self in its widest sense, therefore, is coextensive with consciousness, the distinctive feeling of self as opposed to the elements in consciousness which represent the outer world is based on these bodily sensations which are connected with the relations of objects. . . . The formal consciousness of self might be schematized as a straight line connecting two points, in which one point represents the foreground, and the other the background, of consciousness" (pp. 65, 66). "If we now accept this view, and ask under what conditions the sense of self may be lost, the answer is at once suggested. It will happen when the 'twoness' disappears, so that the line connecting and separating the two objects in our scheme drops out or is indefinitely decreased. When background or foreground tends to disappear or to merge either into the other, or when background or foreground makes an indissoluble unity or unbreakable circle, the content of consciousness approaches absolute unity. There is no 'relating' to be done, no 'transition' to be made. The condition, then, for the feeling of personality is no longer present, and there results a feeling of complete unity with the object of attention" (p. 66).

But this, unhappily, is not the only form in which the author states the matter. She also says that "the self, at any given moment of consciousness, is felt as one group of elements which form a background of consciousness as over against another group of elements which form a foreground" (p. 64), and, in other passages, as we shall see, she speaks of one of the two poles essential to the very existence of a conscious experience dropping out altogether (cf. pp. 73, 75, 83).

What she means, doubtless, is that, as she says elsewhere, "the feeling of transition . . . drops below the threshold" (p. 67), the "feeling of transition disappears with the absence of related terms" (p. 73), the self-feeling disappears with the "disappearance of the transition-feeling, its cause" (p. 84). But if so, we have another difficulty on our hands. If the feeling of transition has dropped from consciousness, how can anything in the way of consciousness be left: how, for example, can she speak of there still being 'an overwhelming

sense of union with the One, the Absolute, God' (p. 73). If there is still an æsthetic *feeling*, then the sense of relationship and transition have at the most only been reduced, they have not been annihilated. Is it not after all, on *her* theory, a mystery, an anomaly, that an experience from which the feeling of transition has dissolved may still be felt not only as 'intense' and 'blissful' but as 'definite' (pp. 83, 84)? And how can an experience be recognized as 'more intense' (p. 85) and even as 'doubled' in *emotional* value (p. 84) if there is no internal articulation, if there is no sense of transitions, no intellectual factor of diversification? And as for 'selfless emotion'—this surely is the quintessence of psychological paradox.

Miss Puffer says that "the loss of the sense of personality is an integral part of the æsthetic experience. . . . It is a necessary psychological effect of the unity of the object. . . . The unity of the object is constituted just by the inhibition of all tendency to movement through the balance or centrality of impulses suggested by it. In other words, the balance of impulses makes us feel the object a unity" (p. 79). "This balance of impulses, this inhibition of movement, corresponding to unity, is what we know as æsthetic repose." The "conditions of æsthetic repose and of the loss of self-feeling are the same" (p. 79). "The true æsthetic repose is just that perfect rest in the beautiful object which is the essence of the loss of the sense of personality" (p. 79).

Miss Puffer further explains the loss of the sense of personality in æsthetic contemplation by saying that we are "held in equilibrium in the object of attention; we cannot connect with it our self-background, for the will cannot act on the object of æsthetic feeling. We cannot eat the grapes of Apples or embrace the Galatea of Pygmalion; we cannot rescue Ophelia or enlighten Juliet. . . . The real ground of the possibility of a momentary self-annihilation lies in the fact that all incitements to motor impulses — except those which belong to the indissoluble ring of the object itself — have been shut out by the perfection of unity to which the æsthetic object has been brought" (p. 78).

But if, as we have seen, the æsthetic experience belongs distinctly to the category of conscious experiences then there must be a subject-object relationship, however subordinated one of the two factors may be to the other. There is no consciousness in which "one term disappears, and the other remains a perfect whole" (p. 83). We have seen that in a value experience there is a characteristic emotional intimacy and integrity which are absent from the cognitive types of consciousness, but the fact remains that there is a certain degree of tension, of relationship. The alleged loss of the self-feeling in æsthetic contemplation must therefore be explained on other grounds than those advanced by Miss Puffer.

The author herself is not quite able to escape the implications of this view of the æsthetic experience, since, where she speaks of one pole of consciousness lapsing, she says, "the remaining, the positive pole of consciousness, is an undifferentiated unity, with which the person must *feel himself one*. The feeling of personality is gone with that on which it rests, and its loss is joined with an overwhelming *sense of union* with the One, the Absolute, God" (p. 73). But if (as indicated in the phrases italicized) there is a 'sense of union' and the person 'feels himself one,' obviously the sense of relationship has *not* totally disappeared.

The author indeed explicitly reckons with this problem. 'Whence,' she asks, comes the 'bliss' of self-abandonment, 'the definiteness and intensity' of the experience in which the sense of self has disappeared? "It is precisely with a fading of self-feeling that intensity and definiteness deepen," she affirms (p. 84). 'The solution of this apparent paradox' she offers is that "if variation in the degree of self-feeling is the common factor, and the disappearance of the transition-feeling its cause, then the lowest member of the scale, in which the loss of self-feeling takes place with mathematical completeness, must be included" (p. 84). But this is like insisting that the unconscious is only a minimal consciousness and frankly, looks like a skillful piece of dialectical sleight-of-hand admitting back by way of the rear door of the 'lowest member of the series' what has been publicly ejected at the front entrance of the formal contentions of her main theory.

The true explanation would seem to be, not that the will 'cannot' act on the object of æsthetic feeling but that it need not because of the relative adequacy of the subject-object relationship in the specific instance. The 'incitements to motor impulse' (*i. e.*, the sense of personality) are not so much 'shut out' as they are incorporated into the situation in such a way that they enrich it from within. These impulses are functional within the situation instead of leading beyond. If they really required to be inhibited, the situation would change to a cognitive instead of an æsthetic experience.

In this same chapter Miss Puffer cites 'the ecstasy of intellectual production' (p. 79) in which she says there is 'the same extinction of the feeling of individuality' (p. 80). But is not this a still more striking refutation of her doctrine? Surely, this is the moment of the keenest and most heightened sense of self as well as of the object. It is an intensely integrated experience, but not exclusively on the side of the object. The integrity and totality and absorption of the experience represents rather the perfection of the control of their interaction than the extinction of either aspect. The condition of artistic creation is not so much 'a lack of outward stimulation,' a 'closed circle' (p. 81), as it is a relative control and adequacy of *all* the conditions. The 'psychological' self, to use Professor Baldwin's distinction, may be said to be absent from such an experience, perhaps, but the 'psychical' self is not absent. It is present, on the contrary, in a fuller and richer way than in any other type of experience. Is it possible that here Miss Puffer has fallen into the psychologist's fallacy and mistaken the lapsing of the 'self-known self' for the lapsing of the 'self'?

Finally, has not Miss Puffer herself hinted at the real truth in the apparent loss of the self-feeling in the principle which she has invoked in her previous chapter — the principle of the 'over-individual' nature of beauty? Is not the so-called loss of the self-feeling to be interpreted, on the positive side, not as a dissolution of the feeling of individuality, but rather its widening and deepening and enrichment, its incorporation into a wider social realization of the self? The conditions of æsthetic repose do not result in the 'loss of the sense of self,' then, but in the

realization of selfhood on a higher plane, in a wider context. The self is experienced in terms of the extra-organic contextual self instead of exclusively in terms of the immediate warm mass of the empirical ego, as Professor James calls it. Such a view, moreover, would harmonize with the experiences of many persons who maintain that their moments of most intense emotional experience and creative activity are accompanied by a heightened sense of selfhood rather than by a loss of the self-feeling. It would harmonize also with all that has been said in the classic treatises on the disinterestedness, the contemplative character and the objectivity and universality of the æsthetic experience.

If 'self-completeness' is the goal of the æsthetic experience, this surely is a more illuminating description of it than one which involves the loss of this very feeling of self. If 'the perfect moment of unity and self-completeness' which is the 'end of beauty' is at the same time to be described as 'repose in excitement' (p. 207), this latter element — excitement — would seem to imply the fullest realization of the *consciousness* of self rather than its extinction.

It might be urged: "We admit that the self is not annihilated but only the sense of self, not self-activity which is rather heightened and enhanced, but only self-consciousness." But is not this just the essence of selfhood — to be *conscious of self as self*? Subhuman nature, the stone, the tree, the animal, is a self in the sense of a center of voluntary activity, but are incapable of artistic creation and æsthetic appreciation — Why? Just because they lack self-consciousness in their activities.

THE NERVOUS CORRELATE OF PLEASANTNESS AND UNPLEASANTNESS.

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CHAPTER II. AN HYPOTHESIS CONCERNING THE STRUCTURE AND FUNCTION OF THE NERVOUS SYSTEM.

If we wish to develop a plain and comprehensive view of the relation between consciousness and nervous activity, especially between pleasantness and unpleasantness and nervous activity, we must first of all develop a plain and comprehensive theory of nervous function. To what extent this latter theory can ultimately be accepted as right, is only of secondary importance in this connection, provided, of course, that the theory does not clearly contradict any facts known beyond doubt. It is easier to change details of a definite theory when necessary, than to make definite a theory which is vague at the start. Let us, then, base our considerations upon the hypothesis described in the following paragraphs.

1. *Structural Arrangement of the Nervous Elements: Centralization by Degrees.*

The nervous system of the simplest animals which possess nerve tissues may be regarded as a mere aggregation of reflex arches. By reflex arches we shall mean a system made up of three neurons (compare Fig. 1), a sensory and a motor neuron, and one connecting neuron. Actually, a reflex arch will hardly be found anywhere which does not contain a far greater number of connecting neurons. But here, in attempting to develop a schematic view, this fact may be neglected and a single connecting neuron be substituted for a chain of neurons made up of many links. By motor neuron we mean a neuron which has one of its ends in a motor point of the body, that is, in muscle fibers. By sensory neuron we mean a neuron which has one of its ends in a sensory point of the body, that is, in physiolog-

ical surroundings which particularly favor stimulation of this nerve end under special mechanical or physical or chemical conditions. Neurons which do not have one of their ends in either a sensory or a motor point of the body will be called connecting neurons.

It is self-evident that in all but the very lowest animals there must exist a connection between the different reflex arches.

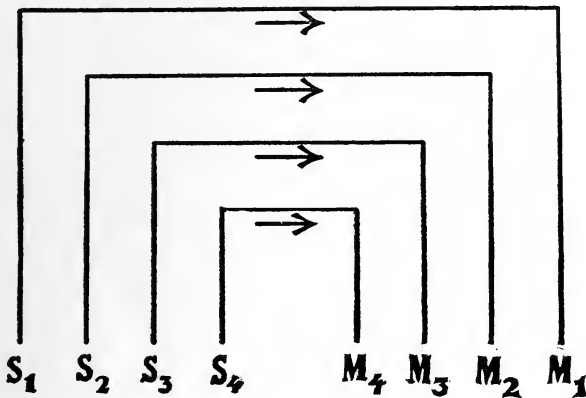


FIG. I.

Otherwise stimulation of a definite sensory point would always and inevitably result in the reaction of the same motor point of the body. But we know that such is not the case. Variations occur, so that the same stimulation which is originally followed by one reaction, is followed later by another. And further, stimulation of one sensory point may result in the reaction of a whole system of motor points; and stimulation of a whole system of sensory points may result in the reaction of a single motor point or at least only a small number of such points. We may use the term 'condensation of the motor process' or 'motor condensation' in order to refer to the latter effect or to the changes by which it is brought about. The term 'condensation of the sensory process' or 'sensory condensation' may refer to the former effect or to the functional changes in the nervous system by which it is brought about. Variation, sensory condensation, and motor condensation are then the three classes of phenomena which a comprehensive theory of nervous function must explain

before we can hope to draw conclusions as to the correlation between nervous and mental functions. In order to explain these phenomena, let us conceive the hypothesis that a number of reflex arches are united into a system as represented by Fig. 2. For simplicity's sake the figure represents only three reflex

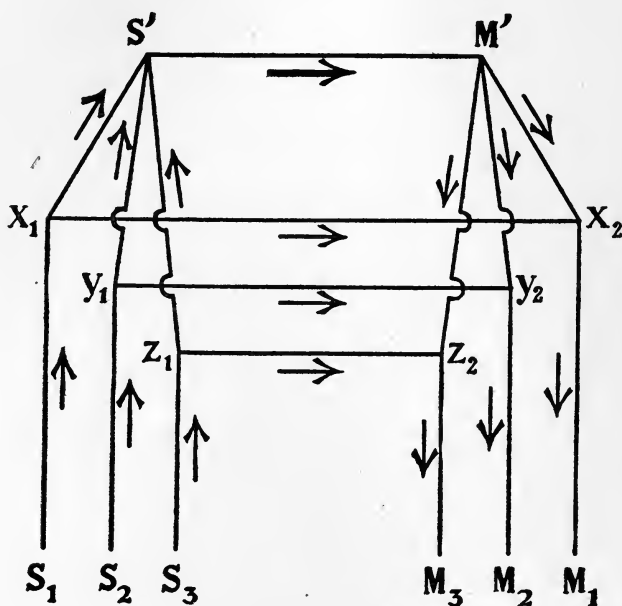


FIG. 2.

arches, but we may conceive the number as high as we want to. We assume that the three sensory neurons which have their peripheral ends in S_1 , S_2 and S_3 , are connected by three connecting neurons having the common point S' . We also assume that the three motor neurons which have their peripheral ends in M_1 , M_2 and M_3 , are connected by three connecting neurons which possess the common point M' . Let us further assume that the points S' and M' are connected by the connecting neuron $S'M'$.

The whole system, then, is clearly like in kind to one of the simplest reflex arches from which we started. It is a reflex arch of a higher order. Among the connecting neurons within this system there are some which may be called sensory or

motor, in a relative sense, although they do not have one of their ends in a sensory or motor point of the body. However, those connecting neurons which pass down from S' are functionally nearer to sensory than to motor points of the body, those from M' nearer to motor points of the body.

We may now introduce and define a new term, very common in neurological literature, that of a 'nerve center.' Whatever the literal meaning of the word center, we shall mean by it simply an accumulation of functionally related connecting neurons. So we may say that the totality of the connecting neurons which have one of their ends at either S' or M' is a nerve center. In order to understand the significance of the terms 'lower' and 'higher' nerve centers, we may further develop the scheme of Fig. 2. Let us assume, as in Fig. 3, an aggregation of three systems, each like Fig. 2, representing any actual number of systems.

The points S' , S'_a and S'_b are in a relative sense sensory points. We assume them to be connected by three neurons having the common point S'' . The neurons, $S''S'$, $S''S'_a$, $S''S'_b$, belong to the class of connecting neurons, since they do not have one of their ends in a sensory point of the body. But in a relative sense they may be called sensory neurons, as being functionally nearer to sensory points than to motor points of the body. Similarly the neurons $M''M'$, $M''M'_a$, $M''M'_b$ may be called, in a relative sense, motor neurons, although they belong to the class of connecting neurons. The points S'' and M'' we assume to be connected by one neuron, as shown in the figure. We may now regard the totality of the neurons which have at least one of their ends either at S'' or at M'' as a nerve center, and we may name this center $S''M''$. This would be, relatively, a higher nerve center, and the nerve centers $S'M'$, or $S'_aM'_a$ would have to be called lower nerve centers. That is, the terms low and high as applied to a nerve center would have to be defined thus: A nerve center is to be called the higher the greater the number of steps (neurons) by which we could reach from it either a sensory or a motor point of the body.

Let us now imagine three systems (representing any actual

number of systems) like that of Fig. 3. Let us assume their, relatively speaking, sensory points S'' , S_a'' , S_b'' to be connected by three neurons having a common point, S''' (compare Fig. 4). Let us assume also their motor points M'' , M_a'' , M_b'' to be connected by three neurons having a common point M''' . Let us assume S''' and M''' to be connected by the connecting

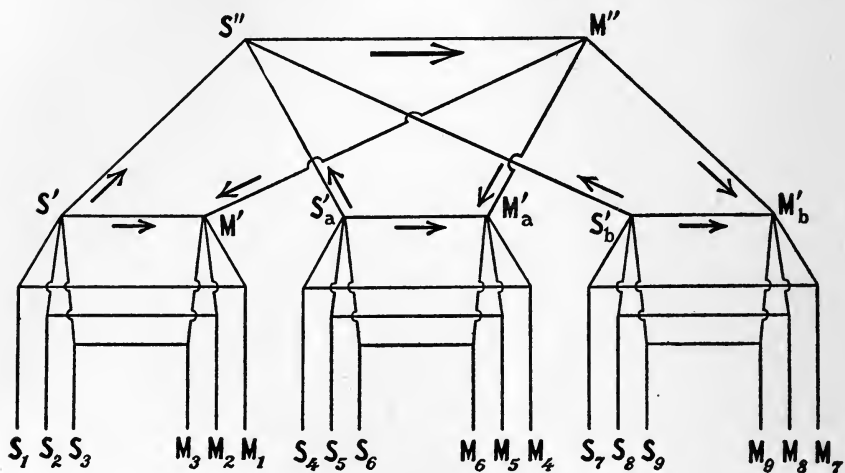


FIG. 3.

neuron $S'''M'''$. The connecting neurons $S'''S''$, $S'''S_a''$, $S'''S_b''$ may then be called, in a relative sense, sensory neurons; and the connecting neurons $M'''M''$, $M'''M_a''$, $M'''M_b''$, in a relative sense, motor neurons. The totality of neurons which have one of their ends in either S''' or M''' , must then be called a nerve center higher than the nerve center $S''M''$, or $S_a''M_a''$, these being 'lower' centers in comparison with the center $S'''M'''$ and 'higher' centers in comparison with others, as we saw above. Let us now conceive this scheme of connections by higher and higher connecting neurons carried as far as the actual complexity of the human or an animal's nervous system would justify. Let us make the hypothesis that any nervous system is a system of connections of essentially the same kind as in the above scheme, and that the difference between the nervous systems of higher and lower animals consists in the existence of 'centers' (as above defined) of a higher order than

found in the lower animals, while the number of simple reflex arches may be identical in both classes.

We must at once raise the question whether this hypothesis agrees well enough with the fundamental neurological facts to deserve to be called probable. I shall mention two facts which seem to agree with the hypothesis.

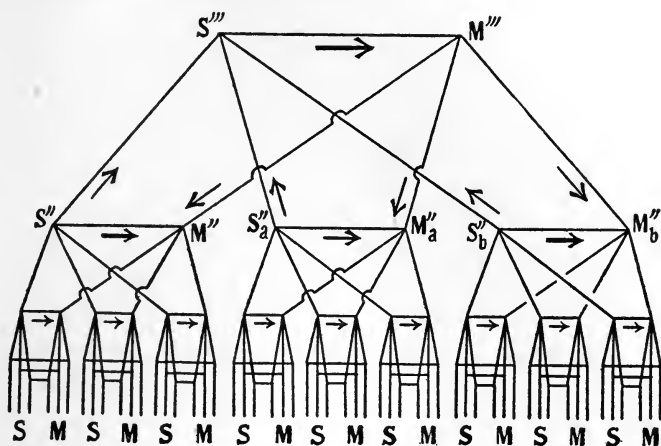


FIG. 4.

If we examine the evolution of the nervous system, we notice that the nervous system shows a distinct tendency towards 'centralization.' Comparing the nervous system of a bird with that of a fish, we notice that it is not bulkier in each of the parts of the body, but that the increase in size is almost exclusively restricted to that part which in man has assumed such enormous size, the cerebral hemispheres. This manner of evolution is to be expected if the new additions to the nervous system serve no other purpose than that of making possible mutual connections of 'the highest centers' previously existing. The new additions are to be expected, then, at the very place where the last additions were made, where the last highest centers were added during the process of evolution, rather than anywhere else. In accordance with this we see the cerebral hemispheres expanding further and further, upwards, towards the sides, the back, and finally in a forward direction, entirely covering, in man, those masses of nervous tissue which were so

conspicuous when we opened the skull of a fish, demanding an enormous cranial cavity for their accommodation. And similar tendencies towards 'centralization' may be found, not only in the vertebrates, but even in invertebrates.

A second fact to be mentioned is the relation between the brain weight and the size of the whole animal organism. I expect to meet with assent if I regard the amounts of variation, of sensory condensation, and of motor condensation possible as measuring the degree of intelligence of an animal. Now, since the nervous tissues enclosed within the skull are not in their entirety higher centers, but to a considerable extent centers of the very lowest kind, that is, mere accumulations of reflex arches, the relative size of the brain cannot immediately be taken as an indication of relative intelligence, for the larger animal needs a greater number of reflex arches than the smaller animal. We must first answer the question, how the size of the brain depends on the size of the body when a species, through evolution, increases in size, but remains on the same level of intelligence. It is clear that the large majority of important stimulations occur on the body surface, where the body is most exposed to the influences of the environment. Stimulations within the internal organs are relatively insignificant. We must expect then, if a species increases in size, but remains on the same level of intelligence, that its brain will increase approximately in proportion, not to its body weight, but to its external surface. We may express this relation also thus: The weight of the brain must be approximately proportional, not to the third power of its linear measurement (m^3), but to the second power (m^2). If we wish to compare brain weight and body weight, because no other data are available than body weight, we may take the third root of the body weight and raise it to the second power ($m^2 = c \sqrt[3]{w^2}$). If we find that the ratio of the brain weight to this value is larger in one animal than in another we have the right to conclude that that animal excels in intelligence, since there is an excess of nervous tissue above that which is determined by the size of the body, an excess which, as higher nerve centers, can serve the three ends of variation, sensory condensation, and motor condensation. It is

remarkable that ideas like these have only in very recent years begun to find favor with neurologists, that the absurdity of a direct comparison of brain weights or even the ratios of brain weight to body weight, for estimating relative intelligence, has not been noted long ago.

The most interesting application of this principle is to be found in a comparison of the two sexes in man. The absolute weight of the male brain is considerably greater than that of the female brain, the ratio being $1.169 : 1$; and fanatics have regarded this as a proof of the intellectual inferiority of woman. It was then pointed out that absolute measurement was valueless because woman is smaller in stature. The brain weight relative to body weight (br/w) is somewhat less in man than in woman, the ratio being $.967 : 1$; and although the difference is not great, fanatics have again regarded this as a proof, but, this time, of the intellectual superiority of woman. The brain weight relative to body surface ($br/\sqrt[3]{w^2}$) is slightly greater in man than in woman, the ratio being $1.029 : 1$; and if we take into account that the increase of surface, while being the most important factor, is not the only one, that increase in bulk of the body, although a factor of minor importance, cannot be altogether neglected, our hypothesis concerning the architecture of the brain leads with great force to the conclusion that comparison of the weight of the brain teaches that there is no difference between the intelligence of man and woman. And this seems to be the outcome also of all direct investigations of the relative intelligence of the two sexes.

2. *Function of the Nervous System and its Consequences: Variation of Response, Sensory Condensation, Motor Condensation, Inhibition.*

Let us now return to our hypothesis of the structure of the nervous system. We assumed that the nervous system consists of reflex arches which are united into groups by higher connecting neurons, that these groups are again united into groups by still higher connecting neurons, and so on, in the manner indicated in our diagrams. We now have to make another hypothesis as to the function of this system, in order to explain the

original relative independence of the reflex arches and at the same time the possibility of variation of response, of sensory condensation, and of motor condensation developing during the individual's life. Let us note, however, that this functional hypothesis is by no means independent of the structural hypothesis, that it would not be applicable to every kind of conception of the structural organization of the nervous system.

It is well to formulate any hypothesis of this kind as far as possible in purely mechanical terms. The present writer does not share the views of those who believe that science must reduce the whole world to matter and motion. Nevertheless it is often preferable to state an hypothesis in mechanical rather than in other terms, in order to make it clear and to understand more readily its consequences.

1. Let us assume, then, that any point where two or more neurons are connected, functions like a valve which permits fluid to pass through only in one, not in the opposite direction, and that this valve opens only in the direction towards motor points of the body. For example, in Fig. 2, a current coming from S_1 and over α_1 reaching S' cannot pass through either of the other connecting neurons from S' down to y_1 or z_1 , but can pass on only in the direction of M' ; and a current coming from S_1 and over α_1 directly reaching α_2 cannot pass up to M' , but can proceed only in the direction of M_1 . A current which has reached M' , can proceed thence over α_2 to M_1 , or over y_2 to M_2 , or over z_2 to M_3 . The same principle applied to Fig. 3 would mean, for example, that a current which has reached S'' over S' can proceed only to M'' , not to S'_a or to S'_b ; and a current which has reached M' over either S' or M'' , can proceed only in the direction of either M_1 or M_2 or M_3 . No current can normally proceed in the direction $M'S'$, or $M'_a S'_a$, or $M''S''$, or $M'M''$.

2. Let us assume that any neuron system has functional properties analogous to those of a pipe system filled with a fluid, one end of the pipe system being usually closed (the sensory point), the other end being under the influence of negative pressure, or suction, tending to produce a current in the direction of this end, the motor point.

