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THE RELATIONS OF LOGIC TO ALLIED DISCIPLINES.[1]

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In 1787, in the preface to the second edition of the Kr. d. r. V., Kant wrote the following words: "That Logic, from the earliest times, has followed that secure method" (namely, the secure method of a science as attested by the unanimity of its workers and the stability of its results), "may be seen from the fact that since Aristotle it has not had to retrace a single step, unless we choose to consider as improvements the removal of some unnecessary subtleties, or the clearer definition of its matter, both of which refer to the elegance rather than to the solidity of the science. It is remarkable, also, that to the present day, it has not been able to make one step in advance, so that to all appearances it may be considered as completed and perfect. If some modern philosophers thought to enlarge it, by introducing *psychological* chapters on the different faculties of knowledge (faculty of imagination, wit, etc.), or *metaphysical* chapters on the origin of knowledge or different degrees of certainty according to the difference of objects (idealism, skepticism, etc.), or, lastly, *anthropological* chapters on prejudices, their causes and remedies, this could only arise from their ignorance of the peculiar nature of logical science. We do not enlarge, but we only disfigure the sciences, if we allow their respective limits to be confounded; and the limits of logic are definitely fixed by

[1] Paper read at the Congress of Arts and Science, St. Louis Exposition, 1904.

the fact, that it is a science which has nothing to do but fully to exhibit and strictly to prove the formal rules of all thought (whether it be *a priori* or empirical, whatever be its origin or its object, and whatever be the impediments, accidental or natural, which it has to encounter in the human mind)."— [Translated by Max Müller.]

Scarcely more than half a century after the publication of this statement of Kant's, John Stuart Mill (Introduction to *System of Logic*) wrote: "There is as great diversity among authors in the modes which they have adopted of defining logic, as in their treatment of the details of it. This is what might naturally be expected on any subject on which writers have availed themselves of the same language as a means of delivering different ideas. * * * This diversity is not so much an evil to be complained of, as an inevitable, and in some degree a proper, result of the imperfect state of those sciences" (that is, of logic, jurisprudence, and ethics). "It is not to be expected that there should be agreement about the definition of anything, until there is agreement about the thing itself." This remarkable disparity of opinion is due partly to the changes in the treatment of logic from Kant to Mill, and partly to the fact that both statements are extreme. That the science of logic was 'completed and perfect' in the time of Kant could only with any degree of accuracy be said of the treatment of syllogistic proof or the deductive logic of Aristotle. That the diversity was so great as pictured by Mill is not historically exact, but could be said only of the new epistemological and psychological treatment of logic and not of the traditional formal logic. The confusion in logic is no doubt largely due to disagreement in the delimitation of its proper territory and to the consequent variety of opinions as to its relations to other disciplines. The rise of inductive logic coincident with the rise and growth of physical science and empiricism, forced the consideration of the question as to the relation of formal thought to reality, and the consequent entanglement of logic in a triple alliance of logic, psychology and metaphysics. How logic can maintain friendly relations with both of these and yet avoid endangering its territorial integrity, has not been made clear by logicians or psy-

chologists or metaphysicians, and that, too, in spite of persistent attempts to justly settle the issue as to their respective spheres of influence. Until modern logic definitely settles the question of its aims and legitimate problems, it is difficult to see how any agreement can be reached as to its relation to the other disciplines. The situation as it confronts one in the discussion of the relations of logic to allied subjects may be analyzed as follows:

1. The relation of logic as science to logic as art.
2. The relation of logic to psychology.
3. The relation of logic to metaphysics.

The development of nineteenth century logic has made an answer to the last two of the foregoing problems exceedingly difficult. Indeed, one may say that the evolution of modern epistemology has had a centrifugal influence on logic, and instead of growth towards unity of conception we have a chaos of diverse and discordant theories. The apple of discord has been the theory of knowledge. A score of years ago when Adamson wrote his admirable article in the *Encyclopædia Britannica* (Article 'Logic,' 1882), he found the conditions much the same as I now find them. "Looking to the chaotic state of logical text-books at the present time, one would be inclined to say that there does not exist anywhere a recognized currently received body of speculations to which the title logic can be unambiguously assigned, and that we must therefore resign the hope of attaining by any empirical consideration of the received doctrine a precise determination of the nature and limits of logical theory." I do not, however, take quite so despondent a view of the logical chaos as the late Professor Adamson; rather, I believe with Professor Stratton (PSYCH. REV., Vol. III.) that something is to be gained for unity and consistency by more exact delimitation of the subject-matter of the philosophical disciplines and their interrelations, which precision, if secured, would assist in bringing into clear relief the real problems of the several departments of inquiry, and facilitate the proper classification of the disciplines themselves.

The attempt to delimit the spheres of the disciplines, to state their interrelations and classify them, was made early in the history of philosophy, at the very beginning of the development

of logic as a science by Aristotle. In Plato's philosophy, logic is not separated from epistemology and metaphysics. The key to his metaphysics is given essentially in his theory of the reality of the concept, which offers an interesting analogy to the position of logic in modern idealism. Before Plato there was no formulation of logical theory, and in his dialogues it is only contained in solution. The nearest approach to any formulation is to be found in an applied logic set forth in the precepts and rules of the rhetoricians and sophists. Properly speaking, Aristotle made the first attempt to define the subject of logic and to determine its relations to the other sciences. In a certain sense logic for Aristotle is not a science at all. For science is concerned with some *ens*, some branch of reality, while logic is concerned with the methodology of knowing, with the formal processes of thought whereby an *ens* or a reality is ascertained and appropriated to knowledge. In the sense of a method whereby all scientific knowledge is secured, logic is a propædeutic to the sciences. In the idealism of the Eleatics and Plato, thought and being are ultimately identical, and the laws of thought are the laws of being. In Aristotle's conception, while the processes of thought furnish a knowledge of reality or being, their formal operation constitutes the technique of investigation, and their systematic explanation and description constitute logic. Logic and metaphysics are distinguished as the science of being and the doctrine of the thought-processes whereby being is known. Logic is the doctrine of the organon of science, and when applied *is* the organon of science. The logic of Aristotle is not a purely formal logic. He is not interested in the merely schematic character of the thought-processes, but in their function as mediators of apodictic truth. He begins with the assumption that in the conjunction and disjunction of correctly formed judgments the conjunction or disjunction of reality is mirrored. Aristotle does not here examine into the powers of the mind as a whole; that is done, though fragmentarily, in the *De Anima* and *Parva Naturalia*, where the mental powers are regarded as phases of the processes of nature without reference to normation; but in his logic he inquires only into those forms and laws of thinking which mediate proof.

Scientific proof, in his conception, is furnished in the form of the syllogism, whose component elements are terms and propositions. In the little tract *On Interpretation* (*i. e.*, on the Judgment as *interpreter* of thought), — if it is genuine, — the proposition is considered in its logical bearing.

The treatise on the *Categories*, which discusses the nature of the most general terms, forms a connecting link between logic and metaphysics. The categories are the most general concepts or universal modes under which we have knowledge of the world. They are not simply logical relations; they are existential forms, being not only the modes under which thought regards being, but the modes under which being exists. Aristotle's theory of the methodology of science is intimately connected with his view of knowledge. Scientific knowledge in his opinion refers to the essence of things; for example, to those universal aspects of reality which are given in particulars, but which remain self-identical amidst the variation and passing of particulars. The universal, however, is known only through and after particulars. There is no such thing as innate knowledge or Platonic reminiscence. Knowledge, if not entirely empirical, has its basis in empirical reality. Causes are known only through effects. The universals have no existence apart from things, although they exist *realiter* in things. Empirical knowledge of particulars must, therefore, precede in time the conceptual or scientific knowledge of universals. In the evolution of scientific knowledge in the individual mind, the body of particulars or of sense experience is to its conceptual transformation as potentiality is to actuality, matter to form, the completed end of the former being realized in the latter. Only in the sense of this power to transform and conceptualize, does the mind have knowledge within itself. The genetic content is experiential; the developed concept, judgment, or inference is *in form* noëtic. Knowledge is, therefore, not a mere 'precipitate of experience,' nor is Aristotle a complete empiricist.