3. Let us assume that ordinarily no movement can take place in the pipe system because the sensory end is closed; that the application of a weaker or stronger stimulus means the same as the opening to a lesser or greater extent of the closed end of such a pipe system, thus permitting fluid to escape through the motor point. We assume that the fluid thus lost from the system is replaced in some way or other during the time when there is no stimulation, that is, no opening at the sensory point.

4. Let us assume that the resistance suffered by the fluid in moving through the pipe system depends in the ordinary manner on the length and the width of the pipe. The resistance depending on the length of the pipe line may be measured by counting in our diagrams the number of straight lines (neurons) of which a path from a sensory to a motor point of the body is composed, imagining that each line has the same actual length, whatever its length in the drawing. This does not preclude, of course, innate differences of resistance depending on other conditions.

5. Let us assume that a current has a tendency to widen the pipe in which it is occurring in proportion to its intensity and duration; and that any pipe, while no current is passing through it, has a tendency to grow narrower, gradually and very slowly. Let us further assume that both these properties of the pipe are present in the highest degree in the highest connecting neurons, in lower degrees in lower connecting neurons, and entirely absent in the sensory and motor neurons.

In five divisions we have thus stated a functional theory of the nervous system in mechanical terms. At the present time, when so little is definitely known about the processes going on in the nervous system and yet the need of such knowledge is so strongly felt, it seems to the present writer a decided advantage to be able to think of nervous function in purely mechanical terms, because of the clearness of such terms. But however clear, this hypothesis would be of no value unless its consequences agree with the fundamental facts of mental life. Let us now test the hypothesis in this respect.

Imagine a new-born animal with a nervous system like that

represented in Fig. 3. Let a stimulus be applied to S_2 . At every one of the nine motor points a reaction is possible. At M_2 because of the reflex arch $S_2 y_1 y_2 M_2$. At M_1 because of the connection $S_2 y_1 S' M' x_2 M_1$. At the motor points M_4 , M_5 , M_6 because of the connection $S_2 y_1 S' S'' M'' M'_a$. But the reaction at the motor points of the second and third groups must be very weak because the current has to go on in seven neurons. At M_1 and M_3 the reaction is not quite so weak because the current has to go on in only five neurons, so that there is less resistance. (The width of the pipe is assumed to be the same everywhere, although this might be otherwise.) At the point M_2 alone a strong reaction is to be expected, since M_2 can be reached from S_2 over three neurons, by way of y_1 and y_2 . It is clear that only at M_2 can a noticeable reaction occur; little or no reaction is possible at the eight other motor points. The function thus far studied illustrates therefore the phenomenon of reflex or instinctive activity, making allowance, of course, for the fact that this is a mere analogy, for no reflex, however simple, may be the result of quite as simple a nervous function.

If this function, the nervous correlate of instinctive activity, occurs frequently and at intervals not too long, according to our hypothesis the path $y_1 y_2$ becomes somewhat widened—much more so than any of the other paths in which only weak currents have been active. The consequence is that the resistance of this path is slowly, but steadily reduced, that less and less current is possible along other paths, whose resistance is relatively high. In psychological terms, instinct becomes habit. Habit, however, means in this particular case no more than that when S_2 is stimulated the reaction at M_2 occurs even more exclusively, than originally. On the other hand it follows from our hypothesis that an instinct which is never used, through the gradual increase of resistance along the path, may become practically extinct. This might be called a negative habit.

Let us see, now, whether we can derive from our hypothesis the more important form of habit which consists in a variation of the original instinct. It is clear that such variation can come about only by simultaneous stimulation of at least two reflex arches. Suppose S_1 is stimulated simultaneously with S_2 , but

much more strongly than S_2 . According to our hypothesis the current over y_1y_2 must be much weaker than the one over x_1x_2 . To understand the conditions more clearly, we may separate the two reflex arches under discussion as in Fig. 5. Less current

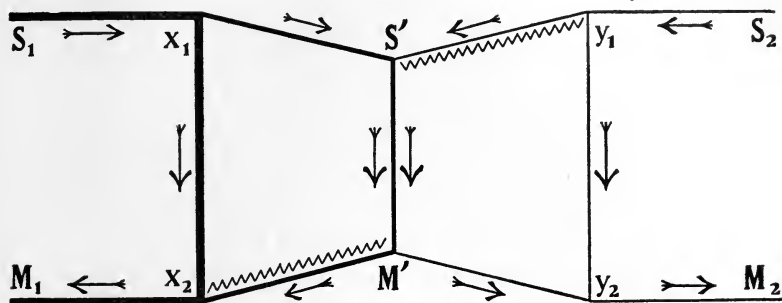


FIG. 5.

is going over the longer paths of higher connecting neurons by way of $S'M'$, but here again there is unequal flux; the current in y_1S' must be much weaker than the one in x_1S' . These differences in flux are indicated in the figure by the relative thickness of the lines. Here we remember the dynamic principle that hydraulic pressure is less than hydrostatic pressure, of which the jet pump used for drainage or for exhausting air is a familiar illustration. The pressure diminution depends on the velocity of the fluid. It increases much more rapidly than the velocity of the fluid, being proportional to the square of the velocity. The consequence is that the fluid moving over x_1S' with a velocity greater than that of the fluid in y_1S' attracts the latter fluid. That is, more fluid takes the path over y_1S' and less the path over y_1y_2 than in case the point S_2 is alone stimulated. As we have made the assumption that the resistance of higher neurons (*e. g.*, y_1S' is more easily reduced by currents than that of lower neurons (*e. g.*, y_1y_2) the resistance of y_1S' might soon become less than that of y_1y_2 , although the velocity in y_1S' did not, perhaps, at any time become actually less than that in y_1y_2 . At the same time the resistance in $S'M'$ and $M'y_2$ must decrease because of the great flux from S_1 . Because of the great flux over $x_1x_2M_1$ the hydraulic pressure at the point x_2 must be low and act upon the fluid in $S'M'$ as suction, so that

but little of this fluid can move over $M'y_2$. The consequence of all this is that an ever-increasing amount of the fluid moving through S_2y_1 moves on in the direction of M_1 by way of the path indicated by the zigzag lines y_1S' and $M'\alpha_2$, an ever decreasing amount in the direction of M_2 . The outcome of this is that when some time later the sensory point S_2 is stimulated separately, the current passes on over $y_1S'M'\alpha_2$ to M' , finding here less resistance than over $y_1y_2M_2$. That is, the original reflex arch has been put out of function, an instinct has been modified into a habit with a different kind of reaction. Of course, one condition must be fulfilled while the habit is being formed: S_2 must not too frequently be stimulated alone, for this would tend to decrease the resistance of the neuron y_1y_2 and would thus interfere with the development of the variation.

How can sensory condensation be explained on the basis of our hypothesis? The explanation by the aid of Fig. 5 is not difficult. Suppose that the combination just discussed occurs frequently, and that the stimulation symmetrically opposite occurs with about equal frequency, S_2 being stimulated strongly and S_1 at the same time weakly, but that neither S_1 nor S_2 are much stimulated separately. The consequence is that the resistance of $\alpha_1\alpha_2$ as well as of y_1y_2 increases gradually, whereas the resistance of the path $\alpha_1S'M'y_2$ as well as of the path $y_1S'M'\alpha_2$ decreases. The ultimate outcome of this development must be this: When finally the sensory point S_1 is stimulated alone, the current proceeds, not over $\alpha_1\alpha_2$, but over α_1S' to M' , divides here equally, and equal reactions occur at the motor points M_1 and M_2 simultaneously. And also, when the sensory point S_2 is now stimulated alone, the current proceeds, not over y_1y_2 , but over y_1S' to M' , divides here equally, and equal reactions occur at the motor points M_1 and M_2 simultaneously. That is, while two stimuli at S_1 and S_2 were originally required to bring about simultaneous reaction at M_1 and M_2 , a single stimulus is now sufficient for the same result. We have developed the kind of habit which we called sensory condensation.

Our next task is to explain from our hypothesis the development of habits of the kind which we have called motor condensation. This explanation is a simple matter if we recall our

explanation of variation of response. We saw that when S_2 is rarely stimulated alone, but frequently together with S_1 in such a manner that the stimulation of S_1 is stronger than that of S_2 , the channel y_1y_2 tends to close and the current, when S_2 is finally stimulated alone, takes the path $S_2y_1S'M'x_2M_2$. It is plain that when this stage of development has been reached, simultaneous stimulation of S_1 and S_2 , whatever the relative intensities of the stimuli at S_1 and S_2 , can result in nothing more than in a reaction at the single motor point M_1 . Thus we explained in mechanical terms, on the basis of a structural and functional hypothesis the three fundamental facts of genetic psychology, variation of response, sensory condensation, and motor condensation. If we look at Figs. 3 and 4, we see at a glance that the application of this explanation to higher and higher 'nerve centers' is in no respect different from the explanation when applied to the nerve center in Fig. 2. That the same rules are applicable throughout must be regarded as a particular advantage of the structural and functional hypothesis upon which the explanation is based.

There is one further conception of fundamental importance in psychology, that of inhibition. I do not, of course, use the term inhibition here in the sense in which it is often used by physiologists, referring to the fact that a certain organ may be made to function rapidly by one kind of nervous influence, to function slowly—or perhaps, in reversed manner—by another kind. I have in mind the fact that a motor reaction expected in consequence of appropriate sensory processes or imagery, is often suppressed by sensory processes or imagery which—without being strictly opposed to that motor reaction—would not in themselves lead to it. For example, a student walking home, suddenly stops on the sidewalk, forgets that dinner is waiting for him, in consequence of thinking of the problem in geometry given him by his teacher. How is this kind of inhibition, which in its most conspicuous appearances is attributed particularly to the very highest nerve centers, to be explained from our hypothesis?

Let us remember our explanation of the variation of response. When S_2 in Fig. 5 is stimulated, we expect a reaction at M_2 .

But this reaction does not take place if a much stronger stimulus is simultaneously applied to S_1 , bringing about a reaction at M_1 . The expected reaction at M_2 is inhibited. It then becomes at once clear why inhibition depends so largely on the function of the very highest nerve centers. In our above case there could be no inhibition if the two systems of reflex arches did not have the higher connecting neuron $S'M'$ in common. There could be but little of the phenomenon of inhibition in our mental life if we did not possess — in the sense of the diagram of Fig. 4 — very high 'nerve centers,' belonging anatomically to different reflex arches which, as simple reflex arches, are perhaps entirely separate from each other, serving to produce movements which are mutually independent.

CHAPTER III. A THEORY OF THE NERVOUS CORRELATE OF PLEASANTNESS AND UNPLEASANTNESS.

We are now prepared to raise and answer the question as to the nervous correlate of consciousness. Whoever accepts our previous discussions based on our structural and functional hypothesis can hardly hesitate to answer, that consciousness accompanies processes in the 'higher' connecting neurons, the higher 'nerve centers,' whereas processes restricted to the lower centers may go on without any consciousness. A definite line in this respect cannot be drawn. It is impossible to state just how high the centers involved, how indirect the neuron connections leading from sensory to motor points of the body have to be in order to be accompanied by consciousness. Nevertheless there will scarcely be any objection to the general statement of this dependence. It is also natural to assume that the consciousness must be the more elaborate, consisting of sensory impressions and whole trains of associated imagery, the more indirect the paths taken by the current, the more delayed accordingly the motor response.

What then is the nervous correlate of pleasantness and unpleasantness? If we held, as one of the psychologists mentioned, that unpleasantness was merely a weak sensation of pain and pleasantness merely a weak sexual sensation, then no further answer would be necessary, the answer would have

been given already. But we hold that pleasantness and unpleasantness are states of consciousness differing in kind from sensations, perceptions, images, ideas. One principle must be adhered to. We must not multiply conditions beyond need. We must apply the same views without change as long as comparison with the facts of experience permits. We have assumed that sensation and imagery depend on activity of the higher connecting neurons of the nervous system. Let us therefore assume that pleasantness and unpleasantness too, depend on activity of the higher connecting neurons. But if pleasantness and unpleasantness are different in kind from sensation and imagery, then the kind of 'functional' (in a mathematical sense) relation between nervous activity and pleasantness and unpleasantness is likely to be found to be a different one.

Asking, then, the question as to what constitutes the nervous correlate of pleasantness, we give this answer. The nervous correlate of pleasantness and unpleasantness must be *some form of activity in the higher nerve centers*, since it is generally admitted that only activities in the higher nerve centers are accompanied by consciousness, and pleasantness and unpleasantness are kinds of consciousness. But while the correlate of sensation is the nervous current itself, the *correlate of pleasantness and unpleasantness is the increase or decrease of the intensity of a previously constant current if the increase or decrease is caused by a force acting at a point other than the point of sensory stimulation.*

Some psychologists will doubtless be quick to raise the objection that the correlate of a mental state must be a 'physical state,' a nervous process going on in a mysterious 'feeling center,' that it is *inconceivable* that the nervous correlate of pleasantness or unpleasantness could be a mere increase or decrease in the rate of flow. However, things are often inconceivable for the sole reason that they have never been conceived. That heat, light, magnetism, electricity, are anything but substances capable of flowing from one place to another has been inconceivable to some, that they are anything but forms of vibratory motion of a hypothetical ether has been inconceivable to others.

And still there are those who conceive of them as mere periodical changes in the distribution of energy. If preconceived notions were less strong in psychology than anywhere else in human activity, the psychology of feeling would long ago have passed out of the state of confusion in which we find it at present. Nothing is inconceivable but that which implies a logical contradiction. The theory above advanced does not contain such a contradiction. Its scientific value, of course, is not proved thereby, but depends on its capacity for bringing the varied experiences referred to by feeling or by pleasantness-unpleasantness under a clearer and more comprehensive formula than other theories are capable of. That there is an increasing tendency among psychologists toward some such theory as the above appears from some of the views reported in our historical introduction and similar views expressed in some recent text-books on general psychology. However, I do not know of any attempt at giving this theory any formulation which can compare in definiteness with the one presented above.

The most difficult part of our task is still before us, that of showing that the varied experiences of pleasantness and unpleasantness become easily intelligible as special cases of the general fact stated. The difficulty of this task, however, is not—as is often the case with theories—the result of a lack of definiteness; it is the consequence of the enormous complexity of the conditions under which pleasantness and unpleasantness come to be felt in ordinary life. We must therefore restrict ourselves at present to applying our theory to a number of typical instances.

1. *Pleasantness-Unpleasantness Does not Occur Apart from Perception.*

Writers on psychological theory usually emphasize the fact that pleasantness and unpleasantness seem to lack independence, that they cannot occur alone but only as an accompaniment of sensory or ideational states. Some have felt constrained under these circumstances to assume that pleasantness and unpleasantness are attributes of all sensations, that every sensation has a feeling-tone, positive, negative, or indifferent. This doctrine

of the feeling tone of sensation must be rejected because it does not fit such cases as that mentioned by Miss Calkins where a person mistakes an ice-cream fork for an oyster fork. But it must be admitted that pleasantness and unpleasantness never occur alone, separate from sensory or ideational mental states. Now this is just what is to be concluded from our theory. There can be no increase or decrease of a nervous process without the nervous process existing itself. Therefore there can be no pleasantness or unpleasantness without sensory or ideational content. On the other hand, a nervous process can exist without increasing or decreasing. It is true that a nervous process cannot come into existence without increasing or go out of existence without decreasing. But this increase or decrease is the consequence of conditions existing at the point of stimulation, and is therefore, according to our theory, not the correlate of any pleasantness or unpleasantness.

2. *Pleasantness-Unpleasantness Is Not Localized.*

Excepting a few psychologists there is a general agreement that pleasantness and unpleasantness cannot be localized, whereas all sensations can be localized, although not always very exactly. Nothing else could be the case according to our theory. We can localize the sensory point from which a nervous process takes its origin, for instance, by imagining the visual appearance of that sensory point amidst its surroundings. But it is obviously impossible to have, visually or by other sensations, any experience of the point within the central nervous system where the decrease or increase of the nervous process originates. Sometimes, however, we know or think we know that the decrease or increase has its indirect cause in a certain sensory stimulation, as, for example, when we are studying and hear our neighbor's piano. Some psychologists may describe this experience by saying that they localize unpleasantness in the ear, but the majority will probably insist that the unpleasantness of this experience is not localized anywhere, that the sound only is localized in the ear.

3. *Certain Sensations Are Usually Unpleasant.*

Certain sensations, for example, pain, bitterness, acidity, are nearly always unpleasant. But it would be misleading to state that this is the feeling-tone of these sensations — a doctrine which we have already rejected. Many articles of food which are but slightly sour or bitter, are pleasant to eat. And psychologists are coming more and more to recognize the fact that even the sensation of pain, in its lower degrees, is not invariably unpleasant. The relation of these facts to our theory is not difficult to see. One may distinguish two ways in which the sensation of pain may be brought about, by a movement on the part of the subject, as when I lift my hand and thus come in contact with a sharp instrument, and by an influence of another kind while my body is at rest, as when I am unawares bitten by a dog. However, there is no fundamental difference between these two cases, for rest too, in ordinary life, means a definite kind of muscular innervation. Now, if my nervous organization, by both instinct and habit, were such that the nervous processes going on at the time when my hand was bitten could remain the same after this event as before, the probability is that the dog would bite me again and would thus diminish my chances for life. It is entirely in accord with what we must expect from the necessities of life when we find that the sensory processes resulting from the application of the dog's teeth bring about cessation of the muscular innervation existing at that moment and substitution of another kind of muscular activity. We see at once that for this purpose it is necessary and unavoidable that I be so organized nervously that the two processes, the one which results in what we called rest and the new one which originates from the point where my pain nerves were stimulated, and which results in withdrawal of the hand and in other movements of defense, meet somewhere in the nervous system. According to our structural hypothesis any two nervous processes can meet somewhere. As soon as the second process meets the first, it will through its own greater intensity detract from the first process and thus bring about the cessation of the muscular activity which had existed up to the time of biting. If the meeting of the two nervous processes occurs in 'nerve centers' which

are not very high there is no accompanying consciousness. The movement of defense would be called instinctive or automatic. Something like what we have described might occur during sleep without the subject's awaking. But if the meeting occurs in a very high nerve center, there must be the consciousness of the sensation of pain and other ideas associated. The defensive movement in this case would be called voluntary. And now, there must also be, according to our theory, a conscious state of unpleasantness whose intensity depends on the *rate* at which the first nervous process is *deflected* from its original course into that of the second process — which is identical with the rate at which the original flux is *decreased*. The flux of the second process is thus increased, but this, according to the theory, does not result in pleasantness because the second process is only establishing itself, has not previously been constant.

It is not strange, then, that the sensation of pain is nearly always accompanied by unpleasantness. But there are some, though rare, cases where the sensation of pain is not accompanied by unpleasantness. From our theory we can understand these cases as well as the more common case just discussed. Those, for example, who are chronically sick and suffer constant pain, would only injure themselves by reacting upon pain as a normal person reacts upon a dog bite. They learn to continue the muscular activity in which they are engaged even when the sensation of pain suddenly makes itself felt. That is, the new nervous process is no longer able to meet the first process, to detract from the first process, but takes its separate path leading to some kind of muscular activity irrelevant to the subject. According to our theory there can then be no unpleasantness. Psychologists have often thought to give a complete description of such a case by simply stating that the invalid pays no attention to the sensation of pain. While it is doubtless true that very often he does not pay any attention to the pain, that very often the second process does not reach any higher centers, in the opinion of the present writer this is not the whole truth, but must be supplemented by showing that even when attention is paid there need not be any unpleasantness; and this we have shown above.

Imagine a scientist, perhaps a psychologist, studying experimentally the sensation of pain. He cuts out a piece of his skin and records carefully how the sensation of pain develops. It is not astonishing if we are told that, although he felt the sensation of pain, he felt no unpleasantness. If the nervous process starting from his pain nerves had interfered with, detracted from those processes going on at the moment, his experiment would have been a failure because it would have been cut short. If he is so interested in the experiment that he succeeds in bringing it to the proper end, then there can have been no unpleasantness, for there has been no deflection of his nervous processes. There might have been even pleasantness, for the sensation of pain, being expected, may induce the experimenter to cut further. The nervous process starting from the sensory nerves of pain in this case did not take any course of its own, but joined the nervous processes going on at the time when it started, increasing their intensity.

Insects have bitten us, and the itching thus caused produces scratching movements. Pain is the result of the scratching; but this pain is by no means unpleasant, rather pleasant. Why? The pain does not stop us scratching. On the contrary we scratch the more for it. The nervous process starting from the pain nerves joins the process going on when the pain was first produced. However, if the pain becomes too strong, then the sensory process of pain intercepts the previous process, a typical pain reaction follows, scratching ceases, and unpleasantness is felt.

If a sour or bitter substance is put in an infant's mouth, the instinctive response is that of spitting. The new nervous process intercepts those going on at the time, and unpleasantness is felt. While the tastes of sour and bitter are invariably unpleasant to children, they are often found to be pleasant in older people unless they occur in too strong a degree. Some people like bitter beer and sour pickles. How does this come about? The answer is not difficult. If for one reason or other, that is, under the influence of strong nervous processes which overpower the instinct, sour or bitter food is frequently taken, the resistance of the path representing the original instinct is increased, accord-

ing to our theory, and a new nerve path of small resistance leading to the movement of sucking and swallowing is formed. Whenever now a movement occurs which brings a slightly bitter substance into the mouth, for instance the movement of sucking beer from a mug, the nervous process resulting from the bitter stimulation is of essentially the same kind as the one which has been going on and therefore simply joins it, increasing its intensity. According to our theory pleasantness must then be experienced.

But why should the sensation of bitter be unpleasant to the same subject when recurring in a much higher degree, caused, say, by a dose of quinine? Now, we did not say that the original (instinctive) nerve path has been entirely obliterated. The stronger the stimulus the greater the diffusion of the nervous process. This diffusion is to be expected particularly in the direction over the original path. This path was by inheritance, and is still, connected with a large number of the most ordinary motor paths, in order to insure to the animal the protection so necessary against getting harmful substances into the mouth. It is highly probable, then, that this strong process passing over the instinctive path will be joined by other accidental nervous processes, that thus it will become still stronger until its intensity becomes greater than that of the other branch passing over the habit path. Immediately, according to our theory, the habit process is intercepted and the original instinct has for the moment full sway. Unpleasantness is the logical consequence.

Although there is a natural aversion against tobacco, alcohol, and other drugs, their taste and smell, etc., may be made pleasant by simply using these substances persistently in spite of the original instinct, till the instinct is sufficiently weakened, that is, the resistance of the reflex arch sufficiently increased. The establishment of the habit must be quickened, of course, by changes in the chemical constitution of the nervous system and the sense organs, which take place in consequence of the organism's adapting itself as well as possible to the continued prevalence of unnatural conditions.

4. *Certain Sensations Are Usually Pleasant.*

Certain sensations are almost invariably pleasant. Sweet and sexual sensation are good examples, so much so that some psychologists, as we saw in our introduction, have been misled into regarding pleasantness as a weak sexual sensation. It is plain that, if animals were so organized nervously that the nervous process starting from stimulation of the sexual sensory nerves were likely to intercept those nervous processes leading to the muscular innervation existing at the moment of stimulation, fertilization of the ovum and thus propagation of the race would be a highly improbable occurrence. But the nervous system of all animals is by inheritance of such a structure that the higher connections of the reflex arches and the distribution of resistances cause the nervous process starting from stimulation of the sexual sense to join those processes existing at the moment of stimulation, to increase the intensity of the muscular innervation of this moment. The result is, according to our theory, pleasantness.

Nevertheless there are cases where the sexual sensation is indifferent or even unpleasant, just as there are cases where the sensation of pain is pleasant. Both the possibility and the comparative rarity of the sexual sensation's being unpleasant are easily comprehended from our theory. In a similar way the theory can be applied to the familiar experiences of pleasantness or unpleasantness of the sensation of sweet.

5. *Sensory and Intellectual Pleasantness and Unpleasantness.*

The chief objection to the doctrine of a feeling-tone of sensation is this, that pleasantness and unpleasantness accompanying ideational states are in a grown person's life much more numerous and also, on the whole, much more intensive than pleasantness and unpleasantness accompanying sense impressions. It must be regarded as one of the points of superiority of our theory that it helps us to comprehend this fact without forcing us to distinguish sensory and intellectual pleasures as two different classes of mental states. According to our theory pleasantness can exist only when one nervous process is increased by a second and weaker process which is forced to join

it partially or wholly ; unpleasantness can exist only when one nervous process is decreased by being partially or wholly intercepted by a second and stronger process. Such influences of a second nervous process on the intensity of an existing nervous process are possible only if the two processes meet somewhere in higher connecting neurons. It is at once clear that, as a rule, processes passing from sensory to motor points of the body over very indirect paths, by way of the highest connecting neurons, the 'highest centers,' are more likely to meet and interfere with each other than those which reach motor points of the body over very direct paths. The latter, however, are the nervous correlate of simple sensations and perceptions, the former the correlate of the more complex conscious processes made up of percepts and ideas, possibly long trains of thought. We comprehend thus why, on the whole, the highest intellectual activities give us the most intensive experiences of pleasantness and unpleasantness, whereas pleasantness and unpleasantness accompanying mere sensations are rather insignificant in the mental life of a person of culture.