The conceptual form of knowledge is not immediately given in things experienced, but is a product of noëtic discrimination and combination. Of a sensible object as such there is no concept; the object of a concept is the generic essence of a thing;

and the concept itself is the thought of this generic essence. The individual is generalized; every concept does or can embrace several individuals. It is an 'aggregate of distinguishing marks,' and is expressed in a definition. The concept as such is neither true nor false. Truth first arises in the form of a judgment or proposition, wherein a subject is coupled with a predicate, and something is said about something. A judgment is true when the thought (whose inward process is the judgment and whose expression in vocal symbols is the proposition) regards as conjoined or divided that which is conjoined or divided in actuality; in other words, when the thought is congruous with the real. While Aristotle does not ignore induction as a scientific method (how could he when he regards the self-subsistent individual as the only real?), yet he says that, as a method, it labors under the defect of being only proximate; a complete induction from *all* particulars is not possible, and therefore cannot furnish demonstration. Only the deductive process proceeding syllogistically from the universal (or essential truth) to the particular is scientifically cogent or apodictic. Consequently Aristotle developed the science of logic mainly as a syllogistic technique or instrument of demonstration. From this brief sketch of Aristotle's logical views it will be seen that the epistemological and metaphysical relations of logic which involve its greatest difficulty and cause the greatest diversity in its modern exponents, were present in undeveloped form to the mind of the first logician. It would require a mighty optimism to suppose that this difficulty and diversity, which has increased rather than diminished in the progress of historical philosophy, should suddenly be made to vanish by some magic of restatement of subject matter, or theoretical delimitation of the discipline. As Fichte said of Philosophy, 'The sort of a philosophy that a man has, depends on the kind of man he is'; so one might almost say of logic, 'The sort of logic that a man has, depends on the kind of philosopher he is.' If the blight of discord is ever removed from epistemology, we may expect agreement as to the relations of logic to metaphysics. Meanwhile logic has the great body of scientific results deposited in the physical sciences on which to build and test, with some as-

surance, its doctrine of methodology; and as philosophy moves forward persistently to the final solution of its problems, logic may justly expect to be a beneficiary in its established theories.

After Aristotle's death logic lapsed into a formalism more and more removed from any vital connection with reality and oblivious to the profound epistemological and methodological questions that Aristotle had at least raised. In the Middle Ages it became a highly developed exercise in inference applied to the traditional dogmas of theology and science as premises, with mainly apologetic or polemical functions. Its chief importance is found in its application to the problem of realism and nominalism, the question as to the nature of universals. At the height of Scholasticism realism gained its victory by syllogistically showing the congruity of its premises with certain fundamental dogmas of the church, especially with the dogma of the unity and reality of the Godhead. The heretical conclusion involved in nominalism is equivalent (the accepted dogma of the church being axiomatic) to *reductio ad absurdum*. A use of logic such as this, tending to conserve rather than to increase the body of knowledge, was bound to meet with attack on the awakening of post-renaissance interest in the physical world, and the acquirement of a body of truth to which the scholastic formal logic had no relation. The anti-scholastic movement in logic was inaugurated by Francis Bacon, who sought in his *Novum Organum* to give science a real content through the application of induction to experience and the discovery of universal truths from particular instances. The syllogism is rejected as a scientific instrument, because it does not lead *to* principles, but proceeds only *from* principles, and is therefore not useful for discovery. It permits at most only refinements on knowledge aleady possessed, but cannot be regarded as creative or productive. The Baconian theory of induction regarded the accumulation of facts and the derivation of general principals and laws from them as the true and fruitful method of science. In England this empirical view of logic has been altogether dominant, and the most illustrious English exponents of logical theory, Herschel, Whewell and Mill, have stood on that ground. Since the introduction of German idealism in the last half century a

new logic has grown up whose chief business is with the theory of knowledge.

Kant's departure in logic is based on an epistemological examination of the nature of judgment, and on the answer to his own question, 'How are synthetic judgments *a priori* possible?' The *a priori* elements in knowledge make knowledge of the real nature of things impossible. Human knowledge extends to the phenomenal world, which is seen under the *a priori* forms of the understanding. Logic for Kant is the science of the formal and necessary laws of thought, apart from any reference to objects. Pure or universal logic aims to understand the forms of thought without regard to metaphysical or psychological relations, and this position of Kant is the historical beginning of the subjective formal logic.

In the metaphysical logic of Hegel, which rests on a panlogistic basis, being and thought, form and content, are identical. Logical necessity is the measure and criterion of objective reality. The body of reality is developed through the dialectic self-movement of the idea. In such an idealistic monism, formal and real logic are by the metaphysical postulate coincident.

Schleiermacher in his dialectic regards logic from the standpoint of epistemological realism, in which the real deliverances of the senses are conceptually transformed by the spontaneous activity of reason. This spirit of realism is similar to that of Aristotle, in which the one-sided *a priori* view of knowledge is controverted. Space and time are forms of the existence of things, and not merely *a priori* forms of knowing. Logic he divides into dialectic and technical logic. The former regards the idea of knowledge as such; the technical regards knowledge in the process of becoming or the idea of knowledge in motion. The forms of this process are induction and deduction. The Hegelian theory of the generation of knowledge out of the processes of pure thought is emphatically rejected.

Lotze, who is undoubtedly one of the most influential and fruitful writers on logic in the last century, attempts to bring logic into closer relations with contemporary science, and is an antagonist of one-sided formal logics. For him logic falls into the three parts of (1) pure logic or the logic of thought; (2)

applied logic or the logic of investigation; (3) the logic of knowledge or methodology; and this classification of the matter and problems of logic has had an important influence on subsequent treatises on the discipline. His logic is formal, as he describes it himself, in the sense of setting forth the modes of the operation of thought and its logical structure; it is real in the sense that these forms are dependent on the nature of things and not something independently given in the mind. While he aims to maintain the distinct separation of logic and metaphysics he says (in the discussion of the relations between formal and real logical meaning) the question of meaning naturally raises a metaphysical problem: 'Ich thue besser der Metaphysik die weitere Erörterung dieses wichtigen Punktes zu überlassen' (*Logic*, 2d ed., p. 571). How could it be otherwise when his whole view of the relations and validity of knowledge is inseparable from his realism or teleological idealism, as he himself characterizes his own standpoint?

Drobisch, a follower of Herbart, is one of the most thoroughgoing formalists in modern logical theory. He attempts to maintain strictly the distinction between thought and knowledge. Logic is the science of thought. He holds that there may be formal truth, for example, logically valid truth, which is materially false. Logic, in other words, is purely formal; material truth is matter for metaphysics or science. Drobisch holds, therefore, that the falsity of the judgment expressed in the premise from which a formally correct syllogism may be deduced, is not subject matter for logic. The sphere of logic is limited to the region of inference and forms of procedure, his view of the nature and function of logic being determined largely by the bias of his mathematical standpoint. The congruity of thought with itself, judgments, conclusions, analyses, etc., is the sole logical truth, as against Trendelenburg, who took the Aristotelian position that logical truth is the 'agreement of thought with the object of thought.'

Sigwart looks at logic mainly from the standpoint of the technology of science, in which, however, he discovers the implications of a teleological metaphysic. Between the processes of consciousness and external changes he finds a causal

relation and not parallelism. Inasmuch as thought sometimes misses its aim, as is shown by the fact that error and dispute exist, there is need of a discipline whose purpose is to show us how to attain and establish truth and avoid error. This is the practical aim of logic, as distinguished from the psychological treatment of thought, where the distinction between true and false has no more place than the distinction between good and bad. Logic presupposes the impulse to discover truth, and it, therefore, sets forth the criteria of true thinking, and endeavors to describe those normative operations whose aim is validity of judgment. Consequently logic falls into the two parts of (1) critical, (2) technical, the former having meaning only in reference to the latter; the main value of logic is to be sought in its function as art. "Methodology, therefore, which is generally made to take a subordinate place, should be regarded as the special, final, and chief aim of our science" (*Logic*, Vol. I., p. 21, Eng. Tr.). As an art, logic undertakes to determine under what conditions and prescriptions judgments are valid, but does not undertake to pass upon the validity of the content of given judgments. Its prescriptions have regard only to formal correctness and not to the material truth of results. Logic is, therefore, a formal discipline. Its business is with the due procedure of thought, and it attempts to show no more than how we may advance in the reasoning process in such way that each step is valid and necessary. If logic were to tell us *what* to think or give us the content of thought, it would be commensurate with the whole of science. Sigwart, however, does not mean by formal thought independence of content, for it is not possible to disregard the particular manner in which the materials and content of thought are delivered through sensation and formed into ideas. Further, logic having for its chief business the methodology of science, the development of knowledge from empirical data, it ought to include a theory of knowledge, but it should not so far depart from its subjective limits as to include within its province the discussion of metaphysical implications or a theory of being. For this reason, Sigwart relegates to a postscript his discussion of teleology, but he gives an elaborate treatment of epistemology extending through Vol. I.

and develops his account of methodology in Vol. II. The question regarding the relation between necessity, the element in which logical thought moves, and freedom, the postulate of the will, carries one beyond the confines of logic and is, in his opinion, the profoundest problem of metaphysics, whose function is to deal with the ultimate relation between 'subject and object, the world and the individual, and this is not only basal for logic and all science, but is the crown and end of them all.'