6. *Positive and Negative Quantities.*

Pleasantness and unpleasantness have been regarded by many writers as positive and negative quantities the balance of which alone could have actual existence in conscious life. The present writer, from the introspective evidence of his own life, agrees with those psychologists (*e. g.*, Lipps) who hold that pleasantness and unpleasantness can exist at the same time. The belief that they exclude each other seems to have originated from the observation that when there is much pleasantness, there is, as a rule, no unpleasantness at all, and the reverse. Our theory explains, not only the fact just mentioned, but also the coexistence of pleasantness and unpleasantness in less frequent cases. We rarely do two things at the same time. This is a fact which we recognize as such without having to comprehend its biological sources. Doing one thing, however, does not mean that there is, in the strictest sense, only one nervous process passing through our organism from one sensory point to one motor point. Thousands of sensory neurons are stimulated and

thousands of muscle fibers receive innervations from their motor neurons simultaneously. But all these nervous processes must be thought of as running parallel, without any mutual interference. Recalling our Fig. 2, and supposing the reflex arches S_1M_1 , S_2M_2 , S_3M_3 to represent such parallel nervous processes, it is easily seen that any other process which, at a higher connecting neuron, causes any increase or decrease of one of the processes in these arches must influence all others in a similar way. It is quite comprehensible, therefore, that ordinarily we experience either pleasantness or unpleasantness or neither, not both. But the nervous system is made up of such an enormous number of reflex arches and such a complicated hierarchy of nerve centers that doubtless nervous processes may go on somewhere within it and simultaneously other processes elsewhere so that a third class of processes may cause an increase of intensity in the currents of the first class and simultaneously a fourth class of processes a decrease of intensity in the currents of the second class. Thus pleasantness and unpleasantness do not necessarily exclude each other. But owing to the generally prevailing tendency of centralization of nervous function there will be, as a rule, at any moment either pleasantness without unpleasantness or unpleasantness without pleasantness, or neither. To describe pleasantness and unpleasantness as positive and negative quantities seems to the present writer pure speculation which arbitrarily disregards all introspective evidence to the contrary.

7. *Emotions and Pleasantness-Unpleasantness.*

It follows from our theory that the more nervous activity, that is, the more numerous and widely distributed the nervous currents, the more chances there are for intense feelings of pleasantness and unpleasantness. A good example of a wide distribution of the currents over the nervous system is an emotion of an adult human being. The consequence is, on the one hand, the complexity of organic sensation so characteristic of an emotion; on the other hand, the intensity of the pleasantness experienced, or unpleasantness, or both. The former has been most lucidly described by Lange, most successfully applied to psycho-

logical theory by James. The latter consequence, however, has never been clearly understood. The fact that pleasantness and unpleasantness are almost invariably and in great intensity found in emotion has led to the deplorable confusion of psychological terminology, where 'feeling' sometimes stands for an unanalyzed complex of organic sensations, sometimes for the pleasantness-unpleasantness experience, sometimes for both. The present writer cannot help believing that many of the contradictory results of experimental work on feeling of recent years would have resolved themselves and given place to perfect clearness if both experimenters and subjects had worked on the basis of some such theory of pleasantness and unpleasantness as has been presented above.

To avoid misunderstanding it may be stated here expressly that, although emotions of grown human beings, according to our theory, must nearly always be accompanied by strong pleasantness and unpleasantness, our theory does not require that states of consciousness of the kind which some psychologists would call emotions, for example the consciousness of lower animals or small children, must inevitably be accompanied by pleasantness and unpleasantness.

8. *Attention and Pleasantness-Unpleasantness.*

Our theory throws some light on certain problems connected with the theory of attention. 'Interest' has been defined by some psychologists as acquired capacity for attention, as distinguished from strictly native capacity for attention. Other psychologists have defined interest as attention accompanied by pleasantness. If our theory of the nervous correlate of pleasantness and unpleasantness is accepted, both definitions have the same meaning. Imagine you are interested in the presidential election. You have heard the dinner bell and are rising from your chair. The cover of a magazine strikes your eyes, on which you read the title of an article on candidates for the presidency. This interferes with your walking to the dining room and you experience a brief unpleasantness. Perhaps you decide not to take any dinner, but to find out immediately what the article has to say. While you are reading the paper, every

stimulation of your sense organs other than the sight of the printed pages is unable to reach its motor end, but must join and increase the intensity of the process of reading, because of your acquired capacity for reacting strongly upon words and sentences which have the meaning of politics. According to our theory you experience pleasantness. Thus we see that an acquired capacity of attention can result in unpleasantness at the moment when attention begins and must result in pleasantness as long as attention in the same direction continues. This continued pleasantness is much less likely to occur in a case of native attention; for the reflex arches which are the condition of native attention do not pass over the highest centers and thus are not to the same extent capable of forcing newly arising nervous processes to join them instead of running their own course. The nervous paths which are the condition of a highly developed acquired capacity for attention, are in contact with innumerable higher centers and are thus capable of forcing almost any newly arising nervous process to join and increase the habit process in question.

9. *The Causes of Action.*

Many writers on psychological topics have urged that it causes confusion in theoretical thought to speak of pleasantness and unpleasantness as causes determining our action. Fite, in the paper mentioned above, has strongly urged the necessity of this view denying causality to pleasantness and unpleasantness, in ethics, though unfortunately he has failed to make the necessary distinction between unpleasantness and the sensation of pain. According to our theory of their nervous correlate pleasantness and unpleasantness cannot be regarded as causes of action in the sense in which sensations and ideas are causes of action. The nervous correlate of a sensation is a nervous process starting at a sensory point, passing over a definite path of connecting neurons, and ending in a motor point of the body. The sensation (or perception, if it is a unified group of sensations) preceding the movement may justly be called the cause of the movement. If the nervous process passes over higher connecting neurons which have previously been excited from

different sensory points of the body we experience imagery. These images may justly be called the cause of the action, for this movement would not have taken place in response to this sensory stimulation if the nervous current had not taken this very path over higher connecting neurons. The fact, however, that a current, after becoming established, suddenly suffers an increase of intensity at an interior point of the course is not a necessary condition of a particular reaction, for, conditions in general being favorable, the same reaction can occur without a sudden increase of the nervous process. Therefore, if we regard pleasantness as the mental correlate of the increase in question, we gain clearness by abstaining from calling pleasantness the cause of the action. On the other hand, without this increase of intensity, the action might have suffered inhibition before it had been carried out in all its phases, so that, in this sense, the pleasantness may be called the cause of this action under these special circumstances of nervous activity, just as we often in daily life refer to pleasure as the cause of an action. However, those psychologists seem to have chosen the safer course who refrain from speaking of pleasantness as a cause of action, because thus they are induced to look for the more important, the ultimate causes of the particular response, for the sensory stimulation of the moment which leads to this response and the sensory stimulations of the past which have prepared the way for it; and looking for these ultimate causes in each particular case, they are more likely to discover them than those psychologists who are not in search of them, but are satisfied if they can assert that pleasure had something to do with the response.

10. *No Images of Pleasantness-Unpleasantness.*

Some psychologists have stated that 'feelings' cannot be imaged, revived, as sensations can. If by feelings are meant exclusively pleasantness and unpleasantness, we must agree with this view. According to our theory pure sensory impression occurs when a nervous process passes rather directly into a motor point of the body, imagery when it takes an indirect path over higher connecting neurons over which a different process

has previously passed from a different sensory point of the body. But the mere increase or decrease of a current, which according to our theory is the nervous correlate of pleasantness and unpleasantness, has no reference to directness or indirectness of the nervous path, and its mental correlate, therefore, cannot be expected to show any corresponding distinction.

II. *The Latest Product of Mental Evolution.*

Most psychologists hold that feeling is the most primitive form of consciousness, that sensation is the next higher stage of mental evolution, and ideation the highest. There may be truth enough in this, if by feeling is meant certain kinds of emotion which consist of vague undifferentiated sensation groups. But if by feeling is meant pleasantness and unpleasantness, the truth is probably that these represent rather the highest stage of nervous activity than the lowest. It is obvious that according to our theory of their nervous correlate pleasantness and unpleasantness are the highest product of mental evolution. They cannot exist in animals which are governed by ready-made and invariable reflexes. Only where, through mediation of higher nerve centers, variation of response becomes possible, can pleasantness and unpleasantness be experienced. And only in the highest animal, in man with his highly centralized nervous system, can they reach their highest degrees. That this is opposed to psychological tradition does not prove that it is wrong. The tradition has its origin in the lack of distinction between emotion on the one hand and pleasantness-unpleasantness on the other. The writer's own introspection seems to agree better with the consequence of the theory here developed than with the traditional view. His earliest childhood as remembered was characterized by primitive emotions of the purely instinctive type; but pleasantness and unpleasantness have made themselves felt the more strongly the more his education has advanced, the more his nervous processes have become able to interfere in the most manifold ways with each other. That a child laughs and cries more than an adult is true; but that a child experiences more pleasantness and unpleasantness does not follow. That the consciousness of the lower animals is a kind of primitive

emotion, made up of vague, unanalyzed complexes of organic and external sensations, may be admitted. Analyzed sensation and perception may be the next stage; but here gradually pleasantness and unpleasantness can make their appearance in mental evolution, reaching their highest development where the ideational processes attain their highest development, in the adult educated man.

Someone might raise here the question: If pleasantness and unpleasantness can not be 'imaged,' how can you 'remember' that they were less intense in childhood than in adult life? The answer to this question is this: I can know by memory that certain experiences of my present life are very much like those rather simple experiences of my childhood, and that other experiences in my present life are incomparably more complicated than any which ever occurred in my childhood. Now, if I know that the latter, the more complicated experiences, are, as a rule, distinguished by the most intense pleasantness and unpleasantness, I have a right to conclude that childhood is comparatively poor in pleasantness and unpleasantness.

The question may also be asked, how pleasantness and unpleasantness, if it is true that they are not the causes of our actions, can nevertheless induce a person to sit down at his desk and write a treatise about them. Here it must be understood that their causality has not been absolutely denied, that it has merely been held that their causality is a less direct one than that of sensations and images, and that, as a rule, we obtain a clearer insight into the causal connections in mental life by disregarding pleasantness and unpleasantness as causes than by using them as an ever-ready explanation for any actions whose origin is unknown.

SUMMARY.

By a study of the theories of various writers on pleasantness and unpleasantness we convinced ourselves of the great need for clearness in this field of psychology. In order to obtain this clearness, we found it necessary to develop a definite theory of nervous function. We could not develop this without first making a definite hypothesis as to the structural arrangement

of the elements of which the nervous system is composed. Thus we were enabled to advance a theory of the relation between consciousness and nervous function, in particular between pleasantness and unpleasantness and nervous function. This theory we applied to a number of specially important facts and found that these facts, otherwise rather isolated and not easily comprehensible, appear now as logical consequences of the theory, as an easily comprehensible system of psychological facts having this theory as their common basis.

CORRELATION OF CERTAIN MENTAL TRAITS IN NORMAL SCHOOL STUDENTS.¹

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Investigations of the correlation of mental abilities are fairly numerous, but they are principally of two kinds: first, correlations of proficiency in the various school and college studies, and secondly correlations of the simpler mental processes. A glance at the results will be in place here. There is very little correlation between drawing and the other studies, but there is a considerable amount between the latter studies themselves, usually from 30 to 60 per cent. The surprising feature is that there is as much correlation between the languages and natural science as there is among the languages, and as much between history and natural science as between history and the languages, in short with a few exceptions, "whatever it is that makes for correlation in class standing seems to hold generally for all courses."

The other type of investigation, that of mental processes, has confined itself to quite simple processes. The accuracy shown in bisecting a line, or in striking dots printed on a sheet of paper, or in estimating weights, or in keeping a rhythm is compared with the quickness shown in simple reaction, or in naming colors, or in the association of ideas. Again these are compared with the visual memory for numbers. Often two tests of the same supposed trait, for example accuracy, have been compared with each other, on the theory that correlation among quite different processes was not to be expected. It is significant in this connection that more correlation has been found among the apparently complex processes involved in the school studies, than among the simpler mental processes like those mentioned.

Neither line of investigation has so far given us types of mind, which, however numerous they might be, would be of

¹The MS. of this article was received May 3, 1908. — ED.

use in practical life and in educational theory. For while the investigations of school abilities connect with practical life, they do not give us *complete pictures of individuals*, even on the school side of life. We do not know how individual persons stand in all their studies, *i. e.*, types are lacking. And the studies of mental processes, in the effort to obtain simplicity, have devised tests in many cases removed from life, for example, picking out words containing r and e, or remembering series of numbers. Further, the higher processes of reasoning, generalizing, comprehending abstract thought, art appreciation, moral sensitiveness, etc., are left untouched.

The following investigation belongs to the second group, but it has sought to bring in some of the so-called higher processes, in particular some which play a leading part in acquiring knowledge. It has also been on the lookout for evidences of types of scholastic mind, and for this reason the effort was made to make the tests somewhat comprehensive. Five tests each taking from 30 to 70 minutes were given to a class of second-year normal and college students. The average age was 21 years.¹ The normal school students greatly preponderated. The traits tested were accuracy in copying a bibliography, memory for simple connected thought, deductive reasoning, generalizing power, and power to comprehend abstract thought. The tests were given during five of the regular periods of a course in elementary psychology. They were scattered through a half-year at intervals of a week or more, and the first one was not given until two months of the course had passed. Enough time had elapsed for the students to be familiar with the vocabulary involved in the accuracy test, and to know what generalizing meant when that test was given. In all cases the tests were given under the eye of the instructor, to small sections of the class, numbering not over 35, under conditions which prevented communication and copying.

I. ACCURACY.

The students did not know that this was a test, as it was given first in the series and before any announcement that a

¹ Average deviation, 2.9 years.

series of tests would be made. The bibliography given below was on the blackboard when they entered the room. They were asked to copy it in their notebooks as it stood, without abbreviating it or making any other changes in it. They were allowed as much time as it took the slowest student to finish, and at the end of the hour the notebooks were collected and the pages containing the test were removed. Thus the exercise was a fair test of how accurate they were in the ordinary pursuit of their courses when they were not on their guard. Inquiry after all the tests had been completed showed that only one person in a section of 35 students suspected that it might be a test. In grading the papers only certain classes of errors were taken into account, such as misspelling the names of authors or the titles of books, errors in the paging, volumes and dates of books and magazines, omission of a dash between the first and last pages or chapters of a reference, omission of the word translation. Errors in punctuation and capitalization were not counted, and in general the aim was to take account of such errors as would tend to hinder the use of the bibliography in a library.

Sensations. — Chapters I.–VII. of *An Introduction to Physiological Psychology*, by T. Ziehen (translation), or *The Analysis of Sensations*, by E. Mach (translation).

The Sense Organs. — *The Physiology of the Senses*, by J. G. M'Kendrick and W. Snodgrass.

An Experimental Study of Connections of Impression. — Chapters V. and VI. of *Analytical Psychology*, by L. Witmer. Experimental.

Apperception. — 'The Reading of Words: A Study in Apperception' (in the *American Journal of Psychology*, 1897, VIII., 315–93), by W. Pillsbury; and 'The Apperception of the Spoken Sentence' (in the *American Journal of Psychology*, 1900, XII., 80–130), by W. C. Bagley.

The Physiological Basis of the Emotions. — Chapters IV. and V. of *Pleasure, Pain and Æsthetics*, by H. R. Marshall. Chapters V. and IX. of *An Outline of Psychology*, by E. B. Titchener. Volume I., Pt. II., ch. IX., of the *Principles of Psychology*, by Herbert Spencer.

Feelings of Relationships. — Pages 243–65 of Vol. I. of *The Principles of Psychology*, by Wm. James.

Feelings of Meaning. — On the question whether all thoughts and feelings can be classified as general notions, individual notions and abstractions: secs. 89–92 of *A Primer of Psychology*, by E. B. Titchener.

II. MEMORY.

The selection given below was read to the class. They were told in advance that it was a memory test in which they would be asked as soon as the reading was finished to recall on paper as much as possible; that recalling the language used was not a part of the test, but they should try to recall as many details or facts as possible. A week later with no warning or refreshing of their memories they were asked to write again as much of the selection as they could recall. In both cases there was no limit on the time, the papers being collected when the last student ceased writing.

Noah Webster.

“Noah Webster was born October 16, 1758, in Hartford, Connecticut, about three miles from the center of the city. His father, Noah Webster, Sr., was a respectable farmer, a deacon in the church, and a justice of the peace. The boy worked on the home farm and attended the village school. When he had reached the age of fourteen, we find him beginning the study of the classics under the instruction of the parish clergyman, and two years later he was admitted to Yale College. The Revolutionary War seriously interrupted the college course, but he graduated with credit in 1778, and his father gave him an eight-dollar Continental bill, then worth about half its face value, and told him he must henceforth rely on his own exertions.

“It had been young Webster’s intention to become a lawyer. The country, however, was impoverished by the war, and his first necessity was to make a living. So he resorted to school teaching. Pedagogy at that time was attended with unusual difficulties. Not only was the war still in progress, but the interruption of intercourse with Great Britain had made school-books very scarce. The need of a home source of textbook

supply was evident, and in 1782, while in charge of a school in Orange County, New York, Webster compiled a spelling-book. This was printed at Hartford the next year and gradually won very wide acceptance. During the twenty years its author was engaged in preparing his dictionary, 1807 to 1827, the profits from that one little school-book furnished the entire support of his family, though his copyright receipts were less than a cent a book. The sales went on increasing up to the time of Mr. Webster's death, at the age of eighty-four. A million copies annually were then being called for, and the total distribution had reached twenty-four millions.

“In his person Webster was tall and slender. To the very end he was remarkably erect, and his step light and elastic. He was enterprising, self-reliant, and very methodical, and a most persevering worker. Besides the monumental labor of making his dictionary, he had much to do with newspapers and magazines, both as editor and contributor, and he wrote a great number of books and pamphlets on literary, historical, medical, religious, scientific, and political subjects, some of which were of very marked value in forming public opinion. He taught school in his early manhood for about ten years, and then, from 1789 to 1793, was a lawyer in Hartford. During other periods he served as an alderman in New Haven, as a judge in one of the Connecticut courts, and as a member of the Massachusetts legislature. His activity was astonishing in amount and variety, and it was unceasing. Mental exertion seemed to be the native element of his soul.”

In grading the papers the selection was marked off into 85 facts or details, and each person's grade was determined by adding together the total numbers of facts he recalled in the first and second recalls. Generalizations were fairly common, *e. g.*, he wrote for the newspapers on a number of different subjects. These were allowed 1 point.

III. REASONING.

In this and the two remaining tests each student had a clear mimeograph copy of the questions before him. In the reasoning exercise the aims were to test the student's sense of the

truth or falsity of ordinary judgments and his sense of the logical connection of statements. No course in logic was presupposed. The meaning of the terms 'premise' and 'conclusion' was explained and the necessity of giving reasons for one's answer in case an error in the reasoning was thought to be detected was emphasized, but otherwise no further directions were given than those which head the exercise. Seventy minutes was allowed.

A.

State whether the following conclusions are *necessarily* true or not. If not, where is the error? Point it out. If the reasoning is sound, but the premises false, point out what is false in the premises.

1. The express train alone does not stop at this station ; and as the last train did not stop, it must have been the express train.

2. If Parr's pills are of any value those who take them will improve in health ; my friend who has been taking them has improved in health ; therefore they are of value.

3. Nothing that increases taxation can long be popular. All wars increase taxation, and consequently none of them can be popular very long.

4. If he did not steal the goods why did he hide them, as no thief fails to do?

5. The Greek teacher of oratory and politics, Protagoras, makes an agreement with a pupil, Euathlus, by which the latter is to pay for the instruction which he has received from Protagoras, as soon as he wins his first case ; but as he engages in no suits, Protagoras gets nothing, and sues him on that account, confronting him with the following dilemma : " Whatever be the issue of this case, you must pay me what I claim ; for if you lose you must pay me by order of the court, and if you win you must pay me by our contract." Euathlus retorts as follows : " Whatever be the issue of this case, I shall not pay you what you claim ; for if I lose I am free from payment by our contract, and if I win I am free by order of the court."

6. An Athenian mother urged her son not to enter public life on the following grounds : " If you say what is just, men

will hate you ; and if you say what is unjust, the Gods will hate you. You must say one or the other ; therefore you will be hated." The son replied that he ought to enter public life, giving the following reasons : " If I say what is just the Gods will love me ; and if I say what is unjust, men will love me. I must say one or the other ; therefore I shall be loved."

7. Giving advice is useless. For either you advise a man what he means to do, in which case the advice is useless ; or you advise him what he does not mean to do, and the advice is ineffectual.

B.

Solve the following examples :

1. Twelve persons hired a boat for a certain sum. Four of them withdrew without paying, and thus the expense of each of the others was increased by \$2. What was the rent of the boat?

2. Three men can paint a boat in four days. Two of them can do it in six days. How long would it take the third man working alone?

C.

Prove the following theorems :

1. The diagonals of a rhombus are perpendicular to each other and bisect the angles.

2. Two circles have radii of 8 inches and 3 inches respectively, and the distance between their centers is 15 inches. Find the length of their common tangents.

In grading the reasoning papers no certain amount of credit was allowed for each question. The student's ability was *estimated* as teachers of English estimate a student's ability to use the English language from a written paper. Certain rules regarding doubtful questions, which cannot be given here, were followed. Liberal credit was allowed for partially correct answers or for differing answers, where there was ground for a difference of opinion. The paper gives opportunity for different degrees of ability. In A the first four and the seventh are relatively easy, the sixth more difficult, and the fifth the most difficult. B₂ is harder than B₁, and C₂ than C₁. *As the attempt was made to grade the papers only as good, medium and poor*, it is believed that the marks are reliable. Five degrees of ability could prob-

ably have been distinguished, but the more conservative position seemed the wiser under the circumstances.

IV. GENERALIZING POWER.

Before beginning this test the meaning of generalizing was explained. This was probably unnecessary as the class had already studied the process during the term. The term 'selectmen' was also explained. Time allowed: 50 minutes.

1. What generalizations can you make from the facts given below? Why is the cloth around the glass *wet*? Why is straw put under the saucers in India?

"Water put into a vessel of unglazed clay is kept permanently cool in warm dry air, by the evaporation from the surface of the vessel. A similar result is produced when a glass vessel is employed, if it be wrapped in a wet cloth and placed in a current of air. In some parts of India ice is procured by exposing water at night in shallow unglazed saucers, laid upon rice-straw. More rapid effects may of course be obtained by using instead of water more highly evaporable liquids, such as sulphuric ether. A few drops of ether sprinkled on the bulb of a thermometer, produce an immediate contraction of the contents, which is greater as the temperature of the air is higher. This process, with a quantity of dry oatmeal, or a large surface of sulphuric acid (to absorb the vapor as it is formed) was employed by Sir John Leslie for the purpose of making ice; and is still, with various modifications, the basis of some of the most convenient domestic ice-machines."

2. What general statement or statements can you make which will be true of all the following instances of the way in which Colonial schoolmasters were paid?

In Watertown, Mass., in 1680 the schoolmaster got 25 pounds and the benefit of the Latin scholars. In Newbury, Mass., in 1696 the schoolmaster was offered 30 pounds in country pay by the selectmen provided he demand but 4 pence per week from Latin scholars, and teach the town's children to read, write and cipher without pay. In Lynn, Mass., in 1702 a schoolmaster was allowed 40 pounds by the selectmen, and Latin pupils were charged 6 pence per week. In this case, assuming an average

of 6 Latin pupils attended the whole year, we see his total wages would be about \$237. In Hartford, Conn., in 1643 the town agreed that the schoolmaster should receive 16 pounds, that this should be raised by tuition fees of 20 shillings a year per pupil as far as possible, but the town was to make good any deficit. The indigent were free. Salem, Mass., had a subscription for its school, but the town provided for the poor by a rate.

3. What is the difference between plants and animals?

4. What is the difference between the two classes of movements referred to in this selection: If wasps are allowed to come into a room for honey placed there, and if after they enter the window is closed and another window on the opposite side of the room is opened and they are put out at this window, after a number of repetitions of the experience they will leave by the latter window of their own accord. Chickens driven into a shed after nightfall for a number of days will finally go there without driving. Contrasted with these movements are the movements of the human eyelids when solid matter threatens to enter the eye, and the trophic movements of plants, such as the turning of their leaves toward the light when placed in a window.

5. What is the difference between gambling and legitimate business investment?

6. What is the difference between courtesy and gallantry?

The estimate plan of grading the papers was used here. The questions *most* relied upon in determining the grades were the first, second and fifth.

V. POWER TO UNDERSTAND ABSTRACT THOUGHT.

About 40 minutes was allowed for this test.

Study the selection numbered 1 and tell the meaning of it in your own language. No notice will be taken of papers which quote the selection, even in altered words. Express *all* the ideas that you get from it. Then do the same with the selections numbered 2, 3 and 4.

1. "It has been said that protection is the cause of high wages. Our present tariff averages above forty per cent. on the entire amount of dutiable goods; and as a result the price of all articles named in the schedules, both of foreign and domes-

tic manufacture, is raised in most cases by the entire amount of the tax, since importation continues. Since the list includes nearly every article of comfort or necessity in the family, the laborer must pay a considerable part of his wages to meet this tax. In most cases this increased cost of commodities is far greater than the assumed increase of wages. Hence the laborer is injured, even on the supposition that the claim of protectionists is true. When analyzed, wages are not the dollars received, but the goods which they will buy. Profit is not the money handled, but the sum that is saved."

2. "No one will doubt that men are more possessed by the instinct to fight, to be the winner in serious games and contests, than are women; nor that women are more possessed than men by the instinct to nurse, to care for and fuss over others, to relieve, comfort and console. . . . The fighting instinct is, in fact, the cause of a very large amount of the world's intellectual endeavor. The financier does not think for money, nor the scientist for truth, nor the theologian to save souls. Their intellectual efforts are aimed in great measure to outdo the other man, to subdue nature, to conquer assent. The maternal instinct in its turn is the chief source of woman's superiorities in the moral world. The virtues in which she excels are not so much due to either any general moral superiority or any set of special moral talents as to her original impulse to relieve, comfort and console."

3. By realism we shall mean a belief in the existence of things independent of perceiving minds, and by realism, the contrary belief that nothing exists but minds. The fundamental fallacy of realism lies in its assumption of the existence of primary and secondary qualities in things. By primary qualities they mean those which exist in things independent of the perceiving mind. They are extension in three dimensions, weight, motion and number. By secondary qualities they mean those which are produced by the action of things on our sense organs, such as color, sound, taste, odor, temperature, and so on. But according to this definition of secondary qualities, all the so-called primary qualities are as truly secondary as the secondary ones themselves. For we know nothing of

their existence, except as we get them through our sense organs.

4. "Motives. There is no need of restricting the word motive to any particular class of feelings. Any mental state may serve as a motive. For a motive to an act is simply any fact which assists to be present and to be approved a mental state which will have the act as its sequent. A motive against the act is simply any fact which hinders the presence and approval of a mental state which will have the act as its sequent."

As in the third and fourth tests the estimate plan of grading the papers was followed, and only the three grades of ability good, medium and poor were distinguished. The selections vary a good deal in difficulty thus allowing scope for different degrees of ability. The third is the most difficult. The fourth, taken from the text-books in psychology they were then using, is a passage which they were supposed to have studied but it was omitted in the recitations.

RESULTS.

Sixty-three persons completed the five tests properly. Thirty-three more took some of the tests but missed others through absence. The percentages of correlation include the latter. In calculating them the grades—given in the form of the total number of errors in the accuracy test, the sum of the total number of facts remembered in the two recalls in the memory test, and in the form of verbal grades in the three other tests—were all changed into their corresponding values in Galton's table of the normal curve of distribution.¹ The coefficients of correlation were then calculated by the method of unlike signed pairs. They are as shown on next page.

It is needless to say that the figures are much higher than those usually obtained for the simpler mental processes. The next table is a group comparison of the 63 students who completed all five tests. It gives their grade in each test. The subjects are denoted by numbers, and are arranged in three groups with reference to their standing in the reasoning test.

¹ Galton, Francis, *Natural Inheritance*, p. 205. I am indebted to Professor E. L. Thorndike for assistance in figuring the coefficients of correlation.

COEFFICIENTS OF CORRELATION.

	Per Cent.	No. of Cases.
Reasoning and generalizing	95	96
Reasoning and abstract thought	83	75
Generalizing and abstract thought	86	77
Reasoning and memory	40	87
Abstract thought and memory	64	71
Generalizing and memory	40	90
Reasoning and accuracy	45	63
Abstract thought and accuracy	48	56
Generalizing and accuracy	28	63
Memory and accuracy	31	62

In this way their standing in the various tests may be compared. The verbal grade good in accuracy and memory was obtained by averaging the number of goods in the three intellectual tests which gave 30, or 48 per cent. of the 63 persons concerned. The highest 48 per cent. of the memory and of the accuracy grades were then called good. The terms medium and poor were obtained in the same way. Hence in these two tests the terms are not estimates, but derive their meaning from the three other tests. The table may be read thus: Of the 30 persons good in reasoning all are good in generalizing, 25 are good in comprehending abstract thought, 20 are good in memory, and of the 24 persons good in reasoning left after deducting the 6 defective in eyesight, 15 are good in accuracy. Of the remainder more are medium than poor. Of the 17 persons poor in reasoning 12 are poor in generalizing, 13 in abstract thought and 8 in memory, and of the 16 poor in reasoning left after deducting 1 defective in eyesight, 6 are poor in accuracy, etc. We find in this group comparison considerable evidence for the existence of three major types of mind, from the point of view of the traits investigated: First, persons good in the three intellectual traits, secondly, those poor in them, and thirdly those between the two extremes in all three traits. The term type is used to denote stages along a continuous line.

But the types tend to be more comprehensive than that. Persons who are superior in the three intellectual traits are apt to have better memories, and obversely. This is shown both by the group comparison and by the average of 48 per cent. correlation between memory and the intellectual traits. There

is some tendency for even accuracy to vary with the three mentioned (40 per cent. average correlation).

GROUP COMPARISON.

Good in Reasoning.

Subject.	Generalizing.	Abstract Thought.	Memory.	Accuracy.
1	Good	Good	Good	Good ¹
2	"	"	"	"
3	"	"	"	"
4	"	"	"	"
5	"	"	"	"
6	"	"	"	"
7	"	"	"	"
8	"	"	"	"
9	"	"	"	"
10	"	"	"	"
11	"	"	"	"
12	"	"	"	"
13	"	"	"	Medium
14	"	"	"	Poor
15	"	"	"	Medium
16	"	"	"	"
17	"	"	"	Poor
18	"	"	"	" ¹
19	"	"	"	Medium
20	"	"	Medium	Good
21	"	"	"	"
22	"	"	"	"
23	"	"	"	Poor ¹
24	"	"	Poor	Medium ¹
25	"	"	"	Poor ¹
26	"	Medium	"	Medium
27	"	"	Medium	Poor
28	"	Poor	Poor	Medium
29	"	Medium	"	Good ¹
30	"	"	Good	"

Poor in Reasoning.

31	Poor	Poor	Poor	Poor
32	"	"	"	"
33	"	"	"	"
34	"	"	"	Medium
35	"	"	"	Good
36	"	"	Medium	"
37	"	"	"	"
38	"	"	"	Poor
39	"	"	Good	Good
40	"	Medium	Poor	Medium ¹
41	Medium	Poor	"	Good
42	Poor	Medium	Medium	Poor
43	Medium	Poor	Poor	Medium
44	"	"	Medium	Good
45	"	"	"	"
46	Poor	Medium	Good	Medium
47	Medium	"	"	Poor

¹ Defective eyesight.

GROUP COMPARISON.—*Continued.**Medium in Reasoning.*

Subject.	Generalizing.	Abstract Thought.	Memory.	Accuracy.
48	Medium	Medium	Good	Poor
49	"	"	"	Medium
50	"	"	"	Good
51	"	"	"	"
52	Good	"	"	Medium
53	"	"	"	Good
54	"	"	Medium	" ¹
55	"	"	Poor	Poor
56	Poor	"	Good	Medium
57	"	"	Medium	Good
58	Medium	Poor	Poor	Poor
59	"	"	Medium	"
60	"	"	Poor	"
61	Poor	"	"	Good
62	Good	Good	Medium	Medium
63	Poor	Poor	Poor	Poor

The group comparison also affords ample evidence for the existence of some minor types often assumed by practical experience. Among these are the bright but careless and the dull but painstaking types. One student whose reasoning and generalizing abilities and power to grasp abstract thought are unquestioned wrote in the accuracy test 'Witner' for Witmer, 'Titchner' for Titchener, 'chapters V. and VII.' for V. and VI., and omitted one line of text resulting in giving a wrong name to a book; and there were many others similar, if less extreme. On the other hand 7 of the 17 poor in the intellectual traits are painstaking enough to rank good in accuracy. Still another pair of minor types are those who in memory rise above or fall below their standing in the intellectual traits.

In accounting for the large percentages of correlation it may be said that the grades in the reasoning, generalizing and abstract thought tests are estimates of one person only, who might have been influenced by a preconceived theory, or by a preconceived opinion of the abilities of the persons tested, inasmuch as they had been in his class for two months. The possibility of this is not denied. The writer was on his guard against it always. The papers were graded by sets of a kind, *e. g.*, accuracy, and not all of the papers of one student at a time. On the other hand the coarseness of the grading in three tests

¹ Defective eyesight.

and the method of calculating the coefficients underestimates the real correlation.

In conclusion the question is pertinent: What abilities have been tested? For the whole tenor of previous investigations has been toward the opinion that there is no such thing as *the* trait accuracy or *the* power to comprehend abstract thought, but on the contrary there are as many kinds of accuracy as there are occupations to be accurate in. A person may have considerable acumen in comprehending the psychological differences of the sexes and their consequences, and very little in grasping the effects of a high tariff on wages. There is however a mass of experiences which may be fairly assumed to be the common possession of all normally constituted persons of eighteen years of age or over who have reached the second year of a normal school course requiring two years of high school work for entrance. In framing the tests the writer endeavored to keep well within these limits, and it is believed with the *possible* exceptions of the questions on the tariff and on evaporation, he was successful. It was not necessary to solve the Protagorean dilemma to secure a grade of good in reasoning. For testing the five abilities (or five kinds of abilities, if they are plural) in this elementary way it is believed that a large number of different materials are equivalent. If a person of the maturity and training described cannot make valid generalizations from the questions about the pay of schoolmasters and the difference between gambling and legitimate business investment, it is safe to say he is deficient in what is ordinarily meant by generalizing, namely picking out elements common to a group. Or again, if there is a memory for dates, another for names, and another for simple commonplace statements, and if it is possible for a person to be good in one and poor in others, it is also possible to regard the sum of them as a unity, and the passage used in the memory test is a fair elementary test of this aggregate of abilities.

But another phase of the question appears. It may be said that the reason why there is so much correlation is that to a large extent they all test the same abilities. The power to understand abstract thought for example may be claimed to be

required in all, accuracy excepted perhaps, and memory certainly enters into all five to some extent. Even if this were true, it would still be possible to isolate a kind of ability by increasing the demands made upon one and lessening the demands made upon the others, and the tests have done this. But the claim is not true to any considerable extent, as examination of the material used in the tests would show. In the memory test the demand made upon the power to grasp abstract thought is so small compared to the tax upon the memory that it may be neglected. The reasoning test makes heavy demands upon two abilities, judgment and syllogistic inference. No generalizing is required, and not much power to follow abstract thought except in the geometry questions, which few persons reached. The generalizing test makes large demands upon the power to abstract elements common to a group and a small demand upon memory. There are some inferences which may occur in the abstract thought test, but the peculiarity of this test is the absence of illustrations. Success or failure in it depends upon one's ability to interpret its generalized phraseology by means of his concrete experiences rather than upon the inferences which may be involved.

To sum up the matter, then, each test involves unquestionably not one but several kinds of abilities, but there is a predominance of one kind in each test, and it is this kind which the test makes a trial of. Nor are the results less useful because of this fact of compositeness. To go beyond this and discover the identical abilities in the various traits, which the correlations lead us to assume the existence of, is outside the limits of our present purpose.

THE PSYCHOLOGICAL REVIEW.

A STUDY OF THE EARLY USE OF SELF-WORDS BY A CHILD.

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It has long seemed to me that the first use by children of names for the self—particularly the pronouns ‘I,’ ‘me,’ ‘my’ and ‘mine’—was a matter of peculiar interest. Here, if anywhere, I thought, we may hope to make out what the self-idea actually is, in its naïve and comparatively simple form, in the form under which it functions in the every-day relations of life. I was especially attracted by the interest of the matter for sociology—as throwing light on the question how far and in what sense the self-idea is a social conception—but I suppose it has a bearing on other aspects of psychology, and perhaps on metaphysics.

Having already made some scanty observations in the development of two of my children¹ I determined, in the case of a third, to give especial attention to this point and make as full a record as practicable of the use of self-words and whatever seemed to bear upon it, up to the time when they were thoroughly mastered. This determination was not carried out with ideal completeness; but I hope enough observations were made to be of some value.

The record extends from soon after birth until the thirty-third month, when the normal use of self-words seemed to have been acquired. The method was simply that of ordinary observation, with very little deliberate experiment: the idea being to get a view of development under usual conditions.

¹ See the chapter on ‘The Meaning of I’ in *Human Nature and the Social Order*, 1902.

The observations relate chiefly to a period of about a year, beginning with the twentieth month, during which the child 'learned to talk.' Some scattered notes, however, are given from an earlier period, as being possibly suggestive of the growth of the self-idea before it becomes articulate. The matter given, with the exception of that in brackets, consists exclusively of verbatim transcripts of notes made at the time the phenomena were observed. It must be said, however, regarding the theoretical suggestions thrown out in the notes, that I had some theories to start with.

I proceed to state more particularly some of the questions in relation to which the observations seem to me to be of interest.

The General Problem. — This may be said to be, "How is 'I' learned and what does it mean?"

It is evident that the learning of 'I' offers a somewhat peculiar problem. The reason is the apparent impossibility of learning its proper use by direct imitation. As used by other persons it never, apparently, means the same thing as when used by the child. An apple is an apple to all alike, but 'I' is different for every user of the word.

As to what it means; the following, to me at least, are interesting questions. Does it mean the physical self? If something else, then what? How far, or in what sense is it a social idea? How is the naming of the self-related — as to priority and otherwise — to the naming of other persons? What other names for the self are there, and how are they related to the pronouns of the first person? On all these questions the notes have more or less bearing, which I will try to indicate, in part at least, with the hope of rendering them more interesting and intelligible.

Inarticulate Self-feeling. — The child early manifests a feeling akin to pride in control over her own body and over material objects. (See observations on the fourth month, twentieth day, on 10-16, 11-22, 15-17.)

This extends, nearly or quite as early, to the sense of power over other persons. (3-1?, 3-4?, 3-6?, 7-1, 11-22, 13-28, 15-8, 15-17, 15-24.)

The Correct Understanding of 'I' and 'You' when Used

by Others.—This was achieved by the middle of the nineteenth month. (19-14, 19-16, 19-19.) It is to be noted that this does not involve the same problem as the correct *use* of 'I,' since that word may be understood as a mere objective name for the other person.

Imitative Use of 'I' Phrases, Apparently Without a Sense of the Subjective Reference, or Indeed any Discrimination of 'I' from the Rest of the Phrase.—This is clearly the first step in the actual use of the word, and is a phenomenon that continues, more or less, long after the correct use is acquired. It began, in this case, early in the twenty-second month. (22-7, 22-12, 23-1?, 23-17, 23-23, 24-3, 24-6, 24-7, 24-8, 24-9, 24-10, 24-12, 24-15, *et seq.*)

Suggestions as to How the True or Subjective Meaning of 'I' is Grasped.—This is in some ways the most searching question of all. My answer is that the child gradually comes to notice the indications of self-feeling (the emphasis, the appropriative actions, etc.) accompanying the use of 'I,' 'me' and 'my' by others. These indications awaken his own self-feeling, already existing in an inarticulate form. He sympathizes with them and reproduces them in his own use of these words. They thus come to stand for a *self-assertive feeling or attitude*, for self-will and appropriation. This view is reinforced by noticing how responsive the child is to stress, and how readily she understands and reproduces exclamations and other emphatic words. (14-9, 21-13, 23-5, 23-19, 23-21, 23-23, 24-6, 24-10, 24-15, 25-4, 25-5, 25-6, 25-13, 25-21, 26-2, 26-13, 26-16, 26-17, 26-28.)

Examples of the Earliest Correct Use of 'I' and Other Pronouns of the First Person.—(23-1, 23-5, 23-12, 23-21, 23-22, 23-23, 23-30, 24-4, 24-6, 24-12, 24-15, 24-16, 24-18, 24-20, 24-21, *et seq.*)

Does 'I' Mean Primarily the Visible or Tangible Body?—To this, if I correctly interpret the observations, the answer must be, No. 'I' means primarily a self-assertive feeling, linked with action or emphasis expressive of the same. The earliest examples connect it with the assertion of sensation, of action, of service and of appropriation ('I see mama,' 'my

toast,' 'I make go,' 'I carry pillow,' 'I get it for you,' 'my mama,' 'I go play sand-pile,' 'I got two flowers,' etc.).

Moreover there is another name which comes into use about the same time as 'I' and means primarily the physical body. This name, in this case, was 'baby,' and was apparently learned by direct imitation and association, like the name of any other visible object. The shadow on the wall and the reflection in the looking-glass play an important part here. It is noteworthy how comparatively late self-feeling seems to connect itself with these images. They are much less interesting at first than the shadows or reflections of other persons. (19-16, 19-23, 20-25, 21-13, 23-2, 23-7, 23-14, 23-19, 23-25, 23-28, 23-31, 26-2, 26-28.)

In what Sense is 'I' a Social Conception? — The answer to this is apparently something as follows: 'I' is social in that the very essence of it is the assertion of self-will in a social medium of which the speaker is conscious.

A sympathetic study of the early use of the word will, I think, make this quite plain. 'I' is addressed to an audience — usually with some emphasis — and its purpose is to impress upon that audience the power ('I make go'), the wish ('I go play sand-pile'), the claim ('my mama'), the service ('I get it for you') of the speaker. Its use in solitude would be inconceivable (though the audience may, of course, be imaginary).

To put it otherwise, 'I' is a differentiation in a vague body of personal ideas which is either self-consciousness or social consciousness, as you please to look at it. In the use of 'I' and of names for other people, the *ego* and *alter* phases of this consciousness become explicit.

Others are Named Before the Self. — This was clearly true in the present case. (14-26, 15-8, 18-30, 19-16, 19-18, 19-23, 21-13, 24-20.)

Other Names for the Self. — It is well known that little children frequently use a name for themselves that is directly imitated from others, like the name of any other object. In this case as already noted the first name of this sort was 'baby.' It did not precede 'I' and gradually merge into it as the child became more sophisticated (many have the impression that this is

what takes place), but it arose simultaneously, so nearly as could be ascertained, with the pronoun form. (23-19, *et seq.*)

'Baby' meant at first her reflection in the glass, her shadow on the wall, her physical person. (19-16, 19-23, 20-25, 23-7, 23-14, 23-19, 23-28, 23-31.) It was soon, however, applied to action and possession. (23-25, 24-15, 24-20, 24-21, *et seq.*)

It gained on the pronouns and for some weeks was the commonest name for the self, though it never entirely supplanted 'I.' (24-21, 24-25, 25-2, 25-14, 25-16.) The pronouns, however, mended their pace, gained a lead, and gradually displaced 'baby' altogether. (25-21, *et seq.*, to the end.)

'She,' another self-name acquired by direct imitation — *i. e.*, by hearing people say 'she needs a clean dress' and the like — was used as early as 23-2 and is noted as common towards the end of the twenty-sixth month. It continues so for about two months, then diminishes, and is discontinued about the end of the thirty-second month. (26-22, *et seq.*, to the end.)

The use of 'you' for 'I' by direct imitation (*e. g.*, 'I carry you,' meaning 'you carry me') is first recorded at the end of the twenty-third month, and remained common well into the twenty-seventh. I think, however, that this was never so definitely and deliberately used as a self-name as was 'she' — perhaps because 'you' was already understood in its true sense. Its use for 'I,' though very common, was mostly confined to its occurrence in phrases which were repeated as wholes.

The observations follow.

Second month, 11th day. *B* cries for her bottle, and cries in apparent anger when it is taken away from her. Sometimes cries when laid down.

3-1. *B*, two months old, already cries to be taken up, or in protest against being laid down, also for her bottle. [This and some of the following observations are given as possible manifestations of an early sense of appropriation, such as later underlies the use of self-words. Those cases where the thing appropriated is not a material object but the attentions of other people are especially pertinent. They seem to be the beginnings of that desire for control over others, for social power, which plays so large a part in the mature self.]

3-4. Apparently she has a sense of being neglected, which makes her angry. If I let her simply lie in my lap she screams angrily, but picking her up and changing her position mollifies her. It is not pain that makes her 'mad.' If so she already appropriates attentions that do not minister appreciably to her comfort, has a social self. [Perhaps mere discomfort sufficiently accounts for the crying.]

3-6. *B*, laid down on the bed yesterday, cried hard, with intervals of rest, for twenty minutes or more. *E* finally took her up. She was 'mad.'

4-20. *B* has a look of power and triumph — eyes open and lips pressed together — in grasping and shaking a napkin-ring, or my beard.

7-1. *B*, six months old, clearly appropriates *E*'s attentions. She is used to them and has the my-feeling about them. She cries 'mad' when she is laid down on the bed and *E* goes away.

10-16. What pride *B* shows in her face when she stands on her own legs, holding on to the chair-back, or makes the water splash in her tub. She has put forth will, has intended and achieved, and her look shows the sense of power.

11-22. *B*, nearly one year old, is playing with a large envelope. She pulls it away and grunts angrily when I take hold of it. When she is standing on a chair and I am holding her by the dress she will sometimes try to remove my hand from the latter [*i. e.*, resents assistance]. When *E* or I have been with her and attempt to go out of the room she generally cries.

13-2. *B* now knows 'your ear' [*i. e.*, will touch her own ear when she hears this expression]. She has had her hand directed to her ear, also watched herself feel of it in the glass. For a week or two she has known 'ear' as applied to others.

13-3. She does not remember 'your ear' to-day. She imitates a good deal by ear, little by eye. A hissing sound she repeats when she does not [immediately] hear it made.

13-9. She distinguishes vaguely between 'ear' and 'your ear,' — not, I think, with any [true] sense of 'your.' 'Your ear' is merely a name for certain sensations.

13-28. *B* loves to walk holding my finger. She screams determinedly when I sit down, or when *R* or *M* is offered as a

substitute. She will also lead me to the front door and insist on having it opened and going out. In general she is capable of forming clear wishes and insisting on gratifying them.

Her 'self-consciousness' or 'showing-off' idea is not yet very distinct, though *E* thinks she is often conscious of spectators.

14-9. *E* was feeding baby alternately with herself orange at the table and saying with some emphasis 'now it's *my* turn.' So the word might easily be learned. [*I. e.*, the self-assertive emphasis and feeling on the word 'my' might be learned along with the sound, and the child thus acquire an inkling of the true meaning of the word as the name of a self-assertive attitude.]

14-26. *B* seems to take no interest in her reflection in the glass. Has she become used to it as a picture and not sophisticated enough to care for it as herself?

15-8. *B* has, I think, no self-consciousness regarding her reflection in the mirror. She will smile at it as at another baby, or look puzzled; but there is nothing that suggests self-recognition.

She will sometimes pluck my sleeve or foot to get a look [from me] when I am reading.

15-17. *B* is very vigorously appropriative; screams when she is not allowed her own way, as when she wants to sit in her mother's lap or to have a plaything. Is said to have objected the other day to Emily (still younger) touching her playthings.

15-24. *B* seems to be jealous, or at least fretfully appropriative, of other people. She is not well; her teeth irritate her and her digestion is out of order. She will not let any one else touch her mother when the latter is holding her, but will grunt complainingly and push the offender away. So when I had her at *T*'s she objected to their baby touching me. She expresses the idea 'mine' very clearly.

15-27. *B* is very fond of being talked to — more and more evidently so for some weeks past. She makes noises in reply, chiefly a soft ah, apparently intentional.

15-30. *B* has been indisposed for some weeks, 'out of sorts.' She frequently objects to being looked at, especially by her mother, and will complain and push the other's face about

till it looks away. Perhaps she feels the anxiety [expressed in the face] but I think it is a 'sense of other persons,' a feeling of disturbance and claim.

17-. She imitates dog, cat, squirrel, horse, whistle of nipple, squeaking of finger on tub, children crying, etc., bluejay, rushing of water, piano, pounding of hammer, tearing of paper, many human sounds. The more familiar used as signs.

18-2. *B*, seeing a picture of a man showing his teeth — a tooth-powder advertisement I believe — shut her jaws and opened her mouth in imitation. This is the first conscious facial imitation I have noticed. She watches herself in the glass occasionally.

18-30. *B* shows no (reflected) self-consciousness, nothing like vanity or affectation. She seems to attach no particular meaning [?] to her own name, though often called by it. She betrays no interest in her own shadow on the wall, though she recognizes 'mama,' 'papa' and occasionally *R* [on the wall].