Wundt's psychological and methodological treatment of logic stands midway between the purely formal treatises on the one hand, and the metaphysical treatises on the other hand. The general standpoint of Wundt is similar to that of Sigwart, in that he discovers the function of logic in the exposition of the formation and methods of scientific knowledge; for example, in epistemology and methodology. Logic must conform to the conditions under which scientific inquiry is actually carried on; the forms of thought, therefore, cannot be separate from or indifferent to the content of knowledge; for it is a fundamental principle of science that its particular methods are determined by the nature of its particular subject-matter. Scientific logic must reject the theory that identifies thought and being (Hegel) and the theory of parallelism between thought and reality (Schleiermacher, Trendelenburg, and Ueberweg), in which the ultimate identity of the two is only concealed. Both of these theories base logic on a metaphysics, which makes it necessary to construe the real in terms of thought, and logic, so divorced from empirical reality, is powerless to explain the methods of scientific procedure. One cannot, however, avoid the acceptance of thought as a competent organ for the interpretation of reality, unless one abandons all question of validity and accepts agnosticism or skepticism. This interpretative power of thought or congruity of thought with reality is translated by metaphysical logic into identity. Metaphysical logic concerns itself fundamentally with the content of knowledge, not with its evidential or formal logical aspects, but with being and the laws of being. It is the business of metaphysics to construct its notions and theories of reality out of the deliverances of the special sciences and inferences derived therefrom. The aim of metaphysics is the

development of a world-view free from internal contradictions, a view that shall unite all particular and plural knowledges into a whole. Logic stands in more intimate relation to the special sciences, for here the relations are reciprocal and immediate; for example, from actual scientific procedure logic abstracts its general laws and results, and these in turn it delivers to the sciences as their formulated methodology. In the history of science the winning of knowledge precedes the formulation of the rules employed, that is, precedes any scientific methodology. Logic, as methodology, is not an *a priori* construction, but has its genesis in the growth of science itself and in the discovery of those tests and criteria of truth which are found to possess an actual heuristic or evidential value. It is not practicable to to separate epistemology and logic, for such concepts as causality, analogy, validity, etc., are fundamental in logical method, and yet they belong to the territory of epistemology, are epistemological in nature, as one may indeed say of all the general laws of thought. A formal logic that is merely propædeutic, a logic that aims to free itself from the quarrels of epistemology, is scientifically useless. Its norms are valueless, in so far as they can only teach the arrangement of knowledge already possessed, and teach nothing as to how to secure it or test its real validity. While formal logic aims to put itself outside of philosophy, metaphysical logic would usurp the place of philosophy. Formal logic is inadequate, because it neither shows how the laws of thought originate, why they are valid, nor in what sense they are applicable to concrete investigation. Wundt, therefore, develops a logic which one may call epistemological — methodological, and which stands between the extremes of formal logic and metaphysical logic. The laws of logic must be derived from the processes of psychic experience and the procedure of the sciences. 'Logic therefore needs,' as he says, 'epistemology for its foundation and the doctrine of methods for its completion.'

Lipps takes the view outright that logic is a branch of psychology; Husserl in his latest book goes to the other extreme of a purely formal and technical logic, and devotes almost his entire first volume to the complete sundering of psychology and logic.

Bradley bases his logic on the theory of the judgment. The logical judgment is entirely different from the psychological. The logical judgment is a qualification of reality by means of an idea. The predicate is an adjective or attribute which in the judgment is ascribed to reality. The aim of truth is to qualify reality by general notions. But inasmuch as reality is individual and self-existent, whereas truth is universal, truth and reality are not coincident. Bradley's metaphysical solution of the disparity between thought and reality is put forward in his theory of the unitary Absolute, whose concrete content is the totality of experience. But as thought is not the whole of experience, judgments cannot compass the whole of reality. Bosanquet objects to this, and maintains that reality must not be regarded as an ideal construction. The real world is the world to which our concepts and judgments refer. In the former we have a world of isolated individuals of definite content; in the latter, we have a world of definitely systematized and organized content. Under the title of the Morphology of Knowledge Bosanquet considers the evolution of judgment and inference in their varied forms. "Logic starts from the individual mind, as that within which we have the actual facts of intelligence, which we are attempting to interpret into a system" (*Logic*, Vol. I., p. 247). The real world for every individual is *his* world. "The work of intellectually constituting that totality which we call the real world is the work of knowledge. The work of analyzing the process of this constitution or determination is the work of logic, which might be described . . . as the reflection of knowledge upon itself" (*Logic*, Vol. I., p. 3). "The relation of logic to truth consists in examining the characteristics by which the various phases of the one intellectual function are fitted for their place in the intellectual totality which constitutes knowledge" (*ibid.*). The real world is the intelligible world; reality is something to which we attain by a constructive process. We have here a type of logic which is essentially a metaphysic. Indeed, Bosanquet says in the course of his first volume: "I entertain no doubt that in content logic is one with metaphysics, and differs, if at all, simply in mode of treatment — in tracing the evolution of knowledge in

the light of its value and import, instead of attempting to summarize its value and import apart from the details of its evolution" (*Logic*, Vol. I., p. 247).

Dewey (*Studies in Logical Theory*, p. 5) describes the essential function of logic as the inquiry into the relations of thought as such to reality as such. Although such an inquiry may involve the investigation of psychological processes and of the concrete methods of science and verification, a description and analysis of the forms of thought, conception, judgment and inference, yet its concern with these is subordinate to its main concern, namely, the relation of 'thought at large to reality at large.' Logic is not reflection on thought, either on its nature as such or on its forms, but on its relations to the real. In Dewey's philosophy, logical theory is a description of thought as a mode of adaptation to its own conditions, and validity is judged in terms of the efficiency of thought in the solution of its own problems and difficulties. The problem of logic is more than epistemological. Wherever there is striving there are obstacles; and wherever there is thinking there is a 'material-in-question.' Dewey's logic is a theory of reflective experience regarded functionally, or a pragmatic view of the discipline. This logic of experience aims to evaluate the significance of social research, psychology, fine and industrial art, and religious aspiration in the form of scientific statement, and to accomplish for social values in general what the physical sciences have done for the physical world. In Dewey's teleological pragmatic logic the judgment is essentially instrumental, the whole of thinking is functional, and the meaning of things is identical with valid meaning. (*Studies in Logical Theory*, cf. pp. 48, 82, 128). The real world is not a self-existent world outside of knowledge, but simply the totality of experience; and experience is a complex of strains, tensions, checks, and attitudes. The function of logic is the redintegration of this experience. "Thinking is adaptation *to* an end *through* the adjustment of particular objective contents" (*ibid.*, p. 81). Logic here becomes a large part, if not the whole, of a metaphysics of experience; its nature and function are entirely determined by the theory of reality.

In this brief and fragmentary *résumé* are exhibited certain characteristic movements in the development of logical theory, the construction put upon its subject-matter and its relation to other disciplines. The *résumé* has had in view only the making of the diversity of opinion on these questions historically salient. There are three distinct types of logic noticed here: (1) formal, whose concern is merely with the structural aspect of inferential thought, and its validity in terms of internal congruity; (2) metaphysical logic whose concern is with the functional aspect of thought, its validity in terms of objective reference and its relation to reality; (3) epistemological and methodological logic, whose concern is with the genesis, nature and laws of logical thinking as forms of scientific knowledge, and with their technological application to the sciences as methodology. I am not at present concerned with a criticism of these various viewpoints, excepting, in so far as they affect the problem of the interrelationship of logic and the allied disciplines.