19-14. *B* apparently understands 'my' and possibly 'me.' With four of us sitting about she will correctly put her finger on 'your' (*i. e.*, her own) eye, nose, ear, tooth, etc.; 'my,' '*R*'s,' 'mama's,' 'papa's.'

19-16. *B* seems to have no reflective self-consciousness. She has and uses names for papa, mama, etc., none for herself. It is doubtful if she understands any name for herself, though she knows the meaning of 'your' as applied to nose, ear, etc. She recognized and named our shadows on the wall before showing any interest in her own. She knows the latter now as 'baby,' but seems to regard it merely as an external object. [She understood but did not *say* 'baby' as referring to her shadow.]

19-18. *B*'s words are used when she sees the object, or when some one mentions it, not deliberately to ask for something. 'Mama' she has only begun to use in this way within a few days, *i. e.*, calling out when she sees *E*.

19-19. 'Other.' She understands this perfectly; 'other eye,' etc. When I said 'Where is the other mouth?', she pointed to *R*'s. She does not know 'his' or 'her' though clear on 'my' and 'your.'

✓ 19-23. *B*, as *E* and I agree, has no reflective idea of herself at all. She knows the reflection in the glass and the shadow on the wall as 'baby' but seems to view them merely as external objects, without self-feeling. She is beginning to call the rest of us by name, but has no name for herself.

B has none of the evident 'self-consciousness' that *M* had much earlier, none of the 'perfect little actress' tricks. She is learning to talk rapidly.

✓ 20-25. *B* when asked 'Who is this?' (touching her on the chest) answered, 'baby.' This is the first time she has been observed to name herself.

✓ 21-13. I notice that *B* constantly hears 'my' and 'mine' used emphatically and addressed to herself. For instance, at table her mother, feeding her, will say of the food 'no, this is mine,' etc.

The children try to teach her to say 'baby,' but as yet she does not do so at all of her own accord, though she says 'mama,' 'papa,' and 'Leila' freely.

22-7. *B* now says 'I see' or 'I do' imitatively, with no real sense of the meaning of 'I,' after *E* or the children. To-day she said 'two ear' the first observed case of her making a sentence, limiting one word by another.

22-12. *B* has been taught to say 'I see Yacky,' 'I see papa,' etc. She seems to have some inkling of the meaning, and will say 'I see cocky' to the picture. It is all imitative and probably involves no true sense of 'I.'

23-1. *B* was playing by herself in the room with *E* to-day, and began to say 'my mama' over and over, meditatively. Presently she changed to 'my papa,' then 'my hanky.' She said it very plainly. It is not apparent why she connected it [*i. e.*, the word 'my'] with these words. Doubtful also whether she had any sense of the meaning.

✓ 23-2. She still has no word for herself. We call her 'baby,' but she never uses it. . . . If you say 'Where's baby?' or 'Where's *B*?' she says 'Here she is.' [This last phrase probably a mere echo.]

23-4. It is hard to tell whether *B* appropriates her reflection [in the glass] or not. Sometimes she seems indifferent, some-

times a little 'strange,' as if it were some child she did not know. She was much amused and delighted when she saw it with its clothes off. Never, apparently, does she seem 'self-conscious' about it, like an older girl 'seeing how she looks.'

23-5. *E* says 'I see baby.' *B* says [in answer] 'I see mama' *not* 'I see baby.' She even seems, sometimes, to emphasize 'I.' Of herself she said 'I see O' [the letter]. She knows 'I see' as an exclamation of seeing; but whether she feels the self-assertion in it I can't say.

23-7. *B* understands that 'baby' means herself when someone else speaks it (probably also 'Mary Elizabeth' and 'Mary') but she will seldom or never say it herself. Touch *E* and ask 'Who's this?' she says 'mama': touch me, 'papa'; touch her, she remains silent or grunts. She will not repeat the word 'baby' after you in any connection, though she will almost anything else. She does not seem embarrassed or self-conscious or puzzled; merely prefers not to use the word. It is hard to interpret it, I can only suppose some slight embarrassment. Formerly she did say it occasionally, now not at all.

23-12. *E* thought she said 'my toast' this morning, but could not say whether she really meant it. It is easy to see, however, how she can learn 'my.'

23-14. Proofs from photographer. *B* will point to her own picture when we say 'Where is baby?' but seems quite indifferent to it and will not name it when we point to it. On the other hand she eagerly points out all the rest of us.

23-17. *B* is perfectly able to say 'my' as indeed almost anything else, and occasionally does so imitatively. Just now *E* said 'Where's my shoe?' and *B* repeated 'my shoe.'

23-19. This evening *B* overcame her reluctance to name herself. *E* touched herself saying 'Who's this?' *B* said 'mama.' Then she touched *B*, repeating the question. *B* answered 'baby' with a smile — almost a laugh. She has often refused to do this, though she knows the word 'baby' very well.

I notice that *B* — and doubtless all children, *vide R* — quickly notice and imitate any word used with strong emphasis, reproducing the emphasis as exactly as possible. To-day *E* lost her patience over the push-cart and said 'the deuce' half under

her breath. A few minutes later *B* began saying it, repeating it many times. This may bear on the learning of 'my' and 'I,' being words often brought out with strong feeling. 'My' might be used at first as a mere exclamation associated with controversy.

23-21. *B* was calling her ball 'come ball,' then 'mama.' *E* said 'don't call me, I'm not a ball.' Immediately she began to say 'Don't call you, don't call you.'

B this morning was pulling the thread from some of the spools on *E*'s screen, making the spools revolve. She said 'Makee go, makee go.' Presently she hesitated and said 'I makee go, I makee go' quite clearly, kind of singing it to herself. She has never used 'my' understandingly nor called herself by any other name [?]. N. B. Just as I was saying this in her presence she remarked 'My papa' as if to confute me.

[The above is the first fairly clear case of the deliberate use of 'I' with a true sense of its meaning.]

I have little doubt that *B* uses 'I' with a sense of appropriative feeling which she has perceived to accompany its use by other children. *M*, for instance, is constantly saying 'I'll do it,' 'I'll show you,' etc.

23-22. *E*, "Where is the marble? Do you see the marble?" *B*, 'I see marbly' (though she didn't).

23-23. 'Me,' first use of the word. *B* was reaching for her pillow. *E* was present but at a little distance. *B* said, as if to herself, 'gi't to me, gi't to me.' Then, as if pleased with the sound of the word, she said several times 'me, me, me.' As *E* says, she probably hears the children use this phrase and stores it up as a whole. 'Give it to me' is associated in her mind with appropriative activities observed in others.

Although *B* is apparently beginning to use 'me,' 'I' and 'my,' she does not by any means employ them wherever they would be in place. Thus *E* says, 'Ask Rutger to put you up.' She goes and says 'Ask Yacky put up,' a mere repetition.

Just now *B* suddenly began tugging at a piece of tape attached to some work *E* was doing, crying emphatically, 'My, my.' She did this for a few seconds and then turned to something else. She never [?] used the word before except by mere echo.

23-25. Said 'Baby's shoe' without suggestion. First [possessive] use of this kind of name for herself.

[The reader will note that the use of the subjective names for the self — 'I,' 'me' and 'my' — begins almost simultaneously with objective names like 'baby.']

23-26. To-day *B* was riding in her cart and put her hand on the wheel. [She had been scolded for doing this.] She exclaimed 'Why, baby' in a tone of reproof, just as she says 'Why, Yacky' to *R*.

23-28. [By her mother.] Playing with silver cup. I said 'Who is in there?' seeing the reflection. She looked in carefully and said 'Mama' (I was looking in too), 'baby.' I said 'See the blue dress.' She put her hand on her own dress. Presently she put her hand on her head (not looking in the cup) and said with a queer little look, 'My baby.' As when a familiar idea looms up in a new light, not a smile.

23-30. *B* is learning to talk very rapidly. She will look at a picture of two girls and say 'Lilly girl walk-walk. Other lilly girl walk-walk.' When she falls down she says 'You'll fall,' and then 'Hop up.' [Echoes, of course, of what has been said to her on such occasions.]

This afternoon as *B* was lying on the bed she said, *apropos* of nothing, 'This is me, this is me.' Apparently there could be no mistake about the words; but I am not sure what she meant.

23-31. She was interested in her shadow on the wall this morning, putting her finger on it and saying, 'Baby, baby.' She has known this for months and got it directly, as the name of the shadow.

She seldom if ever calls herself 'baby.' [The cases previously recorded remained for a time almost unique.]

24-3. *B* still refuses to name her reflection in the glass — usually; though occasionally she will say 'Baby.' She seems a very little conscious about it now.

'Where's my comb?' *B* said this many times yesterday — imitatively. It began in her taking *E*'s comb, who said 'Where's my comb?'

24-4. Sitting on the piano this evening *B* said two or three

times, with emphasis, *apropos* of nothing obvious, 'Dis my.' Don't know just what she meant.

24-6. *B* was playing with her pillow up stairs and talking to herself. She said 'I carry pillow' several times = taking it from the box to the chair, etc.

E dropped the book and said 'There goes our book.' *B* said 'There goes *my-y* (emphatic) book.'

When *B* wants to be carried she says 'I carry,' an echo of 'Shall I carry you?', or she says 'Takey you, takey you,' echoing 'Shall I take you?' These are words, total symbols: she does not analyze them.

24-7. Just now she was sitting on my lap. She reached toward *E*. 'What do you want?' 'Shee-e you' = apparently 'Come and see you.' [It was still doubtful whether she had acquired the proper use of 'you.']

B occasionally repeats sentences beginning with 'I' that she has heard; *e. g.*, 'I guess it's so.'

24-8. *B* says 'I'll carry you' when she wants to be carried; an echo of course. 'Yacky tease you' (me). [On the other hand 'you' is sometimes used correctly.] *B*, crying, says 'I want you,' apparently her mother.

24-9. At breakfast *B* says 'Come see me' to the stuffed duckling. She probably learns such phrases as wholes = 'I will take it' or the like.

M said 'I wish baby could go out doors.' For some minutes thereafter she [*B*] said at intervals 'I wish out doors.'

24-10. She constantly repeats [after someone else] phrases containing 'my,' *e. g.*, 'Don't touch my (sewing-machine) wheel.' She seems to put more emphasis on 'my,' dwelling on it as if it impressed her.

B shows great aptitude for exclamations—doubtless because they are uttered with great emphasis. She has recently used 'Deuce,' 'Gee Whiz,' 'Oh My,' 'Oh Dear,' 'Why Yacky.' N. B. 'My' and 'I' are perhaps learned on nearly the same principle, *i. e.*, an expression of vivid feeling.

February 19, when Leila went away, *B* could scarcely if at all put two words together. She had a few single words besides our names; *e. g.*, 'street-car.' Now, not two months

later, she uses words quite freely and gets off such sentences as this (probably copied, but not immediately) 'Where my nut, squirly says' (no attempt to give exact sound).

24-12. She just said 'Where's my ball?' (We had been playing with it.)

She says 'Take you,' 'I carry you,' meaning, apparently, 'You take me,' etc.

She just said 'Eat my spoon.' (She had a spoon in her mouth.) Can't tell how she understood it.

The use of 'you' for 'I' is very frequent.

24-13. *B*, looking for *E*, said 'Hello, baby' [echoing what her mother might say when found].

24-15. She says 'I take you' (You take me), 'Come and see me (you) and many similar phrases. But she perhaps does not identify 'me' with anyone else. They are mere [imitative] formulæ describing action. 'I carry you, shovely,' she says to the shovel. To the candle 'I takey you.' [These last are examples of how 'I' may be correctly used in describing action before its special meaning is discriminated.]

She dropped the harp and wanting *R* to get it, said 'Want that, Yacky?' He did not move: then she got down, saying, 'I get it for you.' This last phrase is one she hears her mother use, and probably means for her merely 'pick it up' or the like — perhaps with the idea of self-action.

To-day she said 'Baby wash hands,' meaning she wanted to wash. She does this [uses 'baby' to name herself] occasionally now, not often, but apparently more often than she did.

'Want you' = 'I don't want you.' N. B. 'You' here seems used correctly.

24-16. She just called out as she was going up stairs, 'Going to find my dolly.'

But this [use of 'my'] is rare. Did she mean possibly 'Margaret's'?

24-18. She caressed *E* just now and said softly and deliberately, 'This my mama.' And immediately put her finger to her face and said 'baby.' It looked like an effort of self-social consciousness. This is rare if not unique.

24-20. *B* has occasionally used 'I,' 'my,' 'me' and 'baby'

apparently as names for herself (as previously noted) but at this date she uses none of them commonly. When she wants a thing she simply names it without personal pronouns. *She has no name for herself in regular use.* Though she names the rest of us constantly.

B's imagination is developing. We have told her the wolf and piggy story, and she thinks about it. She came up to *E* yesterday and said 'Wolf say puff! puff!' To-day she seemed to think the wolf might be down the register, saying, 'Wolf down there? No, no, wolf.'

At dinner to-night she asked for potato by saying 'Baby some tato' but did not use this form again. She also said 'I takey pillow' when she picked it up to bring to me. This evening again, 'Baby lie down.'

24-21. She seems to have begun the free use of 'baby' as a name for herself. The first thing this morning she said 'Baby want matches' and 'Baby's shoes.'

To-day she picked up a handful of grass and said, softly as if to herself, 'I gotty grass.' Then *E* picked up a handful and she said 'You gotty grass.'

She now uses both the pronominal and 'baby' form. I am curious to see which will prevail.

[Between the last and the succeeding.] This morning *B* said 'Baby's leg.' Immediately after she said 'I sit down.'

24-24. My for me. 'My some tato.'

24-25. 'I' and 'baby' together. 'Baby go getty hook. I gotty hook. Gi' it to mama.' She seemed to be dramatizing, speaking *to* baby. She uses 'baby' a good deal, 'I' rarely.

You. 'You takee book too,' meaning herself.

24-26. My. 'Takee my hand and pull.'

25-2. Looking for a picture of a baby in the magazine she said 'Baby, where are you?' Probably imitative? [The correct use of 'you' was still uncertain. 'You' mostly meant herself.]

B uses 'baby' now a good deal. Also, occasionally, 'I' as just now 'I take the rooster.' She still uses phrases like 'I take you' (= You take me).

'I' used rightly a good deal: 'I get this ball.' Have not

noticed 'my' recently. *E* says she occasionally says 'Take my hand.'

25-4. Although she uses 'I' correctly at times she almost always (quite?) uses phrases she might take bodily from others — as 'I'll get the carriage,' etc. I incline to think she learns these as wholes.

B wanted the knife. *E* said emphatically, 'My knife.' About fifteen minutes later *B* said 'Want that *my* knife.' She took it and repeated 'My knife.' [This is perhaps suggestive as to how 'my' becomes associated with the expression and act of claim.]

Mixing 'I' and 'you' (as self-names). 'Mama carry you (me). I go play sand-pile.' Also to her doll-carriage, 'Stay there. I'll go pick stones.'

25-5. She uses 'I' in sentences of action rather frequently — perhaps a dozen times a day, *e. g.*, 'I getty cushion.'

25-6. 'Have that my knife. *My* knife.' [See 25-4.] Immediately after she said 'Papa help you' (me). She doesn't use 'me' in its right sense, if at all.

25-7. 'Baby, I.' Sometimes she unites them: 'Baby I got two, mama.' She uses either quite freely in this sense.

Long sentence. 'When Yah-Yah ring bell ding-a-ling-a-ling, then come dinner.'

25-8. 'Where's the pillow?' 'I'll get it for you.'

25-13. She says 'I got two flowers.' Is very fond of 'I got two —.' Last evening she was saying 'My Margy' and 'My papa.' I never heard her use 'my' in altercation. [This refers to a theory I had that the first personal pronouns, especially 'my' might be learned in disputes over possession.]

25-14. She uses 'baby' now a good deal. ['I,' 'my' and 'me' rarely.] Will these be lost?

25-16. *E* thinks that *B* frequently says 'Come see me,' etc. It is often hard to tell whether she says 'me' or 'baby,' she has come to slur the latter so.

'Margy, come see me baby.'

25-21. *M* said, 'I want some bread.' *B*, '*I* want bread.' [The stress seems to show a sense of the self-assertive meaning of 'I.']

25-21. The use of 'I' seems to be gaining rapidly on 'baby.' The former is now, perhaps, the more common.

[Additional examples of the correct use of 'I' and 'me' are omitted as superfluous.]

[Between the last and the succeeding.] 'Mine,' first use. She was talking to herself, making-believe finding things and holding them out. 'Want necktie; here's mine; here's mama's.'

26-1. 'I won't.' Said reflectively, not controversially, this morning when asked to come up stairs. [An echo from other children?]

26-2. I-phrases. She uses many which she seems to learn as wholes — 'I don't know,' 'I want —,' 'I won't,' 'Come see me,' 'Wake me up.' From these she probably gets the I-idea by elimination. [*I. e.*, the rest of the sentence varies but the pronoun remains constantly associated with the expression of will, the self-attitude.]

She has at this date no notion of calling her body 'I,' apparently.

Looking at the photograph she says 'There's baby,' never 'That is I' or 'me.' But when we ask 'Where are you?' she said, with some hesitation, 'There's baby.' (But, on further experiment, this is uncertain.) In answer to 'Where am I?,' however, she named [pointed out in the picture] the speaker.

26-4. Taking a picture from my hand she said 'That's mine.'

26-6. My. Although she sometimes uses it correctly she also uses it incorrectly. *E. g.*, 'Mama go get my [your] lap-board.' 'Take my [your] leg up.'

She never, I think, says 'your,' 'her' or 'his.' (Except your = my, by direct imitation.)

She uses 'me' with more emphasis now.

She said twice to-day 'That's mine.'

26-11. She still says 'I carry you,' much run together, for 'take me up.'

Not only does she still say 'I carry you' for 'You carry me,' but in many other phrases as 'You want cake.' Often she will use 'You,' 'I' and 'baby' in quick succession to mean herself.

26-13. Quickness of children in applying language. It is

amazing, hardly to be fully realized or explained by adults. They are constantly bringing out very aptly some expression they have heard only a few times. Thus to-day *B* said to *R* 'Ring off' when he was teasing her. [Current slang for 'cease.']

26-16. *R* was threatening to take away a necklace. She almost screamed 'Dat mine.' Speaking of her dress she said 'That's *my* dress; that's *mine*; that's *baby's*' all in the same sentence. [The gradual increase of appropriative emphasis on the self-words is notable.]

26-17. Saying 'My book' with great emphasis, at times almost a scream, when threatened with dispossession by *R*. [Compare 25-13.]

26-18. Emphatic 'you.' 'You go get the ball.'

26-21. 'Herself.' ['Baby hurt herself' she said to-day when she fell down.]

26-22. 'She' for self. Is common; *e. g.*, 'She does not want to go to bed.' Imitative of some one's remark about her. [This form became very conspicuous about this time.]

26-24. 'She.' To-day she has used this more than 'I' or 'baby.'

26-28. *E*, 'This is mama' (pointing to *B*); 'This is baby' (pointing to herself). *B*, 'No, *mine*, baby.' [This seems to be the first definite application of a self-pronoun to the physical person.]

27-2. Although she uses 'I,' 'me,' 'my' and 'mine' freely and vigorously she still uses such phrases as 'Mama wants to carry you.' (= I want mama to carry me.)

'We don't want papa,' she said to-day. [First recorded use of 'We.']

27-8. 'I don't want to bite you.' (= You don't want to bite me.)

She uses right and wrong expressions with great freedom and indifference. 'She,' 'baby,' 'I,' 'you,' may each mean herself.

27-9. 'I want to take a walk with me' (you).

27-14. She uses 'she' for 'I' a good deal; but 'I' equally or more. Also 'baby.' She is fond of saying 'I think' or

'She thinks.' Sometimes she uses this form, 'She says she wants two dollies.'

27-25. *B* still uses 'I,' 'baby' and 'she' interchangeably. She is beginning to say 'Mary Liffit' [Mary Elizabeth] also.

28-8. She varies for emphasis. 'I like cake! She likes cake! Baby likes cake!' in quick succession.

'That's yours, Margaret, and that's me's.'

28-27. 'I,' 'baby,' 'she.' *B* still uses all three for herself. I think she tends to use 'baby' rather more for 'me' than for 'I.' 'She' is perhaps somewhat diminishing.

29-26. I notice only an occasional use of 'she' and 'baby' now; also that 'I' and 'mine' are used with more mastery and gusto.

30-2. Heard her use 'she' [for I] but it is rare.

30-12. *E* says that *B* still uses 'she' and 'baby' a good deal, though less than she used to.

30-27. *B* still uses 'she' quite often, though 'I' and 'me' are much more usual. Sometimes she gets queer combinations — as 'me are.'

31-1. She just now said 'Baby going to dance 'se'f' [herself].

31-9. *B* has learned to know *T*. To-day she accidentally made one with her blocks. 'Come see my *T*' she exclaimed. Then she made many more, quite excited, crying '*I* did it,' etc.

32-26. Some peculiarities in pronouns. "Yes we am — Huh! 'we am' that's a funny way to talk" [self-criticism]. 'Let I see it.' 'She's name is Binks.' I and she are often used in the objective case.

33-5. We note that *B* no longer uses 'she' for 'I.' She has gradually dropped it.¹

¹ The MS. of this article was received on August 1, 1908. — ED.

THE NERVOUS CORRELATE OF ATTENTION.

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INTRODUCTION.

In a previous article in this REVIEW¹ I developed a theory of the relation between nervous function and consciousness. However, I had to be very brief in the treatment of some aspects of this relation. It was then my chief intention to combat that mythological theory of pleasantness-unpleasantness, according to which Pleasantness and Unpleasantness are two ghost-like entities sitting within our brain—armed, one with shears, the other with a soldering iron (according to a variant: with a stamping iron)—breaking and making connections at will. It is my conviction that, just as it is possible to comprehend the reciprocation of the action of a steam engine as being caused by the engine itself, so it is possible to comprehend the modification to which the instinctive action of a higher animal is subject, as being governed by the fundamental laws of the nervous system itself.

I shall now treat in more detail a number of questions concerning the relation of nervous function and consciousness which I could not take up previously without leading the reader's attention too far away from the problem of pleasantness-unpleasantness. But we shall no more restrict ourselves now to an exclusive discussion of the non-affective consciousness than we

¹ 'The Nervous Correlate of Pleasantness and Unpleasantness,' PSYCHOLOGICAL REVIEW, XV., 4, 5, 201-216, 292-322, 1908.

restricted ourselves then to an exclusive discussion of pleasantness-unpleasantness. It is, of course, only by abstraction that we divide our consciousness into classes to be kept in different compartments. Every application to actual life forces us to take into consideration the mutual relations of these classes, although our scientific interest may momentarily seem to be confined to one of them.

Meanwhile Titchener's *Psychology of Feeling and Attention* has been made public. If there is anyone whom the historical part of my previous article did not convince that the traditional methods of investigating feeling — no matter whether experimental or otherwise — have reached a *cul-de-sac*, Titchener's book will convince him. The author's conclusion is decidedly pessimistic, one might even say desperate. He confesses "to a feeling of unpleasantness, tension and depression. We know so very little of the subject of these Lectures, and the work that we have found to do will take so long in the doing!" This will hardly encourage any student to devote himself to an investigation of feeling. What we need is a new point of view. I offer my own view with the hope that it will give the reader as much relief, encouragement, and pleasantness as it has given me.

I. THE FUNDAMENTAL LAWS OF NERVOUS FUNCTION.

Let me begin with an abbreviated statement of the laws of nervous function as found on pages 300 ff. of my previous article.

1. Let us assume that any point where two or more neurons are connected, functions like a valve which permits fluid to pass through only in one, not in the opposite direction, and that this valve opens only in the direction towards motor points of the body.

2. Let us assume that any neuron system has functional properties analogous to those of a pipe system filled with a fluid, one end of the pipe system being usually closed (the sensory point), the other end being under the influence of negative pressure, or suction, tending to produce a current in the direction of this end, the motor point.

3. Let us assume that ordinarily no movement can take place in the pipe system because the sensory end is closed; that the application of a weaker or stronger stimulus means the same as the opening to a lesser or greater extent of the closed end of such a pipe system, thus permitting fluid to escape through the motor point (or points).

4. Let us assume that the resistance suffered by the fluid in moving through the pipe system depends in the ordinary way on the length and the width of the pipe.

5. Let us assume that the pipe is widened by the current in proportion to its intensity and duration, and that, while unused, the pipe has a tendency to grow narrower; and that this *susceptibility* of the pipe is the more pronounced the 'higher' the connecting neuron.

To these assumptions was added on page 303 a sixth one, the most important one in so far as it serves to explain the function which is analogous to that of a steam-engine's *valve-gear* — a function for which thus far mythological explanations have been offered rather than scientific ones.

6. Nervous currents are subject to a law analogous to the dynamic law that hydraulic pressure is less than hydrostatic pressure, of which the jet pump is a familiar illustration.