For my present purpose I reject the extreme metaphysical and the extreme formal positions, and assume that logic is a discipline whose business is to describe and systematize the formal processes of inferential thought *and* to apply them as practical principles to the body of real knowledge.

I wish now to take up *seriatim* the several questions touching the various relations of logic enumerated above, and first of all the question of the relation of logic as science to logic as art.

I. *Logic as science and logic as art.*

It seems true that the founder of logic, Aristotle, regarded logic not as a science, but rather as propædeutic to science, and not as an end in itself, but rather technically and heuristically as an instrument. In other words, logic was conceived by him rather in its application or as an art, than as a science, and so it continued to be regarded until the close of the Middle Ages, being characterized indeed as the *ars artium;* for even the *logica docens* of the Scholastics was merely the formulation of that body of precepts which are of practical service in the syllogistic arrangement of premises, and the Port Royal Logic aims to furnish *l'art de penser.* This technical aspect of the

science has clung to it down to the present day, and is no doubt a legitimate description of a part of its function. But no one would now say that logic *is* an art; rather it is a body of theory which may be technically applied. Mill, in his examination of Sir William Hamilton's Philosophy (p. 391), says of logic that it 'is the art of thinking, which means of correct thinking, and the science of the conditions of correct thinking,' and indeed, he goes so far as to say (*Syst. of Log.*, Introd., Sect. 7): 'The extension of logic as a science is determined by its necessities as an art.' Strictly speaking, logic as a science is purely theoretical, for the function of science as such is merely to know. It is an organized system of knowledge, namely, an organized system of the principles and conditions of correct thinking. But because correct thinking is an art, it does not follow that a knowledge of the methods and conditions of correct thinking is art, which would be a glaring case of *μετάβασις εἰς ἄλλο γένος*. The art-bearings of the science are given in the normative character of its subject-matter. As a science logic is descriptive and explanatory, that is, it describes and formulates the norms of valid thought, although as science it is not normative, save in the sense that the principles formulated in it may be normatively or regulatively applied, in which case they become precepts. What is principle in science becomes precept in application, and it is only when technically applied that principles assume a mandatory character. Validity is not created by logic. Logic merely investigates and states the conditions and criteria of validity, being in this reference a science of evidence. In the very fact, however, that logic is normative in the sense of describing and explaining the norms of correct thinking, its practical or applied character is given. Its principles as known are science; its principles as applied are art. There is, therefore, no reason to sunder these two things or to call logic an art merely or a science merely; for it is both when regarded from different viewpoints, although one must insist on the fact that the rules for practical guidance are, so far as the science is concerned, quite *ab extra*. Logic, ethics, and æsthetics are all commonly (and rightly) called normative disciplines: they are all concerned with values and standards; logic

with validity and evidence, or values for cognition; ethics with motives and moral quality in conduct, or values for volition; æsthetics with the standards of beauty, or values for appreciation and feeling. Yet none of them is or can be merely normative, or indeed as science normative at all; if that were so, they would not be bodies of organized knowledge, but bodies of rules. They might be well-arranged codes of legislation on conduct, fine art, and evidence, but not sciences. Strictly regarded, it is the descriptive and explanatory aspect of logic that constitutes its *scientific* character, while it is the specific normative aspect that constitutes its *logical* character. Values, whether ethical or logical, without an examination and formulation of their ground, relations, origin, and interconnection, would be merely rules of thumb, popular phrases, or pastoral precepts. The actual methodology of the sciences or applied logic is logic as art.

II. *Relation of logic to psychology.*

The differentiation of logic and psychology in such way as to be of practical value in the discussion of the disciplines has always been a difficult matter. John Stuart Mill was disposed to merge logic in psychology, and Hobhouse, his latest notable apologete, draws no fixed distinction between psychology and logic, merely saying that they have different centers of interest, and that their provinces overlap. Lipps, in his *Grundzüge der Logik* (p. 2), goes the length of saying that "Logic is a psychological discipline, as certainly as knowledge occurs only in the Psyche, and thought, which is developed in knowledge, is a psychical event." Now, if we were to take such extreme ground as this, then ethics, æsthetics, and pure mathematics would become at once branches of psychology and not coördinate disciplines with it, for volitions, the feelings of appreciation, and the reasoning of pure mathematics are psychical events. Such a theory plainly carries us too far and would involve us in confusion. That the demarcation between the two disciplines is not a chasmic cleavage, but a line, and that, too, an historically shifting line, is apparent from the foregoing historical *résumé*.

The four main phases of logical theory include: (1) the

concept (although some logicians begin with the judgment as temporally prior in the evolution of language), (2) judgment, (3) inference, (4) the methodology of the sciences.

The entire concern of logic is, indeed, with psychical processes, but with psychical processes regarded from a specific standpoint, a standpoint different from that of psychology. In the first place psychology in a certain sense is much wider than logic, being concerned with the whole of psychosis as such, including the feelings and will and the entire structure of cognition, whereas logic is concerned with the particular cognitive processes enumerated above (concept, judgment, inference), and that, too, merely from the point of view of validity and the grounds of validity. In another sense psychology is narrower than logic, being concerned purely with the description and explanation of a particular field of phenomena, whereas logic is concerned with the procedure of all the sciences and is practically related to them as their formulated method. The compass and aims of the two disciplines are different; for while psychology is in different references both wider and narrower than logic, it is also different in the problems it sets itself, its aim being to describe and explain the phenomena of mind in the spirit of empirical science, whereas the aim of logic is only to explain and establish the laws of evidence and standards of validity. Logic is, therefore, selective and particular in the treatment of mental phenomena, whereas psychology is universal, that is, it covers the entire range of mental processes as a phenomenalistic science; logic dealing with definite elements as a normative science. By this it is not meant that the territory of judgment and inference should be delivered from the psychologist into the care of the logician; through such a division of labor both disciplines would suffer. The two disciplines handle to some extent the same subjects, so far as names are concerned; but the essence of the logical problem is not touched by psychology, and should not be mixed up with it, to the confusion and detriment of both disciplines. The field of psychology, as we have said, is the whole of psychical phenomena; the aim of individual psychology in the investigation of its field is: (1) to give a genetic account of cognition, feel-

ing, and will, or whatever be the elements into which consciousness is analyzed; (2) to explain their interconnections causally; (3) as a chemistry of mental life to analyze its complexes into their simplest elements; (4) to explain the totality structurally (or functionally) out of the elements; (5) to carry on its investigation and set forth its results as a purely empirical science; (6) psychology makes no attempt to evaluate the processes of mind either in terms of false and true, or good and bad. From this description of the field and function of psychology, based on the expressions of its modern exponents, it will be found impossible to shelter logic under it as a subordinate discipline. If one were to enlarge the scope of psychology to mean Rational Psychology, in the sense which Professor Howison advocates (PSYCH. REV., Vol. III., p. 652), such a subordination might be possible, but it would entail the loss of all that the new psychology has gained by the sharper delimitation of its sphere and problems, and would carry us back to the position of Mill, who appears to identify psychology with philosophy at large and with metaphysics.

In contradistinction to the aims of psychology as described in the foregoing, the sphere and problems of logic may be summarily characterized as follows: (1) All concepts and judgments are psychological complexes and processes and may be genetically and structurally described; that is the business of psychology. They also have a meaning value, or objective reference, that is, they may be correct or incorrect, congruous or incongruous with reality. The meaning aspect of thought, or its content as truth is the business of logic. This subject-matter is got by regarding a single aspect in the total psychological complex. (2) Its aim is not to describe factual thought or the whole of thought, or the natural processes of thought, but only certain ideals of thinking, namely, the norms of correct thinking. Its object is not a datum, but an ideal. (3) While psychology is concerned with the natural history of reasoning, logic is concerned with the warrants of inferential reasoning. In the terminology of Hamilton it is the nomology of discursive thought. To use an often employed analogy, psychology is the physics of thought; logic an ethics of thought. (4) Logic

implies an epistemology or theory of cognition in so far as epistemology discusses the concept and judgment and their relations to the real world, and here is to be found its closest connection with psychology. A purely formal logic, which is concerned merely with the internal order of knowledge and does not undertake to show how the laws of thought originate, why they hold good as the measures of evidence, or in what way they are applicable to concrete reality, would be as barren as scholasticism. (5) While logic thus goes back to epistemology for its bases and for the theoretical determination of the interrelation of knowledge and truth, it goes forward in its application to the practical service of the sciences as their methodology. A part of its subject-matter is therefore the actual procedure of the sciences, which it attempts to organize into systematic statements as principles and formulæ. This body of rules given implicitly or explicitly in the workings and structure of the special sciences, consisting in classification, analysis, experiment, induction, deduction, nomenclature, etc., logic regards as a concrete deposit of inferential experience. It abstracts these principles from the content and method of the sciences, describes and explains them, erects them into a systematic methodology, and so creates the practical branch of real logic. Formal logic, therefore, according to the foregoing account, would embrace the questions of the internal congruity and self-consistency of thought and the schematic arrangement of judgments to insure formally valid conclusions; real logic would embrace the epistemological questions of how knowledge is related to reality, and how it is built up out of experience, on the one hand, and the methodical procedure of science on the other. The importance of mathematical logic seems to be mainly in the facilitation of logical expression through symbols. It is rather with the machinery of the science than with its content and real problem that the logical algorithm or calculus is concerned. In these condensed paragraphs sufficient has been said, I think, to show that logic and psychology should be regarded as coördinate disciplines; for their aims and subject-matter differ too widely to subordinate the former under the latter without confusion to both.

I wish now to add a brief note on the relation of logic to another discipline.

III. *Relation of logic to metaphysics.*

As currently expounded, logic either abuts immediately on the territory of metaphysics at certain points or is entirely absorbed in it as an integral part of the metaphysical subject-matter. I regard the former view as not only the more tenable theoretically, but as practically advantageous for working purposes, and necessary for an intelligible classification of the philosophical disciplines. The business of metaphysics, as I understand it, is with the nature of reality; logic is concerned with the nature of validity, or with the relations of the elements of thought within themselves (self-consistency) and with the relations of thought to its object (real truth), but not with the nature of the objective world or reality as such. Further, metaphysics is concerned with the unification of the totality of knowledge in the form of a scientific cosmology; logic is concerned merely with the inferential and methodological processes whereby this result is reached. The former is a science of content; the latter is a science of procedure and relations. Now, inasmuch as procedure and relations apply to some reality and differ with different forms of reality, logic necessitates in its implications a theory of being, but such implications are in nowise to be identified with its subject matter or with its own proper problems. Their consideration falls within the sphere of metaphysics or a broadly conceived epistemology, whose business it is to solve the ultimate questions of subject and object, thought and thing, mind and matter, that are implied and pointed to rather than formulated by logic. Inasmuch as the logical judgment says something about something, the scientific impulse drives us to investigate what the latter something ultimately is; but this is not necessary for logic, nor is it one of logic's legitimate problems, any more than it is the proper business of the physicist to investigate the mental implications of his scientific judgments and hypotheses or the ultimate nature of the theorizing and perceiving mind, or the problem of causality in relation to his world of matter and motion, although a general scientific interest may drive him to seek a solution of

these ultimate metaphysical questions. Scientifically the end of logic and of every discipline is in itself; it is a territorial unity, and its government is administered with a unitary aim. Logic is purely a science of evidential values, not a science of content (in the meaning of particular reality, as in the special sciences, or of ultimate reality, as in metaphysics); its sole aim and purpose, as I conceive it, is to formulate the laws and grounds of evidence, the principles of method, and the conditions and forms of inferential thinking. When it has done this, it has, as a single science, done its whole work. When one looks at the present tendencies of logical theory, one is inclined to believe that the discipline is in danger of becoming an '*Allerleiwissenschaft*,' whose vast undefined territory is the land of '*Weissnichtwo*.' The strict delimitation of the field and problems of science is demanded in the interest of a serviceable division of scientific labor and in the interest of an intelligible classification of the accumulated products of research.

SOME EFFECTS OF INCENTIVES ON WORK AND FATIGUE.

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These experiments, consisting of three series, were conducted for the purpose of comparing quantitatively the amounts of work that were accomplished by the subject working under two different mental attitudes; one, that of mere doing because the subject was told to work as hard as he could and as long as he could with no idea of securing any specified result; the other, that of doing a prescribed task as long as strength endured; or, in other words, the one consisted in working to get tired, while the other consisted in procuring in connection with each exertion an actual result that could be seen and appreciated. With the first task all incentive, as, the watching of the instrument or the keeping track of his progress by counting strokes, was denied the subject; whereas under the second condition the subject was not only permitted to watch his strokes but was also stimulated to action part of the time by his being requested to count his strokes.

Apparatus.

The apparatus used was Cattell's spring ergograph, the index of which marked the record of movements upon smoked paper on the revolving drum of an ordinary kymograph, a stationary support for the lower arm of the subject, and a metronome regulated to strike twice a second.

Experiments.

The subject worked with his left hand. The fingers of the hand were placed under the base of the ergograph, and the carriage of the instrument was moved downward by the thumb once each second. The movements were timed by the beats of the metronome. One experiment consisted of the amount of

work done during the time the subject was able to move his thumb continuously.

Sharp pains, or cramps, in the muscles, muscular fatigue for the instant, always brought the subject's movements to a standstill, and this was invariably taken to be the end of an experiment, although by trial it was found that a rest of one or two seconds at such a time would so relieve the subject that he could resume work with considerable vigor for another period.

First Series.

The first series of experiments included two classes. The nature of the first class, the no incentive class, constant throughout all the series, has already been fully described in the general description of the purpose of the experiments. To furnish a definite motive for the second class, blocks varying in thickness were inserted under the carriage of the ergograph. The subject was required to push merely to the block and to exert himself to see how many times he could reach it. After failing to touch the block he still pressed as closely to it as he could until strength failed.

This series was conducted between the hours of two (2) and four (4) p. m. on Tuesdays and Thursdays, and were continued during the first half of the college year of 1903–4. Three experiments per day were the rule with each subject excepting the experimenter, who for a few days worked double. On the average a rest of four minutes was taken between two experiments, and but one class of experiments was given in a day. A part of the time one class began the week's work and then the other was given first, so that the two classes might profit equally provided there was any advantage to be derived from the longer rest from Thursday to the following Tuesday.

No clamps were used to hold the lower arm. The experimenter grasped the wrist of the subject to keep it steady and thus to help the subject to confine his movements to his thumb alone. Much introductory practice was given to enable the subject to resist the inclination to use his whole arm each time the thumb and wrist muscles began to grow painful through the continued use.

Subjects. — Four persons, all experienced as laboratory reagents, acted as subjects, Miss Killen (K.), Mr. Shepard (S.), Dr. Pillsbury (P.), and the experimenter (W.).

Results. — In computing results the length of each stroke of the index of the ergograph as it was recorded on the sheet of the kymograph was measured in millimeters. These lengths were then read in kilograms in accordance with the scale of the spring marked on the ergograph. The length in millimeters of each stroke times one half its reading in kilograms–since the spring started from zero in each movement — represents the work of each stroke in kilo-millimeters, the unit of value for all the experiments, and the sum of the stroke values gives the total work of each experiment.

TABLE I.

CLASSES, 1 = NO INCENTIVE; 2 = INCENTIVE. UNIT = KILO-MILLIMETER.

Subject.	Class.	Experiments.	Total Work.	Average.	Mean Variation.	Gain per cent.
K.	1	24	23554	981.4	308.4	4.8
	2	26	26743	1028.5	341.8	
S.	1	11	39431	3584.6	729.1	42
	2	13	66187	5091.3	1076.6	
W.	1	32	120341	3760.6	916.8	15.6
	2	37	160890	4348.3	991.1	
P.	1	6	24535	4085.1	993.8	2.2
	2	5	20878	4175.6	309.6	

A comparison of the results given in the table above shows for all the subjects a gain in the work performed under the conditions of the second class, the interpretation of which we would state thus: the difference in the mental attitudes of the subject under the different conditions imposed upon him in the performance of his tasks affected in no uncertain manner the results accomplished by him; or, as a more general deduction, in seeking the greatest results in the amounts of work to be secured by bodily exertion, the mental attitude of the subject towards his work should be taken into consideration.