For the reason already mentioned I did not attempt in my previous article to justify these assumptions except by applying them to habit formation and to the rôle played by pleasantness-unpleasantness in mental life. I shall now give additional reasons why it seems to me to be wise to make these assumptions rather than others.

A nervous process is generally regarded as a chemical process. But of what kind? It is most frequently compared with the burning of a fuse. In my opinion there is no analogy in this case at all. But before giving reasons why I regard the analogies offered by myself as scientifically valuable, let me say a word in reply to the possible question, why we should use analogies rather than wait until other sciences are able to tell us exactly what the nervous process is.

I take it for granted that a teacher of psychology wants to give his students more than a mere classification of mental

states, that he wants to show them how the laws of mental life can be understood as a part of the natural laws governing a highly developed organic being. What does he answer to the student's question in what manner the nervous system is modified when instincts are modified into habits? Unless he can offer to the student a *picture* — however hypothetical — of the laws of nervous activity, he is obliged to offer mythological entities making and breaking connections at will. I am far from dogmatically asserting that it is inconceivable that pleasantness and unpleasantness make and break connections in the brain; but this is an entirely empty, purely formal statement, as long as *we are not told the exact nervous or mental conditions under which pleasantness and unpleasantness themselves occur*. We cannot explain to the student how our actions are determined by our mental life without a *detailed picture* of nervous activities. Since experimental physiology at present does not offer us such a picture, at least not one which serves the purposes of the psychologist, we have to develop one ourselves. We cannot wait for physiological discoveries which may never be made.

So much in excuse of my making assumptions. Let us return to the statement that we cannot picture a nervous process as the burning of a fuse. A fuse burns in either direction. A nervous process, it is true, if started in a neuron, is propagated in both directions within that neuron. But it does not seem probable, so far as I can judge the experimental evidence, that a nervous process can normally pass from one neuron into another neuron which is *nearer* to a *sensory* point of the body. If this were otherwise, it would be possible for central excitations to produce normal sensory processes in our sense organs. This seems improbable, in spite of so-called synesthesias, which in my opinion must be otherwise explained. I have therefore accepted the first assumption that any point of connection functions like a valve which permits fluid to pass only in one, not in the opposite direction.

Another reason why it seems confusing to picture the nervous process as the burning of a fuse in this: If a fuse branches out, the burning would proceed along all the branches, regard-

less of differences in the *length* of the branches. But the nervous process does not branch out in this manner. However important the law of nervous diffusion may be, this kind of diffusion — analogous to the burning of a branching fuse — does not exist. Another point of disagreement is the following: A fuse cannot be made to continue burning for a considerable time by mere persistence of the cause of the burning. But a nervous process can be made to continue by continued stimulation, although not for an indefinite time.

It seems to me most probable that the nervous process is of the same nature as the migration of ions in an electrolyte. The migration of ions is accompanied by electrical phenomena which permit a diagnosis of the migration and a measurement of the flux of ions. Similarly the nervous process is accompanied by electrical phenomena. Migration of ions can be caused by the electric current: so can the nervous process. But migration of ions is also dependent on and caused by many other physical and chemical conditions: so is the nervous process. In spite of these and other agreements, I did not in my second assumption picture the nervous process as a migration of ions for the following reason. Some one who might think that he knows that the nervous process is not a migration of ions, might forget that I offered merely a picture and might argue against the whole theory. No one, surely, will forget that speaking of the nervous system as a pipe line is merely using a picture, an analogon, so that his refusal to admit that it actually is a pipe line, cannot be made an argument against the theory here offered.

A possible confusion of terms may be anticipated and prevented by explanation. When we think of a fluid, first at rest and under a constant tension ('negative pressure'), then moving, the word 'velocity' may be used in two different meanings, namely, as standing for the flux or for the velocity of the propagation of the relief of tension. In a pipe closed at one end, and with suction applied to the other end, the whole column of fluid is under tension. As soon as the closed end is opened, the tension is relieved at this end, and the flux may begin. But at any distant point the flux can begin only after the relief of tension

has occurred at that point; and the whole column of fluid can be in motion only after the relief of tension has traveled all through the pipe and reached the open end. The velocity with which this relief of tension travels is analogous to the velocity of the propagation of the nervous process as usually measured and found to be about 60 m. per second or less. It is *independent* of the size of the opening at the sensory point, that is, of the intensity of stimulation. On the other hand, the term velocity might be used in the sense of 'number of fluid units which pass a cross-section of the pipe in one second.' Velocity in the former sense does not concern us in our present discussion. In the latter sense it is an important concept; but owing to the equivocality of the term, I shall avoid it in the future and use the word flux. Flux, then, is analogous to intensity of the nervous process.

The assumption of a constant suction at the motor end of the pipe line is merely analogous to the fact that the nervous system, unless exhausted, is always ready to respond to stimulation. It does not, of course, imply that the *muscle fibers* act like an exhaust pump. I do not conceive either of the sensory or of the motor points of the nervous system as points where energy is transmitted, but as points where the performance of work is made possible by the fulfilment of a necessary condition. Sensory stimulation may be compared with the immersing of the zinc in a plunge-battery — the resulting migration of ions is of course not the equivalent of the mechanical energy of the motion of the zinc, although the greater the immersing movement of the zinc, the greater the flux of ions. Innervation of the muscle may be compared with a signal for action given to a body of men by means of an electric bell. Again there is no energy equivalent. This will explain the third assumption.

The fourth assumption needs no explanation. The fifth assumption shows clearly the advantage of using a mechanical picture as analogon of the nervous process. We can easily conceive a pipe line, the inner wall of which consists of a material that may be washed out by action of the fluid. Just recall a limestone cave. And it is also easy to think of a deposit on the walls resulting from lack of use. Let us call this property

of the pipe, enabling its resistance to decrease or increase, the *susceptibility* of the pipe. This susceptibility I assumed to be the greater the higher the connecting neuron in question. I did this for the following reasons: (1) Our sense organs do not seem to respond more promptly to stimuli to which they have often been exposed. Rather the opposite. Blind-born persons who for years have made little use of their eyes, have after operation no inferior, but rather a superior visual sensitivity. It seems best, then, to assume that the sensory (and also the motor) neurons have no susceptibility as above defined, but that this belongs only to the connecting neurons. (2) It is generally accepted that the higher nerve centers suffer more easily from pathological influences than the lower ones. I have therefore accepted the assumption that the higher connecting neurons have a greater normal susceptibility than the lower ones.

The sixth assumption shows again the advantage of using a mechanical picture of the nervous process. Everybody is familiar with the principle underlying the function of a jet pump. No vague conception, but a clear image of a familiar instrument guides our thought. What is possible in a mechanical system — the attraction of a weaker process by a stronger one — must also be possible under physiological laws, which are far more complicated than those of mechanics. Of course, there is this difference between the mechanical instrument in our theory and the ordinary jet pump, that in the latter the moving force is pressure, in our case it is suction, which requires a somewhat different mechanical arrangement.

The second and sixth assumptions would not be possible without the first. If the nervous process could pass in either direction through any connecting point of neurons, flux might easily occur *from one motor point* in the direction of another, as soon as the force of suction should fail to be exactly alike at all motor points. And the change from hydrostatic to hydraulic pressure would also cause, by attraction, flux *from motor points* to a motor point. This seems to lead to impossible complications, and is an additional reason for making the first assumption.

II. THE UNIQUENESS OF PAIN REACTIONS.

Instinctive reactions upon pain show a remarkable difference from other instincts. Unless this difference is clearly understood, pain reactions present a serious difficulty to our theory of nervous function. We have assumed that a stronger nervous process attracts a weaker one. A strong and continuous pain process, for example one originating from a sore tooth, might then be expected to attract all other nervous processes from whatever sense organs they originate. Since the pain process is there first, the new nervous processes, it seems, can never attain constancy of flux, but as soon as they originate must join the pain process. The flux of the latter, therefore, is again and again increased at points other than sensory points of the body. Must we not conclude then from our theory that a person who has a strong toothache should uninterruptedly be engaged in the same muscular activity, and that a toothache should be a highly pleasant experience?

To some extent this difficulty can be met theoretically by the following explanation. Touching and pressing upon the tooth does probably weaken the sensation of pain somewhat. But as soon as our hand has now begun to respond to some other stimuli acting upon our eyes, ears, or other sense organs, the pain stimulus starts again with renewed vigor, and the renewed process coming from the pain point deflects these other nervous processes soon after they have become constant, with resulting unpleasantness.

Of much more importance, however, is the following fact, which makes it plain why a strong sensation of pain must be unpleasant although the stimulation may continue strong. If the instinct of, say, swallowing is properly stimulated, the subject swallows. If the stimulus continues, the subject does not scratch himself behind the ear or spit, but swallows again and again. But the instinctive response to a pain stimulus is not a repetition of the first reaction. If I perceive pain at a definite point of my body, I perhaps move first my finger toward that point. If in spite of this movement the pain should continue, could it be of much value to me to repeat the movement? This movement obviously failed to remove the cause of the sen-

sation of pain. *Another kind* of movement must therefore occur, as a biological necessity, — and actually does occur, instinctively. If the pain still continues, a *third kind* of movement occurs; and so on. We may describe the difference between the instinctive pain reaction and other instincts thus: If the pain reaction is repeated because of a continuance of the stimulus, this does not mean that the same movement is repeated, but a different movement occurs each time. The nervous process, although starting from the same sensory point, does not, as in other instincts, continue to flow over the same path in the same motor direction, but suddenly takes a different path, after a while, if the stimulation continues, again a different path, and so on. Everybody knows what dancing and writhing movements result from continued pain, wherever the stimulus may be located. By what mechanism this recurrent change of action is brought about, I am unable to suggest. But the fact of its being brought about by some structural or functional peculiarity of our pain nerves cannot be doubted.

If we apply this to the above case of a sore tooth, we understand why a continued toothache cannot be pleasant. We at first thought of the nervous process resulting from the stimulation as a process going on continuously over the same path, and forcing all later arising and weaker processes to join it. We now see that the pain process is not one long-continued process, but many different processes succeeding each other. Every time another pain reaction occurs, the new nervous process interferes with the other processes going on at that moment, coming from various sense organs, by deflecting them. Unpleasantness must therefore be felt.

What has been said of pain reactions applies largely also to the instinctive reactions upon those other sense impressions which are harmful to the body, as bitterness or acidity. Having got a bitter substance into our mouth, we at first simply spit; but if the bitter sensation continues with any strength, we instinctively do many other things, wash our mouth with our tongue and with our fingers, put other things in our mouth, drink water, etc. For the same reason, therefore, an uninterrupted stimulus of bitter or sour is not likely to produce a sensation accompanied by pleasantness.

III. THE SUSCEPTIBILITY OF CONNECTING NEURONS.

That property of the connecting neurons which in our fifth assumption we called susceptibility, is of much significance in several respects. In my previous paper I did not make any statement concerning a definite ratio of the susceptibility of higher and lower neurons, but merely stated that the susceptibility of the higher neurons was greater. The assumption of definite values, however, leads to important consequences.

It is necessary that we distinguish between the two kinds of susceptibility by giving them definite names. Let us call *positive susceptibility* that property of a neuron which consists in a decrease of resistance in consequence of carrying a current, *negative susceptibility* that property which consists in an increase of resistance in consequence of lack of function.

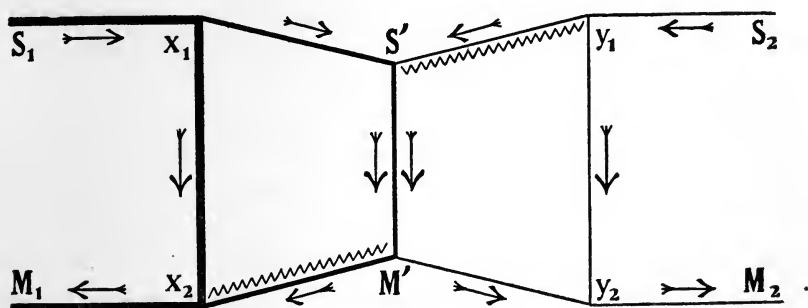


FIG. 1.

Let us arbitrarily assume that the positive susceptibility of each of the three neurons x_1S' , $S'M'$ and $M'y_2$ in Fig. 1 is three times that of the neuron x_1x_2 ; and further, that at the earliest time when all these neurons have reached their complete development, the resistance of x_1x_2 is equal to that of each of the neurons x_1S' , $S'M'$ and $M'y_2$. Suppose now that the point S' is stimulated. The flux is distributed according to the resistances offered by the paths. The resistance of the path $x_1S'M'y_2$ is three times the resistance of the path x_1x_2 . The flux at any point of the path x_1x_2 must therefore be three times the flux at any point of the path $x_1S'M'y_2$. The resistance of both paths must decrease because of the current in both. If the decrease

depended on the flux alone, it would be three times as great in $\alpha_1\alpha_2$ as in $\alpha_1S'M'\alpha_2$. But we assumed the positive susceptibility of the latter path to be three times that of the former. The decrease of the resistance is therefore exactly the same at any point of $\alpha_1S'M'\alpha_2$ as at any point of $\alpha_1\alpha_2$. Consequently, when the stimulation at S_1 ceases, although the resistance of all the four neurons in question has decreased, we find again that the resistance of $\alpha_1\alpha_2$ is equal to the resistance of each of the neurons α_1S' , $S'M'$ and $M'\alpha_2$. In this consideration, for simplicity's sake the existence of the path $M'y_2$ has been neglected. The flux from S' to M' must of course divide at the point M' . But most of it must take its way toward α_2 , much less towards y_2 , because of the attraction by the current going on in $\alpha_1\alpha_2M_1$.

The negative susceptibility has not yet become effective. Now, how will the relative resistance of the four neurons $\alpha_1\alpha_2$, α_1S' , $S'M'$ and $M'\alpha_2$ be found after some time? If the negative susceptibility does not differ in these neurons, no change will occur. If it is greater in each of the three neurons α_1S' , $S'M'$ and $M'\alpha_2$ than in $\alpha_1\alpha_2$, the resistance of the path $\alpha_1S'M'\alpha_2$ would soon become greater than that of $\alpha_1\alpha_2$. Is this probable? To some extent it seems to be true, for instincts cannot be trained, that is, modified, so well at a time much later than their natural appearance. "Was Hänschen nicht lernt, lernt Hans nimmermehr!" But special experiment alone can give an answer to the question as to just how much greater the negative susceptibility of higher neurons is than that of lower ones.

With respect to the positive susceptibility, if we had not made the assumption that in each of the neurons α_1S' , $S'M'$ and $M'\alpha_2$, it was three times that of $\alpha_1\alpha_2$, but the assumption that it was less, say only twice as great, what would have been the consequence? Obviously this: At the time when the stimulation at S_1 ceased, the resistance of the neuron $\alpha_1\alpha_2$ would have been found—not equal to, but only two thirds of the resistance of each of the neurons α_1S' , $S'M'$ and $M'\alpha_2$. Repeated stimulation would then result in a pronounced widening of the channel $\alpha_1\alpha_2$ and a relative or absolute (because of the negative susceptibility) narrowing of the channel $\alpha_1S'M'\alpha_2$. This is the case spoken of very briefly on page 302 of my previous

paper as a habit which is merely a strengthened instinct—strengthened in such a way that *any later modification becomes impossible*.

If the ratios of the positive and of the negative susceptibility are assumed to be exceedingly different, a habit can be conceived which is merely a strengthened instinct, but which *can easily be modified at any time*. Let us assume that the positive susceptibility of each of the neurons $\alpha_1 S'$, $S' M'$ and $M' \alpha_2$ is ten times that of $\alpha_1 \alpha_2$; and that the negative susceptibility of the former is but a trifle larger than that of the latter. Now suppose that the point S_1 is very frequently stimulated, each time for a considerable length of time, and with but short pauses between the stimulations. It is clear that then—in spite of the flux being at first at any point of $\alpha_1 \alpha_2$ three times as great as the flux at any point of the path $\alpha_1 S' M' \alpha_2$ —the resistance of the path $\alpha_1 S' M' \alpha_2$ will finally be only a very small fraction of the resistance of the path $\alpha_1 \alpha_2$, and that this ratio will not appreciably change in time since the negative susceptibility of the higher neurons is assumed to be very little greater than that of the lower neuron. We have thus changed an instinct into a habit in such a manner that the resistance of the paths leading from S_1 to M_1 is much less than it was under native conditions. In so far the case is like the one discussed above. But it is very different in this respect, that whenever now S_1 is stimulated, the nervous current takes the path exclusively over the higher center $S' M'$, whereas in the former case it would take the path exclusively over the lower center $\alpha_1 \alpha_2$. The great significance of this difference for an animal's life is clear. In the former case, the reflex arch $S_1 M_2$ has practically lost its connection, its functional communication with other reflex arches, $S_2 M_2$, $S_3 M_3$, etc. In the latter, the reflex arch has been brought into much closer connection with the other reflex arches, so that at any time it can enter into functional relations with them and those modifications of the response can be brought about which I have described in some detail in my previous article.

It is not, and cannot be, my task here to describe in detail what goes on in the nervous system in any definite situation occurring in a particular person's life. What I wished to show is

merely this, that under the assumption of a very few principles of nervous function, pictured in mechanical terms, the most varied adaptations of the nervous system can easily be comprehended without any necessity for introducing mythological powers of which no one can tell us whence they come and whither they go. A mere change in the quantitative relations of the properties which the neurons are assumed to possess, leads to the result that a habit, instead of being less modifiable than the instinct of which it represents a strengthened form, is on the contrary vastly more modifiable than this instinct. If we only knew more about human and animal instincts and habits and the relations between them, we could derive from this experimental knowledge the quantitative relations which we had to assume quite arbitrarily; and we could understand quite well the functions of the nervous system even if the study of the anatomy and physiology of the nervous system were doomed to remain forever on the present level of development — a prophecy which, of course, no one will make.

Let us show in another case how we can explain a special form of habit if only the quantitative relations of our principles are properly selected. On page 304 of my previous paper I applied the theory to that form of habit which I called sensory condensation. The explanation there given is open to criticism because it does not take into account the quantitative aspect of the susceptibility of the neurons. I had to be very brief at that time. I shall now discuss the same case, going a little more into detail. We supposed that both S_1 and S_2 (see Fig. 1 above) were stimulated, but S_1 more strongly than S_2 . Let us suppose that the resistances of all neurons are originally the same, and that the positive susceptibility of each of the neurons $\alpha_1 S'$, $y_1 S'$, $S' M'$, $M' \alpha_2$ and $M' y_2$ is three times that of either $\alpha_1 \alpha_2$ or $y_1 y_2$. (If we restrict ourselves to the establishing of the habit and neglect the forgetting, we need not make any assumption concerning the negative susceptibilities.) We found above that under these assumptions the stimulation of the single point S_1 , however prolonged, would not change the *relative* resistances of the neurons $\alpha_1 S'$, $S' M'$, $M' \alpha_2$ and $\alpha_1 \alpha_2$. All these resistances, although absolutely diminished, would still be equal to each

other. But when S_2 is stimulated simultaneously with, but more weakly than, S_1 , the current in $S'M'\alpha_2$ is increased by some flux coming from S_2 . This reduces the resistance of the neuron $S'M'$, and also of $M'\alpha_2$, to less than the resistance of $\alpha_1\alpha_2$. In consequence of this reduction more of the flux coming from S_1 takes the path α_1S' , less the path $\alpha_1\alpha_2$ than at first. The increased flux in α_1S' reduces the resistance of the neuron α_1S' . It is clear that the longer all this goes on the more must the path $\alpha_1S'M'\alpha_2$ be favored with respect to resistance change in comparison with $\alpha_1\alpha_2$. Finally the existence of the path $\alpha_1\alpha_2$ may be entirely neglected, for its resistance, while it has steadily decreased, has become very much larger than the resistance of the longer path $\alpha_1S'M'\alpha_2$ whose resistance has so much more rapidly decreased.

Thus far, however, the establishment of a habit of the kind which we called sensory condensation has not been explained. If S_1 alone is now stimulated, no appreciable current would occur in $M'y_2$, since the resistance of this neuron is by this time many times that of either of the paths leading from S_1 to M_1 . If S_2 alone is stimulated the response would occur at M_1 , not also at M_2 . If S_2 is stimulated and S_1 at the same time, the response would again occur only at M_1 . It is necessary, in order to bring about this special form of habit, sensory condensation, that double stimulations of both kinds, S_1 strong with S_2 weak, and S_2 strong with S_1 weak, occur in frequent alternation from the start. Suppose the resistance of the path $\alpha_1S'M'\alpha_2$ has been reduced only to very little less than three times the resistance of $\alpha_1\alpha_2$, and now S_2 is stimulated strongly and S_2 weakly. Then the flux from S_2 will not take its way towards M_1 , but most of it passes over y_1y_2 towards M_2 and most of the flux from S_1 takes its way over $S'M'$ towards M_2 . Thus the resistance of $y_1S'M'y_2$ can by steps decrease to much less than y_1y_2 . I say by steps, because this occurs while the symmetrically corresponding change on the left side of the figure, discussed above, has its pauses. The total outcome then is, that the existence of both the paths $\alpha_1\alpha_2$ and y_1y_2 may be disregarded, because the resistance of the paths $\alpha_1S'M'\alpha_2$ and $y_1S'M'y_2$ has become incomparably smaller than the resistance of either $\alpha_1\alpha_2$

or y_1y_2 , although absolutely these latter resistances have decreased too. Whenever now a single stimulus is applied to either S_1 or S_2 , the flux takes its path over $S'M'$ and dividing at M' produces a double response, at M_1 and M_2 . This is what we called sensory condensation.

It may be well to illustrate this kind of habit. A child learning to play the piano has before him two notes to which he is expected to respond by simultaneous movement of two fingers. One note is seen by foveal vision and the corresponding finger movement occurs with definiteness. The other note is seen by extra-foveal vision and the corresponding movement lacks definiteness. The child tries again and looks now at the note whose movement was not properly executed. Everything is reversed. The finger movement which was previously done badly is now done well, and the movement which was previously done well, is done badly. After many trials, on the whole alternating as to the favorable note and finger, the child becomes able to perform both movements simultaneously with definiteness although he is looking at only one of the notes — no matter which one he is looking at.

Summarizing, then, we may say that there is no justification for the remark not infrequently heard, that psychology can make no further theoretical progress, that we have to wait until the anatomy and physiology of the nervous system have made a long step in advance. We need not be discouraged. Experimental knowledge of habits and of their development out of instincts will enable us to obtain a scientific theory of human and animal activity by permitting us to determine the quantitative values which for the present we have to assume quite arbitrarily.

(I may use this opportunity for correcting a mistake in the description of the establishment of the 'variation of response' in my previous article, p. 303. In the fifth line from the bottom, between the words actually and than, the word 'greater' ought to be substituted for 'less'.)¹

(*To be concluded.*)

¹ The MS. of this article was received September 1, 1908. — Ed.

PECULIARITIES OF PERIPHERAL VISION.

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II. THE PERCEPTION OF MOTION BY THE PERIPHERAL RETINA.

I. INTRODUCTION.

1. *Problem.* — In a recent paper¹ by the author, certain differences in the perception of size, between the right and left halves of the retinas, were described and their importance for a theory of the origin of right- and left-handedness was urged. In the same paper, it was mentioned that along with differences in *size*, there were also differences in the apparent *rates* of moving objects, when they appear in the periphery of the field of vision. The apparatus by which the experiments were carried out was described and figured in the paper just alluded to. In its essentials the apparatus consisted of a large perimeter, upon which two cardboard discs could be moved and clamped in any desired position. Two circular, black spots were fastened upon the discs in such a way that they could be moved towards the center of the disc, always along the same radius, whenever it was desirable to do so. The discs were mounted upon a spindle similar to that of a color mixer, which was so drilled and split as to admit the end of a flexible shaft. The other end of the shaft was introduced into the axle of a pulley and the pulley itself was turned by an electro-motor. As both discs were connected in the same way with the same pulley which was driven by a motor, they turned necessarily at the same rate, although the directions of motion of the discs were opposite. It is evident that these conditions afford the best opportunity for comparing the size, rate of motion or form of objects in the periphery of the field of vision. Our problem, then, is to compare the rate of motion of one retinal locality with that of another (only one eye being used at a time), in order to determine the manner and

¹ PSYCH. REV., 15, 69.

degree in which the apparent rate changes; and also to determine, if possible, the cause of the apparent differences in rate. As a part of the paper is to be critical, a general statement, at the outset, of the conclusions may serve to keep the issues clear. (1) When two moving objects which have the same rate, extent and form, of motion appear in different parts of the periphery of the field of vision, the object in the right half, appears to move faster than a similar moving object in the left half, or at the center, of the field of vision. (2) This result is the same for both eyes. (3) The distribution of the illusory differences in rate of motion, within the visual field correspond exactly to the distribution of the illusory differences in size which were reported in the paper already referred to and of which two examples are given in this paper (Figs. 1 and 2). (4) The cause of the illusory motion is the difference in space perception in different localities of the retina.