During the spring of 1903, Mr. Sherman, a student in the Michigan laboratory, made use of the ergograph in testing fatigue, and as his results have never been published and can

be turned to account in connection with my problem, I take the liberty of including his final averages within my report. The subjects were Mr. Sherman (Sh.) and Mr. Hayden (H.)

The problem on which he set out was to prove the influence of the back-stroke from the sensory endings in muscle and tendons of the moving member during motion upon the amount of work that could be accomplished. It was assumed that the motor output in attempted contraction when no motion resulted would be less than when there was actual movement. It was further assumed that the amount of the reduction in work performed could be measured by partially fatiguing a muscle in each of these methods during the same number of contractions, and then using the amount of work required to induce complete fatigue as an indication of the work previously performed.

However in the earlier series of experiments approximately the same amount of work that could be recorded was performed under each condition, first working freely and then working down to a block that checked the movement in its course, and then the amount of work required to complete the fatigue was measured. This was sufficient to show the inapplicability of the method first suggested for it was found that the block acted as an incentive, so that more work was recorded in the first forty or sixty contractions where that was used. For S. 9.62×10^8 as compared with 9.11×10^8 and for H. 9.38×10^8 and 9.31×10^8. Still more anomalously it was discovered that after doing more work with the incentive than without there was less fatigue in the former as was shown by the fact that in the remaining forty strokes work amounting to only 3.66×10^8 could be performed where there had been no incentive while after work with incentive 4.81×10^8 ergs were required to complete the fatigue for S. and for H. the values were 3.72×10^8 and 4.27×10^8 respectively.

Table II. shows the complete records for work with and without incentive:

Mr. Sherman's results thus, while ostensibly obtained for another purpose, substantiate my conclusions recorded above. Each of his subjects, working under a definite mental stimulus as opposed to work of the 'no incentive' class, experiences less fatigue and accomplishes more work.

TABLE II.

CLASSES, 1 = NO INCENTIVE; 2 = INCENTIVE. AMOUNTS IN ERGS.

Subject.	Class.	Experiments.	Average.
Sh.	1	9	12.77×10^8
	2	8	14.435×10^8
H.	1	9	13.07×10^8
	2	9	13.65×10^8

SECOND SERIES.

The second series with the same original purpose in view was conducted during the last half of the same year. The experiments were of three types of requirements: The first class, 'no incentive,' corresponded in all details with the first class of the first series; the second class consisted of 30 strokes, each 18 mm. in length, to touch the block, and then 'no incentive' type for the rest of the experiment; the third class made use of the same block throughout the entire experiment, but the subject was required to press to the block and to continue to press *hard* as long as time would permit and still enable him to keep his strokes in unison of movement with the signals of the metronome moving as above. When the subject could no longer reach the block he continued with the longest possible strokes to the end of his strength.

During all the experiments of this series the lower arm of the subject was not only supported in a stationary rest but was also firmly clamped at the wrist and just below the elbow. It was found that the clamping of the arm in one rigid position made a more uniform condition in the use of the same muscles with each experiment than was possible in the first series, and at the same time the subject was freed from the constant watchfulness necessary to inhibit the use of the whole arm when only a part was wanted.

The subjects were S. and W., and the apparatus was the same as in the first series, excepting the arm support, which in this series had clamping devices. The experiments were conducted at 9 o'clock, A. M., on Tuesdays and Thursdays. Three experiments of the same class constituted a day's work for each subject, and a rest of ten minutes was given between experiments.

The amounts of work were computed as above and are expressed in the kilo-millimeter unit. No results were worked up until the series had been completed. Even the results of the first series were still unknown to the subjects.

TABLE III.

Subject.	Class.	Experiments.	Total Work.	Average.	Mean Variation.
S.	1	17	103119	6065	1096
	2	17	85108	5006	784
	3	18	51907	2883	294
W.	1	16	100813	6300	2004
	2	18	109500	6083	1636
	3	18	71643	3980	1283

A simple comparison of the average amounts of work done under each class of experiments in this series will signify nothing, as there are influencing factors entering that are not measured quantitatively, *e. g.*, the amount of work done in the continued push of the third class, and also the mental effect produced by the pace set in the beginning of each effort of the second class by the thirty strokes of a different length. The only comparison that can be made quantitatively is one between the first class and the third class, and this comparison must be based upon the assumption that each stroke of the third class together with its 'continued push' equals the amount of work done in a corresponding stroke of the first class. Thus by ascertaining the number of strokes 18 mm. and more in length in each class and the amounts of work in addition to these we are able to make a comparison. Table IV. gives the results.

TABLE IV.

Subject.	Class.	Experiments.	Strokes.	Additional Work.	Average Strokes.	Average Additional Work.
S.	1	17	1098	9039	64.58	531.7
	3	18	1194	3570	66.33	198.33
W.	1	16	1073	4861	67.06	303.81
	3	18	1713	2270	95.16	126.11

Putting these average results on the same basis by reducing the increase of strokes of the third class over those of the first class to additional work, we may state for both subjects the dif-

ferences in attainments in the two classes of experiments in terms of additional work alone. For S. these amounts are, 1st class 531.7, 3d class 269.2; for W., 1st class, 303.81, 3d class 1,264.16. S. thus performed on the average for each experiment 262.5 k.-mm. more work in the 'no incentive' class than he did in the third class, just the opposite result from that of his first series of experiments. W.'s results, an average of 960.35 k.-mm., his increase in the third class, agree with his first records.

Some attention was given to introspections and these should enter into our further consideration of the results of this series.

S.: "I may as well stop. I'm not doing anything." In reality, he was still working.

"Pain ensues, then usually there is the feeling that I can't go any farther, can't accomplish anything even if I should try." "Couldn't reach it [block] any longer. When I couldn't hit it, I wanted to quit, no ambition to continue." "I prefer blocks because a definite record can be made. In the other experiment ['no incentive'] I'm doing nothing in particular."

W.'s introspections agree closely with those of S. W. "prefers blocks. There is more of a feeling of satisfaction in doing the work. It seems to amount to something."

The quantitative results of both S. and W. in the first series of experiments, and for W. in this comparison of the first and the third class of the second series, agree with the mental attitude of 'satisfaction,' and 'preference,' shown by the introspections. S.'s results in the second series alone disagree, yet this disagreement emphasizes the influence of a mental factor stronger than those just noted. A glance at Table IV. will show that S. after leaving the strokes of 18 mm. in length, the block in the third class, performed much more additional work in the first class than he did in the third class. (This is also true for W. and but for the fact that he had more extra strokes in the third class than S. had, W.'s results would have felt more strongly this influence.) Such a discrepancy in S.'s closing strokes plainly shows that because S., as he states in his introspections, 'couldn't reach the block any longer,' he fatigued sooner than he otherwise would.

The average results of the experiments of the first and the second class will not admit of mere quantitative comparison, yet in the light of the introspections given some interesting deductions we think can be gleaned from an attempt to make such a comparison. From a physical standpoint there is no reason why the work of the second class should not at least equal that of the first class, and in accordance with the results of the first series of experiments there is a mental factor entering in favor of making the second class exceed in amount the first class. But in reality there is for S. a loss of 1059 k.-mm. and for W. 217 k.-mm. with each experiment of the second class. The sudden dropping from doing a definite task to 'doing nothing in particular' caused both subjects to weaken in their total efforts. Through the continued use of a stimulus not sufficient to call forth their strongest efforts the subjects accepted the same as a standard, and when they were deprived of this standard objectively, its subjective influence still persisted to such an extent that the total accomplishments of the subjects were materially lessened.

Third Series.

The third series was carried on during the first semester of the year of 1904–5 and is the outcome of questionings about the value of the deductions of the second series, particularly those connected with S.'s results.

The same apparatus as in the second series was used, and three groups of experiments were performed. Within each group there were two classes, first, 'no incentive' and second with incentive. That the benefits arising from practice may be evenly distributed in our comparison of results the classes of each group were kept distinct from the other groups. The incentive in each group was furnished by a line drawn on the recording smoked sheet, 17 mm. from the top of the stroke for the first group, 24 mm. from the top for the second group, and completely beyond the reach of the subject for the third group. In working with incentive (2) the subject was instructed to watch his work, count his strokes, put forth his utmost effort with each stroke, and, when his work in the case of the first and second groups receded to the line he was to endeavor to reach the line

as often as possible. Instructions for the first class were the same as in the beginning of the first series. The number of experiments each day was regulated about the same as in the preceding series, and the times of day once fixed for each subject were kept as near constant as possible. Classes of experiments were also alternated to equally distribute advantages of rest. Between each two experiments a rest of five minutes was given.

The subjects were Dr. Pillsbury (P.), Mr. Shepard (S.), Mr. Bayley (B.), Mr. McSherry (Mc.), and Mr. Schottstaedt (Sc.) P. and S. were acquainted with the results of the first and the second series, but the other subjects were to the end of the experiments ignorant of their real purpose. All results were kept from the subjects, and computations are given in the kilo-millimeter unit.

TABLE V.

FIRST GROUP OF THIRD SERIES.

Subject.	Class.	Experiments.	Total Work.	Average.	Mean Variation.	Gain per cent.
P.	1	9	31695	3521.6	455.4	
	2	9	53307	5923	1451.1	68 +
S.	1	9	62817	6979.6	832.6	
	2	9	76695	8521.6	1136.2	22 +
B.	1	9	50036	5559.5	799.2	
	2	9	57261	6362.3	887.4	14 +
Mc.	1	9	32076	3564	895.1	
	2	9	46850	5205.5	1468.3	46 +
Sc.	1	8	50139	6267.3	1563.1	
	2	8	67961	8495.1	3849.6	35 +

TABLE VI.

SECOND GROUP OF THIRD SERIES.

Subject.	Class.	Experiments.	Total Work.	Average.	Mean Variation.	Gain per cent.
P.	1	9	38857	4317.4	612.2	
	2	9	60014	6668.2	655.1	54 +
S.	1	9	62373	6930.3	799.1	
	2	9	65410	7267.7	494.4	4.8 +
B.	1	9	65271	7252.2	949.2	
	2	9	76878	8542	905.7	17 +

TABLE VII.

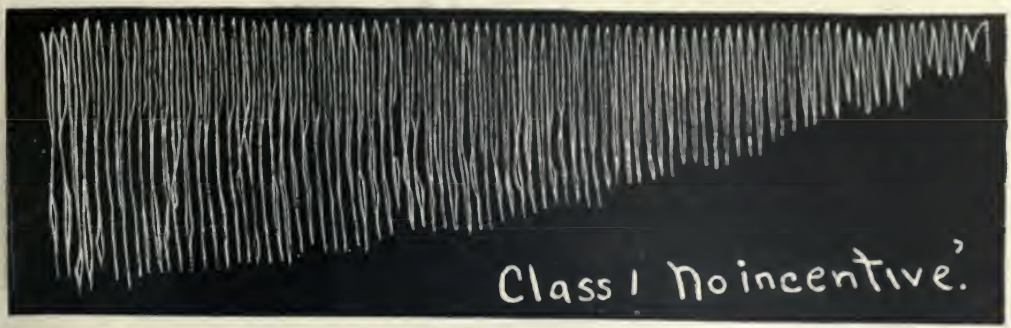
THIRD GROUP OF THIRD SERIES.

Subject.	Class.	Experiments.	Total Work.	Average.	Mean Variation.	Gain per cent.
P.	1	13	79838	6141.3	1463	
	2	13	104359	8027.6	1674.1	30 +
S.	1	16	151529	9470.5	1066.4	
	2	16	154327	9645.4	1087	1.8 +
B.	1	10	69238	6923.8	659	
	2	10	77359	7735.9	725.1	11 +
Mc.	1	6	36710	6118.3	790	
	2	6	34346	5724.3	770.6	6 —

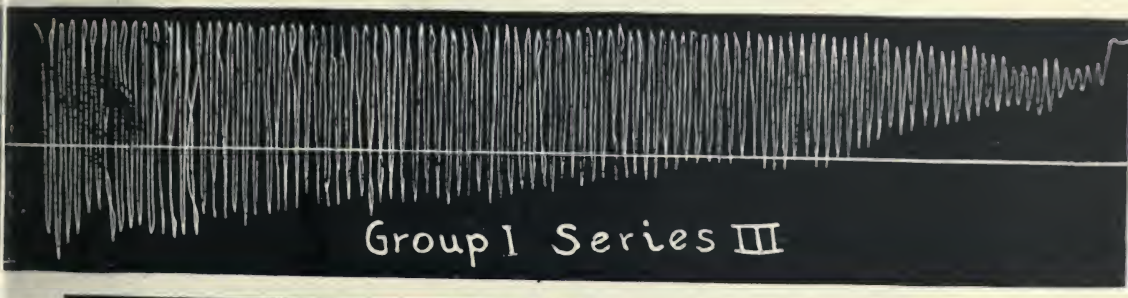
The first group of this third series corresponds in the conditions of requirement to the first series of experiments, and the results in Table V., show conclusions agreeing with the first series, the gain on the side influenced by the added stimulus in the change of mental attitude toward the work ranging from 14 per cent. on the part of B. to 68 per cent. for P.

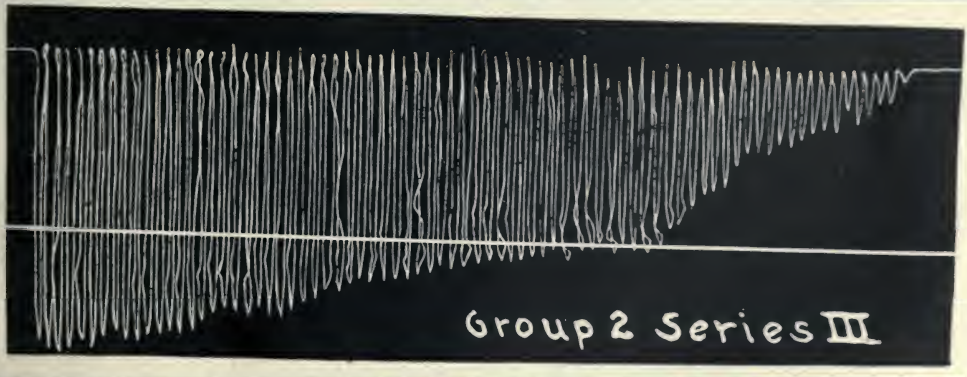
The second and the third group may also be viewed from the same standpoint and, with the exception of Mc. in the third group, all subjects show gains on the side of the added mental stimulus, and thus assist in strengthening our first conclusion, which it must be remembered has been an underlying assumption in our deductions of the second series. But, as to the real purport of the third series, *i. e.*, how far are we justified in our assumptions concerning the influences that caused S. in the third class, the push to the block and a continued push, and both S. and W. in the second class, 30 strokes with block and then 'no incentive' to the end, of the second series of experiments to depart from the result expected in the light of the first series?

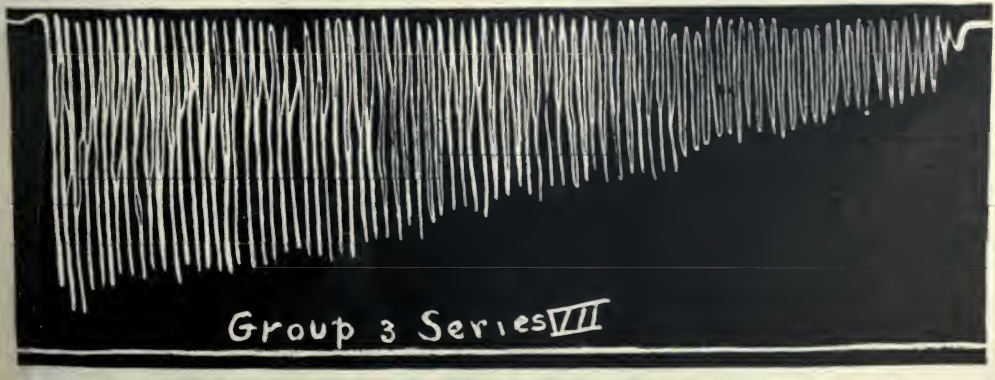
It will be noted that the differences of conditions existing among the three groups of the third series of experiments are not of quality but of degree. The stimulus of the second classes sets a task more difficult of attainment as the groups progress from the first to the third, so that in the third group it is impossible for the subject to fully accomplish what he is told to do. Each subject realized that in this class he never touched the line yet each time at the beginning of the experiment he put forth


Class 1 No incentive.