2. *The Experiments of Others.* — That a moving object appears to move considerably faster when seen in indirect vision than when seen directly has come to be generally accepted. Exner¹ first reported the fact in the paper which is so brief that it is reproduced in full below. Muensterberg in the Milton Bradley Pseudoptics, gives a simple device by which the observation may be made. Dresslar² also describes an experiment by which the fact may be demonstrated. In a recent paper³ by R. Cords and E. Th. von Bruecke, on the velocity of after-images of moving objects, it was found that "Unter sonst gleichen Versuchsbedingungen ist die Geschwindigkeit des Bewegungsbildes in den peripheren Anteilen des Gesichtsfeldes bedeutend groesser als in den zentralen." Basler⁴ found that the overestimation of the motion was not confined to the periphery of the visual field, but occurred in the central region as well.

To this consensus of opinion, there is, so far as I know, but one dissentient voice. Sanford⁵ attributes the difference to the movement of the eye in direct and to its non-movement in in-

¹ *Pflueger's Arch.*, 38, 217.

² *Am. Jour. Psych.*, 6, 312.

³ *Pflueger's Arch.*, 119, 76.

⁴ *Pflueger's Arch.*, 115, 582, 'Ueber das Sehen von Bewegungen.'

⁵ Sanford, *Experimental Psychology*, 306.

direct, vision. "The statement is sometimes made that the apparent rate of moving objects seen indirectly is greater than that of the same objects seen directly, and certain experiments seem to give ground for the statement. It is probable, however, that this is an error, and that an important factor has been omitted in the interpretation of the experiments; namely, that in direct vision the eye follows the moving object, and in indirect it does not. When this difference is avoided, it is hard to perceive a difference in rate in the two conditions."

The empirical evidence for the fact rests upon three experiments: Exner's with a candle on a pendulum, Dresslar's with a pendulum reflected in a mirror and Muensterberg's with a rod which is held in the hand and turned back and forth through a small arc. Exner's experiment and his results are sufficiently explained in the quotation which follows.

Ein Versuch über die Netzhautperipherie als Organ zur Wahrnehmung von Bewegungen.

Vor Jahren habe ich eine Reihe von Beobachtungen publicirt,¹ welche zeigten, dass die Netzhautperipherie, bei ihrer bekannten Unvollkommenheit in der Wahrnehmung räumlicher Formen, im Vergleich zum Netzhautcentrum, doch in hohem Grade befähigt ist, Bewegungen (und wohl Veränderungen überhaupt) zu erkennen. Sie spielt die Rolle eines Wächters, welcher die Aufgabe hat jede verdächtige Änderung in seinem Gebiete zur Kenntniss zu bringen. Ist eine solche einmal bemerkt, dann wird instinctiv der Blick dahin gerichtet und das Vorkommniss mit der Macula lutea genauer geprüft. Mein College v. Fleischl² hat eine Hypothese über die Retinastructur aufgestellt, welche diese Bewegungsempfindlichkeit der Netzhautperipherie zu erklären geeignet ist. Im Folgenden theile ich einen Versuch mit, der diese Hyperasthesie für Bewegungen einem grösseren Publicum zu zeigen gestattet. An einem Pendel von 1-2 Secunden Schwingungsdauer ist eine brennende Kerze angebracht. Man lässt, während das Pendel in Ruhe

¹ 'Das Sehen von Bewegungen und die Theorie des zusammengesetzten Auges,' *Wiener Akad. Sitzber.*, 1875, Bd. 72.

² 'Physiologisch-optische Notizen, III.,' *Wiener Akad. Sitzber.*, Bd. 87, Mai, 1883.

ist, einen Punkt fixieren, der für den einige Meter entfernten Beobachter die Kerzenflamme unter einem Gesichtswinkel von c. 45° erscheinen lässt, und weist ihn an, die Elongationen der Flamme zu beachten, um ein Urtheil über die Grösse derselben zu fällen. Dann erst setzt man das Pendel in Bewegung, am besten so, dass die Elongation unter 10 cm. beträgt. Lässt man sich nun die geschätzte Elongation entweder mündlich in Centimetern oder durch Handstellung angeben, so pflegt dieselbe 2–3 mal zu gross auszufallen. Ich habe nie gesehen, dass jemand die Elongation unterschätzt hatte. In der beistehenden Tabelle sind die Schätzungen enthalten, welche Besucher des Laboratoriums in Laufe einiger Tage auf meine Bitte ausgeführt haben, und zwar ohne Auswahl. Sie stammen von Herren her, welche nicht wussten, um was es sich bei dem Versuche handelt, die also nur den Auftrag hatten, die wahrgenommene Elongation schätzungsweise anzugeben.

Versuchperson.	Wirkliche Elongation.	Geschätzte Elongation.
Dr. P.	10 cm.	25–30 cm.
Dr. K.	7 "	23 "
Stud. med. S.	7 "	32 "
Stud. med. L.	3.7 "	13 "
Prof. von B.	7 "	18 "
Stud. med. R.	8 "	19 "
Prof. S.	7 "	17 "
Stud. med. H.	5 "	18 "

Blickt man abwechselnd nach der pendelnden Flamme und nach einem passend abseitsgelegenen Punkt, so scheint das Pendel langsamer und schneller zu schwingen ¹ oder doch abwechselnd kleinere und grössere Elongationen zu machen. Um sich von der Rede stehenden Täuschung zu überzeugen, genügt übrigens jede Hängelampe; ich habe dieselbe zuerst an einer solchen bemerkt.

Of the three experiments, Exner's gives the most satisfactory result. With some practice it is possible to detect very noticeable differences in the rate of motion between the center and the periphery of the retina. It is significant for the view that is presented in this paper that Exner speaks of the actual and estimated *elongation* of the pendulum. It is not the rate at which the pendulum travels, but the *distance* covered in its movement which is judged. And in the next to the last sentence in

¹ In Analogie zu einem von Collegen v. Fleischel beschriebenen Versuche; *Physiol.-optische Notizen, II.*, *Wiener akad. Sitzber.*, Bd. 86, Mai, 1882.

the article it is said that if one looks towards the swinging flame and then away from it, the pendulum appears to move slower (in direct) and quicker (in indirect vision) or to make a *smaller* or *larger* elongation. Doubtless Exner had in mind the physical formula for velocity, in which velocity is directly proportional to space. At any rate it shows that the fact may appear as an enlargement of space or as a quickening of motion. Similarly, Basler speaks of the magnitude of motion (*Bewegungsgroesse*) without saying whether it is the rate or extent of motion which is overestimated.

I have repeated Exner's experiment with two observers. Not only does the extent of movement appear differently in direct and indirect vision, but the two corresponding halves of the retinas perceive in the same way. The pendulum consisted of a 16 c.p. electric lamp which was suspended from the ceiling of the darkroom by a piece of its own cord one meter in length. The observer sat 50 or 60 cm. from the lamp with his head turned towards it, so that his eye could be directed to one side or the other, or directly at it in such a way that the retinal image of the lamp would fall as desired, upon the temporal, nasal or macular region of the retina. In this manner comparisons were made between the temporal and nasal region of each eye and the fovea: these observations may be called foveal-peripheral comparisons to distinguish them from peripheral comparisons between one peripheral region and another. Exner's observations were all of the foveal-peripheral sort, as are the first four of those in the following lists for each observer. In all observations the observing eye does not move.

Observer.	Eye.	Retinal Regions Compared.	Result.
H. L. Osterud,	R	Nasal and foveal,	Arc longer in indirect vision.
"	"	Temporal and foveal,	" " " direct "
"	L	Nasal and foveal,	" " " " "
"	"	Temporal and foveal,	" " " indirect "
"	R	Nasal and temporal,	" " on the nasal retina.
"	L	Nasal and temporal,	" " on the temporal retina.
C. J. Ducasse,	R	Nasal and foveal,	Arc longer in indirect vision.
"	"	Temporal and foveal,	" " " direct "
"	L	Nasal and foveal,	" " " indirect "
"	"	Temporal and foveal,	" " " " "
"	R	Nasal and temporal,	" " on the nasal retina.
"	L	Nasal and temporal,	" " " " temporal retina.

These results confirm those of Exner. Rate or extent of motion on the periphery of the retina appears faster or larger than on the central region. But it is evident from an examination of the results given above that this statement requires a qualification. Not all peripheral regions give a larger extent of movement than the fovea. In the case of O., the arc when

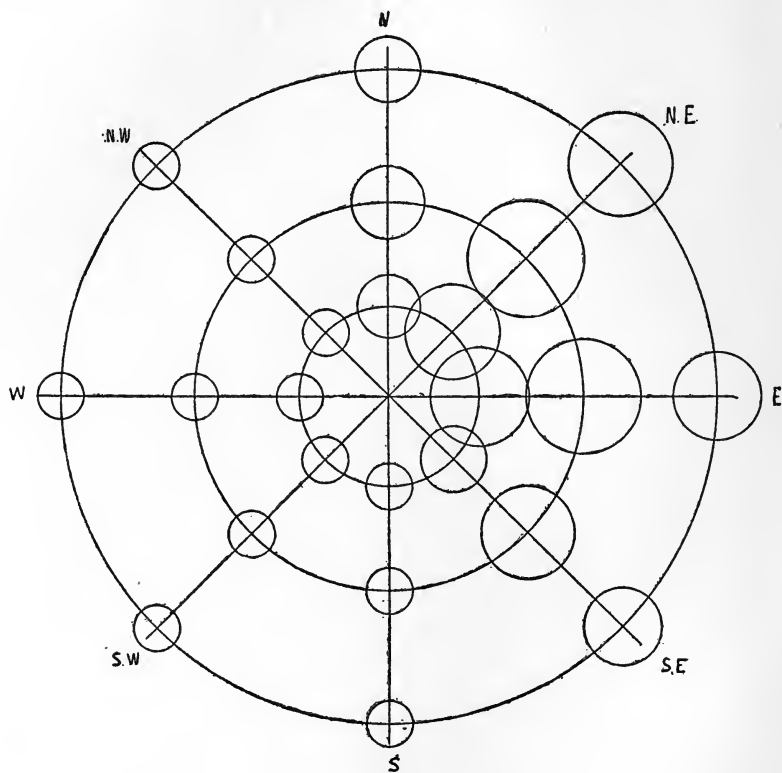


FIG. I.

seen on the nasal of the right, and the temporal of the left, retina appears larger than when seen on the foveal region. On the other hand when the arc is seen on the temporal of the right and the nasal of the left, retina it appears smaller than when seen on the foveal region. The law should, then, read thus: An extent or a motion will appear longer or faster in indirect, than in direct, vision, when the retinal images of the extent or

moving object are formed upon the left corresponding halves of the retinas; when the retinal images are formed upon the right corresponding halves of the retinas the extent or motion appears less in indirect, than in direct, vision. This statement is confirmed by the results here given (with the exception of the fourth of *D*'s observations), and by those previously published.

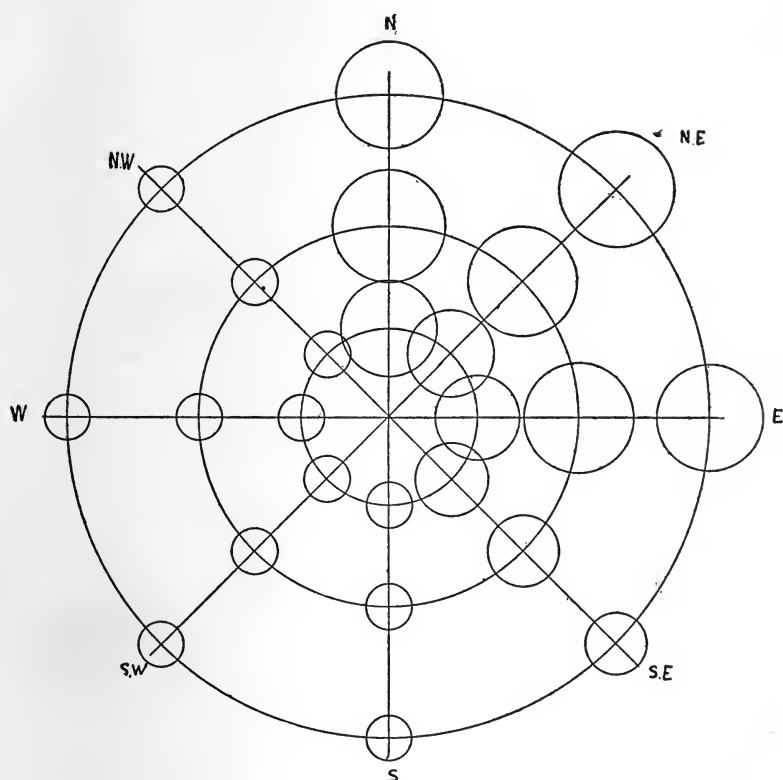


FIG. 2.

Figs. 3 and 4 of the present paper and the same figures of the paper already frequently referred to, show the fact in intuitive form. It is more marked in some observers than in others, but to some extent, it exists in all. The peripheral comparisons show that when the extent or motion falls upon the left corresponding halves of the retinas, it appears larger or faster than when it falls upon the right corresponding halves of the retinas.

The same result may be seen, expressed graphically, in Figs. 1 and 2.

Dresslar's Experiment.—Dresslar's description of his experiment is so brief that it may be quoted in full.

A New and Simple Method for Comparing the Perception of Rate of Movement in the Direct and Indirect Fields of Vision.

While sitting in my room last winter my attention was attracted by the image of a swinging lamp in the mirror, and it then occurred to me that here was a simple method for com-

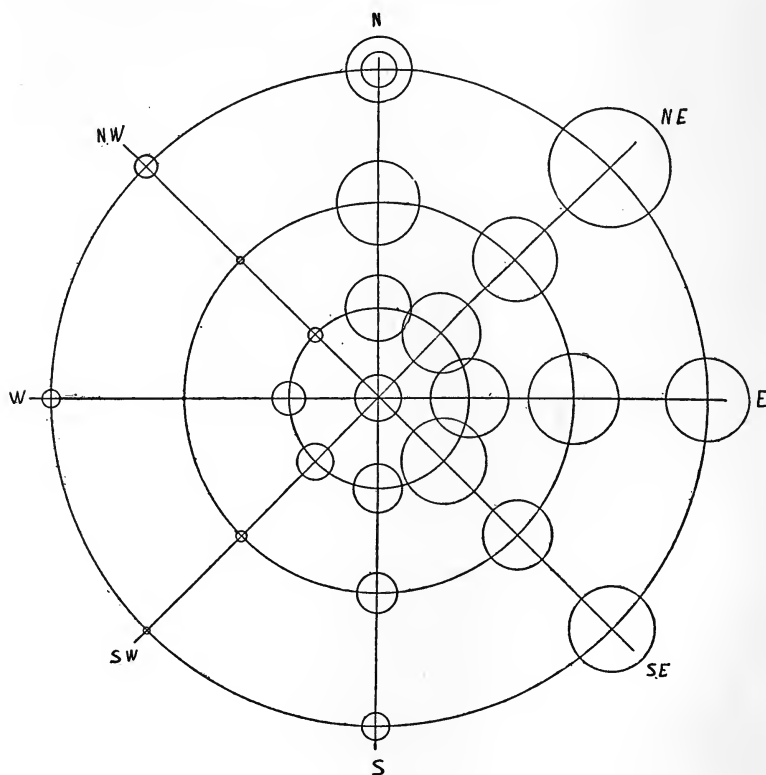


FIG. 3.

paring the perception of rate in the direct and indirect fields of vision. I took a position where, by looking directly at the image in the mirror, the image from the lamp itself fell on the

indirect field of vision. I thus had exactly the same rate, and, provided that I placed myself so that my eye would be near the glass, almost the same extent of movement of the images. The experiment at that time was roughly made, but it showed clearly the well known fact that of two equal rates, the one seen in the indirect field seems to be the more rapid. I have tested the method under more favorable circumstances, and offer it as a simple demonstrational method: Take a small, clear mirror and

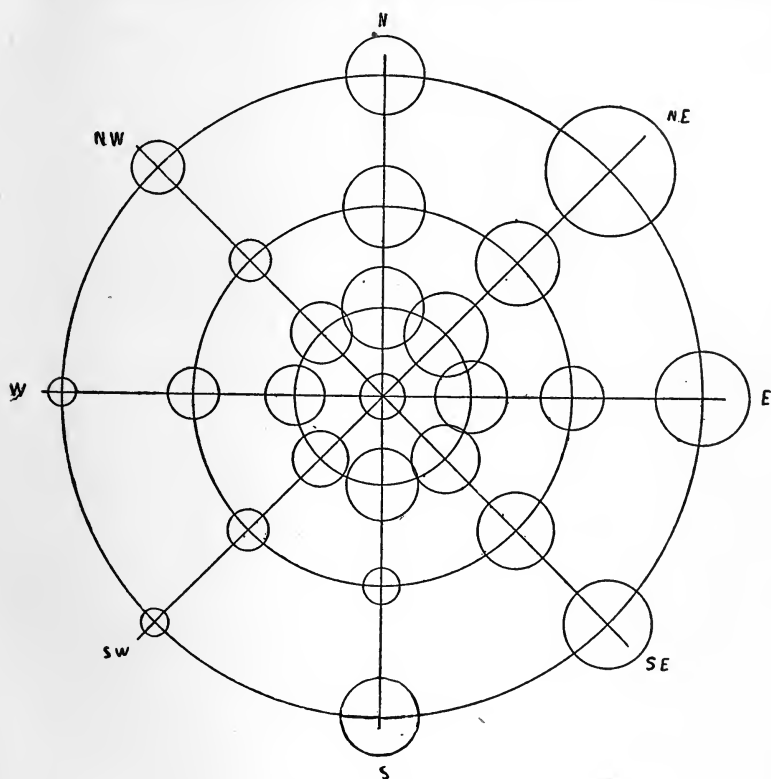


FIG. 4.

arrange it in the median plane immediately between the eyes, so that the eye of the observer may be near the edge of it. Make a pendulum of a small string weighted with a lead ball and place it at some distance away, but near enough to the plane of the mirror to make an angle of perhaps twenty or thirty degrees with it. Swing the pendulum, not too far, nor too fast, in a di-

rection perpendicular to the plane of the mirror. If the observer now directs his eye to some part of the arc, through which the pendulum swings, so that the image of the moving ball will cross the point of clearest vision, the image from the mirror will fall on the indirect field and the two rates can be easily compared. The following diagram will perhaps help to show the arrange-

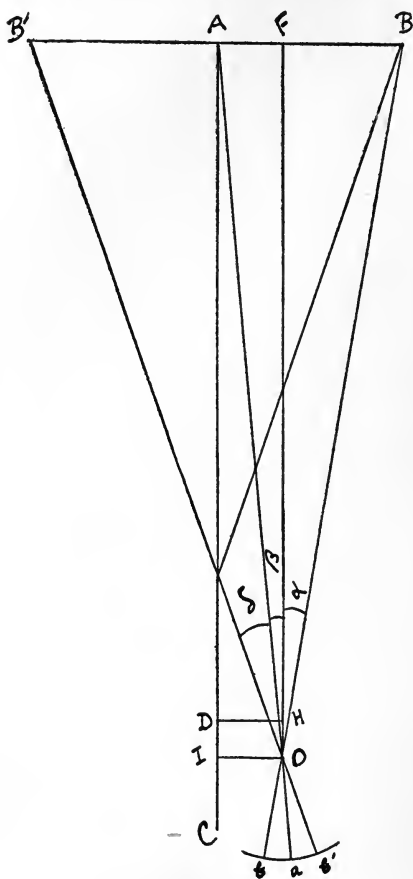


FIG. 5.

ment (the diagram is not reproduced). It will be well, perhaps in most cases, to cover the ball of the pendulum with white paper. It should be noticed also that the background should offer no distraction to the attention as sources of error for the judgment. The apparent difference in the rates will be greater when the observer directs his eye toward the pendulum, because the image from the mirror will then fall on the temporal side of the retina, which is less sensitive than the nasal side, especially in an observer whose eyes are deeply set.

I have repeated Dresslar's experiment myself and with two other observers, but with negative results. The fact that the eye which observes cannot be situated in the plane of the mirror would

seem to render the experiment useless, since, unless that condition is fulfilled, the retinal arcs of the pendulum and its image in the mirror will be of unequal lengths and, therefore, a prime condition of the experiment violated. Fig. 5 and the trigonometrical considerations which follow from it, show that

with the eye 7 mm. from the plane of the mirror, there would be, under the conditions of our experiment, a difference of 28 minutes in the two retinal arcs. In Fig. 5 the line AC stands for the mirror and the line AB for the pendulum. AB' represents the reflected image of the pendulum and, since the arc of the pendulum is perpendicular to the plane of the mirror, AB is equal to $B'A$. The nodal point of the lens is represented by O and the surface of the cornea by H . The distance between O and H is 7 mm. In the case here considered the line of sight is perpendicular to the arc of the pendulum. In our experiment, $AI = OF = 157$ mm.; $AB = AB' = 40$ mm.; $AF = 7$ mm.; $FB = 33$ mm.; $FB' = 47$ mm. Also let $L\gamma = \delta + \beta$. Then

$$\tan \alpha = \frac{FB}{OF} = \frac{33}{157} = 11^\circ 52',$$

$$\tan \beta = \frac{AF}{OF} = \frac{7}{157} = 2^\circ 33',$$

$$\tan \gamma = \frac{FB'}{OF} = \frac{47}{157} = 16^\circ 40'.$$

Hence

$$\begin{aligned} \angle \delta &= \gamma - \beta = 14^\circ 7' \\ \alpha + \beta &= 14^\circ 35'. \end{aligned}$$

It is evident that there is a difference of 28 minutes between the arcs subtended by the pendulum and its image in the mirror. Inasmuch as the minimum visibile is about one minute or less,¹ the error from this source is too great to be neglected.

Muensterberg's Experiment.—This experiment is explained in the Milton Bradley Pseudoptics, section D, which is entitled, Illusions of Movement, experiment no. 5. The apparatus consists of a light metal rod 260 mm. in length. At each end there is a square piece of white cardboard 25 mm. on each side. The rod is held in the hand by means of a thread which is attached to the rod in two places. The passage which follows tells how the experiment is to be performed and it also gives an explanation of the result. "Hold the little apparatus horizontally by

¹ Kuelpe, *Outlines of Psych.*, Eng. tr., 358.

the thread and swing it gently from side to side, rather close to the eye and follow the movements of one of the white moving squares. The other square seen with the side part of the eye in indirect vision seems to move stronger and quicker than the one at which you look, and it appears to become slower as soon as you look at it directly. Explanation of experiment no. 5. The side parts of the retina which are less sensitive to color and to form are more sensitive to motion and to change." It is impossible for me to obtain a satisfactory result with this apparatus. Two serious errors are involved: (1) The eye follows the moving square. That means that the image of the object falls on the same retinal locality throughout the experiment. The motion which is felt is due to the moving of the eye and not to the moving of the object over the stationary retina, which is the proper condition for the observation. (2) The movement of the peripheral square is much more noticeable than that of the other, for the reason that the motion of the central square is greatly foreshortened by being directly looked at.

II. OUR OWN EXPERIMENTS AND RESULTS.

Our own experiments were carried out with the perimeter and moving discs to ascertain whether the illusory differences in rate of motion were distributed in the visual field in a manner similar to the illusion of size. The assumption was that, if there be a complete coincidence of the size and rate illusions, as regards their occurrence in the visual field, one must be the cause of the other. As the apparatus with which the experiments were made was the same as that with which the experiments on the space values of the peripheral retina were made, I must refer the reader to that paper for particulars as to method and dimensions. Here it will suffice to say that when the white discs bearing their black spots appeared at symmetrical points in the field of vision, the orbit of one spot seemed larger, or the spot itself seemed to travel faster, than the other. The discs were so adjusted on their spindles that the spots always occupied symmetrical positions, although the direction of motion of the discs, as has been explained, was opposite. That is to say, if, at any time, the motor was stopped, and the two discs superposed face to face,

the two spots would overlap. It will thus be seen that the observer was asked to compare the rates of two spots moving at uniform speed, in circular orbits, in opposite directions. The rate of revolution was about one per second. Seen under these conditions, the orbit of one spot seems larger, and the spot itself seems to be moving faster, than the other. The problem was to determine whether the orbit appears larger because the spot is traveling faster, or whether the spot appears to be traveling faster because the orbit is larger. Two facts point to the second alternative: (1) Wherever, in the visual field, the orbit appears larger, there the rate of the spot appears faster. And whenever the apparently larger orbit is diminished, as it may be by pushing the spot towards the center of the disc, the difference in rate disappears as the orbits become subjectively equal. (2) The difference in size is as apparent with motionless objects (cardboard discs, for example) as with the moving spots. I give, therefore, the results of experiments with two observers, in which the distribution of the size illusion is shown both in numbers and in figures. That the faster motion always concurred with the apparently larger orbit will have to be accepted on the strength of the statement, as I have not been able to devise any means of measuring the motion independently of the size.

The experiments were either comparisons between two peripheral regions of the retina of one eye, as between the nasal and temporal region of the right eye, or between the fovea and some part of the periphery, of the retina of the same eye. The former sort are called peripheral, the latter, foveal-peripheral, comparisons. All of the experiments are quantitative. That is to say, the exact amount of apparent difference between one retinal locality and another, was measured. The measurements were made by shortening the radius of the orbit of the apparently larger disc, until it equalled, subjectively, the orbit of the other. The actual reductions, for each position in the visual field, are given in millimeters, in Tables I. and II. As the perimeter describes in revolution a hemisphere, of which the pole is the fixation point, the various positions in the visual field, which were studied, may be conveniently described by reference

to the meridians and parallels of this hemisphere. The positions fall upon four meridians: the vertical, horizontal and two oblique, 45 degrees from the vertical, in the first and third, and in the second and fourth quadrants. The parallels were ten,

TABLE I.

Meridian.	Parallels.		
	25	20	10
N. & S.	Re 4 Le 4	Re 8 Le 5 Re 5 Le 6	Re 3 Le 2
	Re 4 Le 2	Re 5 Le 4 Re 6 Le 4	Re 3 Le 1 Re 5 Le 7
	Re 8 Le 8 Re 15 Le 17	Re 15 Le 15	Re 11 Le 12 Re 9 Le 10
	Re 10 Le 5 Re 14 Le 5 Re 14 Le 8	Re 15 Le 14	Re 13 Le 14 Re 9 Le 9
S.E. & N.W.	Re 9 Le 5½ Re 6 Le 6	Re 10 Le 10	Re 3 Le 3½ Re 6 Le 5

TABLE II.

Meridian.	Parallels.		
	25	20	10
N. & S.	Re 14 Le 13	Re 14 Le 15	Re 11 Le 11
	Re 15 Le 16	Re 14 Le 14	Re 8 Le 10
E. & W.	Re 13 Le 14	Re 13 Le 16	Re 11 Le 11 Re 6 Le 6
	Re 4 Le 3	Re 5 Le 6	Re 8 Le 8 Re 6 Le 2

twenty and twenty-five degrees from the fixation point or pole. The meridians are further designated as north and south for the vertical and east and west for the horizontal; the others receiving likewise appropriate names from the points of the compass. In all of the experiments, but one eye was used at a time and that eye was always fixed upon the pole of the visual hemisphere. In the case of the foveal-peripheral comparisons, when one disc covered the fixation point, the eye rested upon the center of the disc.

TABLE III.

Meridian.	Parallels.		
	25	20	10
N.	Re 6		
	Le 2	Re 8	Re 4
	Re 2 C	Le 8	Le 4
	Le 3 C		
N.E.	Re 17	Re 9	Re 7
	Le 15	Le 7	Le 7
E.	Re 8	Re 8	Re 8
	Le 8	Le 10	Le 7
		Re 10	Re 7
		Le 10	Le 6
S.E.	Re 11	Re 6	Re 8
	Le 6	Le 6	Le 9
		Re 4	
		Le 4	
S.	Re 4 C	Re 2½ C	Re 0
	Le 4 C	Le 0 C	Le 1
S.W.	Re 8	Re 9 C	Re 2 C
	Le 9	Le 7 C	Le 2 C
		Re 7 C	
		Le 8 C	
W.	Re 6 C	Re 10 C	Re 3½ C
	Le 6 C	Le 9 C	Le 3 C
N.W.	Re 5 C	Re 7 C	Re 7 C
	Le 5 C	Le 7 C	Le 7 C
		Re 10 C	
		Le 10 C	

The peripheral comparisons are given for observers, *O* and *D* in Tables I. and II.; the foveal-peripheral comparisons for the same observers in Tables III. and IV. The tables show the amount of enlargement a disc undergoes in any of the positions in the visual field, which was studied. For example, in Table

II., in the horizontal meridian, 25° from the fixation point, it was found necessary to reduce the right orbit by 13 mm. for the right eye, before the right, appeared equal to the left disc. In the peripheral comparisons, the right disc in the visual field always appeared larger than the symmetrically placed disc in the left half of the field, and the upper disc always appeared larger than the lower disc. The figures in the tables tell how much the larger, had to be reduced to equal the smaller, disc. In the foveal-peripheral comparisons, the peripheral disc appeared larger in some positions while in others, the central disc ap-

TABLE IV.

Meridian.	Parallels.		
	25	20	10
N.	Re 7	Re 8	Re 8
	Le 8	Le 8	Le 8
N.E.	Re 19	Re 8	Re 9
	Le 19	Le 9	Le 8
E.	Re 11	Re 3	Re 6
	Le 11	Le 5	Le 6
SE.	Re 10	Re 7	Re 5
	Le 9	Le 7	Le 5
S.	Re 7	Re 2 C	Re 6
	Le 8	Le 2 C	Le 6
S.W.	Re 4 C	Re 0	Re 3
	Le 4 C	Le 2 C	Le 1
W.	Re 5 C	Re 2	Re 3
	Le 3 C	Le 0	Le 3
N.W.	Re 2	Re 1 C	Re 3
	Le 0	Le 1 C	Le 4
	Re 2		
	Le 2		

peared larger. In the tables, the letter, *C*, indicates that in those positions the central disc appeared larger than the peripheral disc by as many millimeters as are indicated by the numbers. When the central disc appeared larger, it was diminished until it equalled the peripheral disc. The figures (1, 2, 3, 4) express in graphic form the results of the observations. The concentric circles stand for the parallels, and the straight lines for the meridians, of the visual field. At the intersection of the parallels

and meridians the amount of the enlargement is represented. The enlargement is represented by assigning to the circle which represents the smaller disc, a certain arbitrary radius which in the plates was 10 mm. The circle which represents the larger disc is made with a radius of 10 mm. plus the number of mm. by which the orbit of the larger disc was actually decreased. The number of mm. taken as the amount of increase is the average of all the readings taken, for both right (Re) and left (Le) eyes. In some cases determinations of the same positions were made several times after an interval of a month. In such cases all of the determinations are included in the appropriate square of the tables. Two discrepant readings for the same position are represented, in the figures, by two concentric circles. There is one case of this in Fig. 3.

It should be understood that the view here presented with regard to the cause of the illusory increase of speed on the periphery of the retina, does not invalidate the theory that motion is felt as a sensation and not as a perception of change between two points. The experiments first pointed out by Exner, that the fingers may be seen to move in the periphery of the field of vision where they cannot be discriminated as two or more and the similar observation that the movement of the points of a pair of compasses within an area in which the points cannot be felt as two, prove only that the feeling of motion does not depend upon the discrimination of two points. Basler's experiment is even more significant for this view, for he found that a motion between two points may still be felt although, on the same place on the retina in direct vision, the two points could not be discriminated as separated.¹ Basler assumes a peculiar arrangement of the rods and cones of the retina, by means of which two retinal elements may be excited, although the lateral displacement of the moving object is less than the diameter of one rod or cone. Basler's fact lends weight to the sensational view of motion, while his theory seems to imply that two termini in the shape of two *different* sense organs, are necessary to the perception of motion. The results of our own experiments show that the feeling of motion is dependent upon

¹ *Loc. cit.*, 587.

the feeling of space, although not upon the capacity to distinguish two points as separate. That the feeling of extent and the discrimination of two points are different kinds of spatial feeling has already been urged by Wundt.¹ He points out that, on the back, where the discrimination is poor, just as soon as the threshold is passed the extent is felt as a relatively large one, while on the finger tip where the discrimination is much finer, the distance is felt to be small when once the threshold is exceeded. Exner is right in combating the theory of Vierordt that a *terminus a quo* and a *terminus ad quem* is necessary to the feeling of motion. But if he means, in saying that motion is felt as a sensation, that, as such, it is not dependent upon extent, the present writer must disagree with him.

SUMMARY.

1. There is a fundamental difference in the perception of size between the right and left corresponding halves of the retina. When stated in terms of the retinas, the fact is this: Objects whose retinal images are formed upon the nasal retina of the right, and on the temporal retina of the left, eye appear larger than similar objects whose retinal images are formed upon the temporal retina of the right, and on the nasal retina of the left, eye. When stated in terms of the field of vision, the fact is this: Objects seen in the right half of the visual field appear larger than similar objects of the same size in symmetrical parts of the left half of the visual field.

2. This difference in space perception is the cause of the apparent increase in rate which moving objects, seen in indirect vision, seem to undergo. The evidence for this view rests upon two points: (1) The distribution in the visual field of the size illusion is exactly co-extensive with that of the rate illusion. But if there were nothing more than this similarity of distribution, either one might be the cause of the other. The space illusion is fundamental for the reason that (2) the differences in space perception are apparent with discs of cardboard which are motionless.²

¹*Physiol. Psych.*, II., 442 and 512.

²The MS. of this article was received August 7, 1908. — Ed.

A STUDY OF GALVANOMETRIC DEFLECTIONS DUE TO PSYCHO-PHYSIOLOGICAL PROCESSES.¹

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PART I.

I.

The purpose of our present study is to investigate the relation of emotions and physiological activities to galvanometric deflections. Our aim is to ascertain whether galvanometric deflections can invariably be correlated with psycho-physiological processes. We attempted to eliminate all errors and obviate objections incident in the carrying out of such delicate work and also to deal with the problem of causation. This communication should be regarded as a preliminary one; further research is in progress.

In his study of the emotions Ch. Fèrè was the first to point out the presence of electrical changes under the influence of emotions and affective states in general. He regards the changes as the result of lowering of bodily resistance brought about by the emotions and their correlative physiological processes. R. Vigoroux followed up the subject by a study of clinical cases and referred the electrical changes found not to skin resistance, but to modifications of capillary circulation under the influence of emotions.

In experimenting with the mirror-galvanometer Tarchanov found galvanometric perturbations due to emotions, affective states, sensations and ideas; in fact, according to him, all kinds of mental states bring about deflections of the galvanometer. He describes large deflections apparently caused by the slightest

¹ The MS. of this article was received May 13, 1908. — ED.

emotion and change of affective states and even by mere memory and representation of an emotion. In fact, according to Tarchanov, even such intellectual processes as calculation give rise to marked deflections of the mirror-galvanometer. As the result of experiments which have been repeated by us in the present research he came to the conclusion that the galvanic phenomena manifested were due to secretory changes of the skin. It is to be regretted that Tarchanov did not follow up his experiments as he had promised to do in his original paper.

Many other investigators such as Stricker, Sommer, Müller, Veraguth and more recently Jung, have taken up the subject and have advanced different views and hypotheses as to the causation, physiological and physical, of the galvanic phenomena in relation to psychic activities. While Stricker in opposition to Tarchanov rejects the theory of skin-effects and variations of the activity and secretion of sudorific glands, but ascribes the galvanic phenomena to circulatory changes under the influence of mental states, Sommer regards the phenomena more in the nature of an artefact. He thinks that the galvanic deflections are simply the result of variations of contact between skin and electrodes and that they are due to the movements of the hand, voluntary or involuntary, and to changes of pressure exerted on the electrodes. This is a very serious objection which must be overcome before we can establish any relation between mental processes and observed galvanometric perturbations.

Recently Veraguth and after him Jung have devoted much of their time and energy to the study of the relation of mental states to galvanometric deflections. Veraguth confirms Tarchanov's results and terms the galvanic phenomena observed by him under the influence of emotions and of mental states in general, as 'the psycho-physical galvanic reflex.' Jung has been especially energetic in calling attention to the galvanic phenomena of emotional disturbances and has attempted to utilize them in the detection and analysis of suppressed systems and possibly also of dissociated subconscious mental states. Peterson and Ricksher, working in Jung's laboratory, have in their investigations, performed on normal and on insane individuals, further corroborated the relation between

galvanometric changes and mental states in general. Large galvanometric fluctuations were found by them to be correlated with sensory, emotional and ideational system-complexes. The galvanic perturbations due to ideo-sensory states are referred to the affective states or 'feeling tone,' which, according to Wundt's doctrine, widely accepted in Germany, are supposed to accompany all mental processes.

The following table¹ may possibly give some concrete idea of the magnitudes, as found by these observers, of the galvanometric deflections under the influence of mental states:

Stimulus.	Deflection of Galvanometer.
Multiplying 4×4	34 cm.
Multiplying 9×11	18
Call by name.....	5
Where do you live?.....	38
Capital of Switzerland?.....	14
How old are you?.....	24
Are you married?.....	18
Were you engaged before?	27
Have you been a nurse before?	26
Imagined threat of prick with needle.....	4.3
Imagined threat of fall of heavy weight	1.6
Imagined grief	2.8
Thought of an amusing story.....	1.8
Thought of a painful illness.....	1.6

An inspection of the table shows that the magnitudes of deflections vary greatly among themselves without apparent corresponding variation of the stimuli. Our results differ from these as the sequel will show.

II.

The electrical circuit and apparatus employed by us for these experiments were as simple as possible, in order that there should be no doubt as to the origin of the effects observed. The arrangement was as indicated in Fig. 1.

In series with a battery *B* was a sensitive galvanometer *G* and two electrodes *EE*, across which the subject placed himself, thus closing the circuit. The battery was a single cell giving a constant electromotive force of about 1 volt, which was some-

¹Peterson and Jung, 'Psychophysical Investigations,' *Brain*, 1907.

times replaced by a thermo-element giving only a few millivolts, and sometimes entirely removed from the circuit. The galvanometer was of the suspended coil, D'Arsonval type, and of ex-

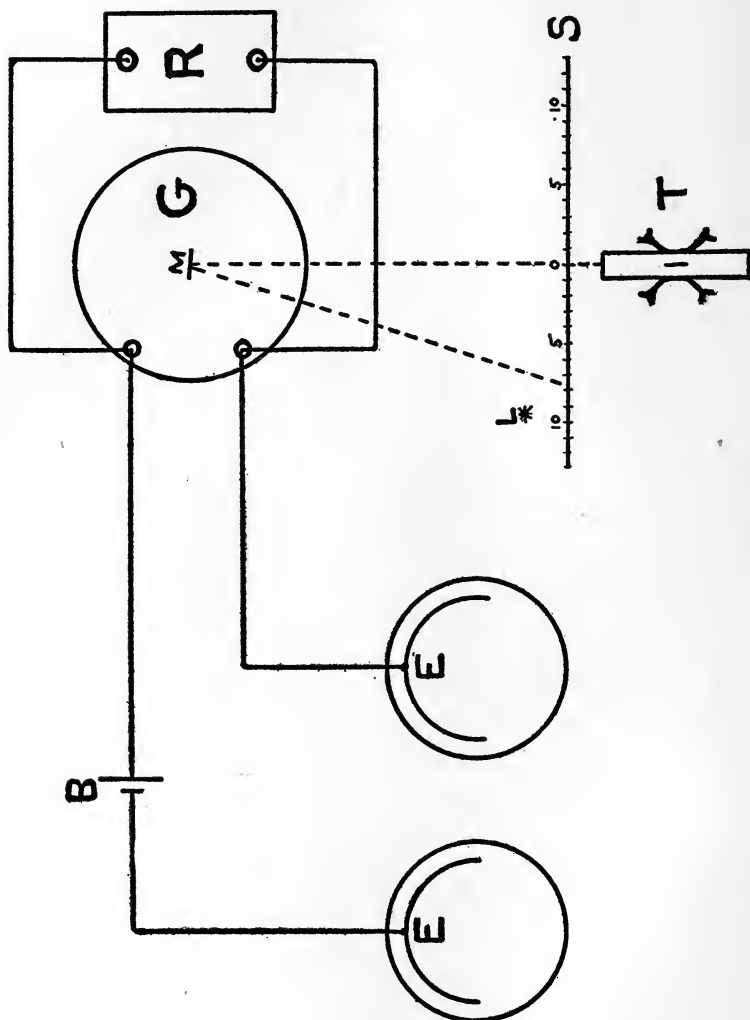


FIG. 1.

treme sensitiveness. The deflections were read by means of a beam of light deflected from a mirror *M*, attached to the moving coil of the instrument, to a telescope *T* with a scale *S*. A deflection of 1 cm. on the scale corresponded to less than 10^{-9} ampère

through the instrument. This extreme sensitiveness was too great for many of our early experiments, so that a resistance R , which could be varied to reduce the sensitiveness to any desired degree, was shunted around the galvanometer.

Not only is it important that the galvanometer employed should respond to very small changes in the current flowing through the circuit, but it must respond quickly, that is, without appreciable lag. The speed of reaction of the galvanometer was tested by direct experiment. First, with an all copper circuit, and then with the human body across the electrodes EE , the circuit was made and broken at the rate of 200 times per minute. Each change was definitely observed by corresponding galvanometric deflections.

The electrodes EE were glass vessels of about 4 liters capacity, nearly filled with a strong electrolyte, as for instance a concentrated solution of NaCl . Into these vessels large copper electrodes C of about 500 cm.^2 area were permanently placed. The circuit was completed by placing the hands, feet, etc., one into each electrode solution.

The galvanometric deflections may be due to changes in the resistance at the electrodes, brought about by such purely physical causes as motion or muscular contraction of the hand, stirring of the electrode fluid or similar incidental secondary effects. In order to eliminate the possibility of such effects it was necessary to devise such electrodes that the current through the circuit should within very wide limits be independent of the position of the hands. The possible sources of error at this point which would change the effective surface of the hand are twofold—(1) due to the variation of the liquid level at the wrist, and (2) due to movements of the hand as a whole. The following device was used to overcome these difficulties. The wrist was covered with shellac for a length of several inches, so that the free liquid surface of the electrode was always in contact with shellac. The shellac was covered by a layer of paraffin, though a moderate coating of shellac alone was such a good insulator that the electrode resistance became independent of the height of liquid on the wrist. In addition to this the hand was put in splints in such a manner that only a small fraction of the

skin was covered, so that no appreciable muscular contraction of the phalanges could take place.

Under these conditions the subject could move his hands about at will through a distance of several centimeters, stirring the electrode liquid violently — the equilibrium reading of the galvanometer remaining absolutely undisturbed. If now a stimulus was given which aroused an emotion or definite affective state of the subject, a marked galvanometric deflection was observed.

A large series of experiments was performed under these conditions.

(To be concluded.)

DISCUSSION.

CONSCIOUSNESS AND MEANING.

In the interest of better understanding I wish to comment on Professor Bode's discussion in the July issue of the *REVIEW*, so far as he refers to my own views on the nature of consciousness.

Professor Bode states the general problem tersely, it seems to me, when he asks, "When an object becomes known, what is present that was not present the moment before?" I have attempted to answer that question in one word — "meaning." This answer may be incorrect or inadequate, but I do not see that it forces the maker into a dilemma. When objects become known, they do not — as I am inclined to think — lose any of the properties or relationships they had before. Water does not become water or cease to be water when I become conscious of it. But when objects become known, they then mean something. The water which was water before I was conscious of it and is still water when I am conscious of it, is now, when I am conscious of it, water meaning something, the quenching of thirst, for example.

Why, then, does Professor Bode state: "Either a fact upon becoming a fact of consciousness transforms itself from an unknowable something into a relation of meaning or it undergoes no such transformation. In the former case the distinction between what is consciousness and what is not is inept, since all is consciousness; while in the latter we have again on our hands the difficulty that no differentia are furnished whereby a given personal experience is distinguished from other facts." Assuredly when an unknown fact becomes known, it has changed from an unknown to a known fact, and to that extent has changed its character. But the question is as Professor Bode has put it, What is present with the known fact which was not present with the unknown fact? Take the water again. When it is unknown — meaning thereby when it is not an object in consciousness — is it lacking in particular chemical and physical properties? Does it take on these properties — or lose them — only in consciousness? If it can have these properties both in consciousness and out of it, there is no necessity of adding anything to them to make them just those properties when they are in consciousness. On the other hand, it seems very difficult to believe that water could mean anything and not be in consciousness; and it seems very natural to believe that if water should

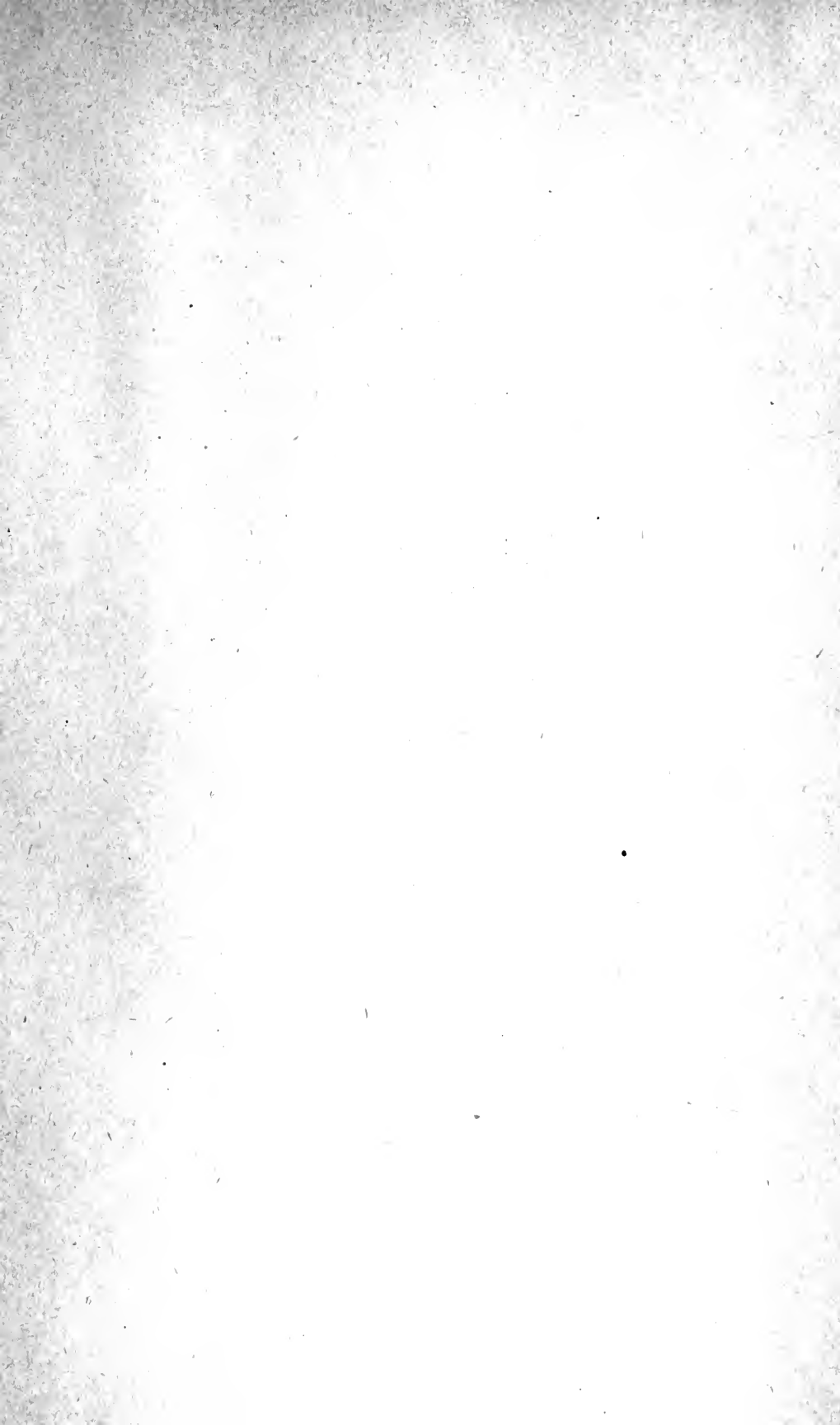
come to mean anything it would, by that fact, have entered consciousness.

And now a word about 'awareness,' for one may claim that not only must a fact mean something to be in consciousness, but we must also be 'aware' of the fact as fact and also of the fact as meaning something. I repeat what I have already said, but now in general terms. If a fact has certain properties which it neither acquires nor loses by virtue of its presence in consciousness, it is evidently unnecessary to add anything to those properties to make them the same properties in consciousness that they are when out of it. Consequently it is not necessary to add 'awareness.' That is, it is not the 'awareness' of a fact that makes the fact a fact of a particular kind in consciousness; it is that in its own right. The simple existence of the fact in consciousness appears, therefore, to be all that is involved in 'awareness of the fact as fact.' But let the fact mean something and its meaning appears to be identical with 'awareness of it as meaning something.' Or, to state the situation in the form of a paradox: If objects were in my consciousness, but entirely devoid of meaning, I should not be aware of them. The presence of meaning among the facts is the awareness of them. In short — to drop the paradox — 'awareness' is but another term for 'consciousness.'

The position which I have thus briefly outlined seems to me to answer Professor Bode's initial question directly and unambiguously. I do not say it answers it correctly or adequately. That is matter for consideration. But I do not see how it can be reduced to the dilemma he states in the discussion of it.

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