Class 2 Series 2


Group 1 Series III


Group 2 Series III


Group 3 Series VII

an effort with the determined purpose to reach the line. This factor the experimenter found upon inquiry remained present in consciousness throughout the third group, although it was desired to have the subject's mental attitude entirely dominated by the knowledge that his task was an impossibility in the one particular, and also to have his experiment performed under this condition alone. It must not be lost sight of that the presence of this other factor will cause an increase in the gains of the third group on the side of the extra mental stimulus, and that, if a decrease in amounts of gain from the first group to the third group can be shown in spite of this influence for an increase in the third group, of so much more worth are the conclusions to be drawn.

S. has a gain of 22 per cent. on the side of added mental stimulus in the first group. In the second group this gain falls to 4.8 per cent. and in the third group it is further reduced to 1.8 per cent. Here is shown a decrease of 78 per cent. between the first and the second group and a decrease of 62 per cent. from the second to the third group, or a drop of 91 per cent. from the first to the third group. (See Tables V., VI. and VII.)

This series of experiments so far as objective conditions are concerned admit of quantitative comparison and the factor of mental stimulus remains constant throughout, but S.'s results plainly show, what we in a measure assumed in the second series, that, on account of the added mental stimulus containing the element of impossibility, S. failed to secure as great results as when no such factor existed. In other words, S.'s 'couldn't reach it any longer, I wanted to quit, no ambition to continue,' his disturbing factor in the second series, becomes a fact and is shown to exert a positive influence toward decreasing his efficiency. Were S. alone in displaying this tendency, it might be argued that he may have been influenced in this last series by a foreknowledge of the results of the previous experiments, but a decrease in the same direction is shown by all the subjects. With Mc. it is so positive in its nature that he loses all the influence of the special stimulus in the third group and actually performs six per cent. more work on the other, the 'no incentive,' side.

Ten experiments, independent of the above series and conducted with Mc. alone, show so clearly the immediate effect of mental stimulus that I insert them here as a matter of mere added interest. A line 17 mm. from the top of the stroke of the ergograph was drawn on the carbon sheet. Five of the experiments were of the 'no incentive' class throughout, the remaining five were of the 'no incentive' class until the experimenter was positive that Mc., if left to his own course in his movements, would not have reached the line again. Then Mc. was told to look at his work, to press to the line and to hold to it in succeeding movements as long as possible. The changed mental stimulus affected thus only a small part of each of the five experiments. A comparison of these five with the five of the 'no incentive' class showed a gain 17 + per cent. in favor of the first, but a comparison of just the amount of work done under the influence of the suggestions or directions made to the subject by the experimenter with the corresponding portion of work of the other five experiments, that is, the work done in the 'no incentive[1] class after the subject's stroke had left the line, showed a gain of 339 per cent., the measure of the influence of the new mental stimulus.

Summary.

We may say that at least three conclusions may be drawn from the results of these experiments.

1. The subject accomplished more work when working under the mental stimulus of having a set task to be performed than he did when working without a definite aim.

2. A known impossibility to accomplish the required conditions tends to decrease the subject's total results.

3. The fatigue accompanying work is not so great when the subject is working under the direct stimulus of a definite aim notwithstanding the fact that he has at the same time produced an increase in his amount of work.[1]

[1] The MS. of this article was received May 4, 1905.—Ed.

DISCUSSION.

THE PROBLEM OF THE SUBCONSCIOUS.

To anyone acquainted with recent psychological literature, an attempt at a critical definition or reconstruction of such terms as mental, conscious, and psychical, taken in a purely empirical and scientific sense, will not seem inopportune. There is no well-defined theory as to the precise limits of their meaning. Data, however, are available which offer a basis for at least a tentative mode of conception somewhat less open to objection than many that now pass current. Such apparent normal phenomena as dreams, mental lapses, absent-mindedness, the supposedly subliminal sensations, action upon suggestion, the sense of familiarity and the familiar experiences of trying to remember, the so-called subconscious phenomena of hypnotism, post-hypnotic suggestion, and double personality should certainly furnish material for some intelligible hypothesis as to the nature of consciousness and its relation to, or its distinction from, purely automatic processes.

In the inquiry here proposed, we have no interest in any philosophical or quasi-philosophical question. We wish simply to offer such a conception of the nature of consciousness, the term of ordinary psychological parlance, as will render intelligible such happenings as are mentioned above. All that we shall have to say will have no bearing upon the question of consciousness as an ultimate entity. In fact, we are quite prepared to agree with Professor James that in this sense it does not exist.

In its briefest form of statement, the problem is that of stating the relation between the conscious and the so-called subconscious, or unconscious, of seeking a conception which will organize the well-known facts of their manifestation. It is recognized at the outset that the best statement which can be offered can be no more than a working hypothesis, the validity of which can be established neither by an examination of the

brain itself nor by introspection. That neurology cannot furnish direct evidence goes without saying, and introspective evidence is impossible because, by definition, one of the elements to be considered is beyond the pale of introspection. If it could be so examined, the problem would cease to be. But even if direct verification is impossible, a working hypothesis is legitimate for even the most exacting experimentalist. Perhaps the ideal course would be to frame no hypotheses which cannot be directly proved. The fact, however, that we do make just such assumptions implicitly, if we avoid them explicitly, should be sufficient excuse for what is here proposed. There is a tendency on the part of psychologists to be somewhat chary of the subconscious, as if a good deal that passes under that category is open to suspicion. Certain phenomena are discounted, because to accept them fully seems to lead to dangerous consequences. The utterly unscientific and in the highest degree fanciful theories of a subconscious mind with extraordinary powers, an apparent recrudescence of the savage notion of the soul, which have of late years been advanced by certain pseudo-psychologists, have made us fearful of going too far. It is, however, because the psychologist has had no clearly scientific theory of these phenomena, that he has often in his own statements given ground and even authority for just the extreme views he wishes to avoid.

Let us note in the first place the outcome of some recent discussions of the subconscious. Professor Jastrow, in his article 'The Status of the Subconscious,'[1] attempts chiefly to relate what he regards as authentic subconscious happenings to the facts of ordinary waking consciousness. He refers to the well known phenomena of subliminal sensations, holds that the subconscious is analogous to the normal dream consciousness, and, in general, maintains that the most pronounced subconscious phenomena are really of the same species as our common mental lapses, cases of absentmindedness and of habit. We get no clue from his discussion as to just how he conceives the relation between clear consciousness and these subliminal events. The net outcome is that there *are* certain occurrences which

[1] *The American Journal of Psychology*, Vol. XIV., July–Sept., 1903.

may be called subconscious and which are not objectively different from the events of ordinary conscious experience. Of course the problem still remains of how the existence of these facts of common experience and the supplementary ones of kindred nature brought to light by the experimentalist affect our general theory of consciousness.

Professor Stratton[1] also holds to the theory of habit, neural and mental, as furnishing the safest explanation for most cases of the so-called subconscious. He holds that there is insufficient evidence in the case of memory for the supposition that ideas can persist as a low degree of the activity characteristic of consciousness, and that the past must be thought of as influencing the present through some sort of neural or mental dispositions. Thus, "The former acts themselves are dead and gone, and what remains is not even a pale image or copy of them, but * * * the person in enacting them formed a habit or disposition by which such acts could as often as he pleased be reënacted, but never literally preserved." As to the phenomena of the threshold, he feels that the evidence is insufficient for subliminal sensations, but with reference to the discriminative threshold, it is somewhat more convincing. His discussion need not be repeated here. We are concerned rather with his conclusion which is as follows: "The results are not in favor of unconscious ideas, but rather of unconscious materials out of which conscious ideas arise. They lead us to acknowledge that there are indiscernible occurrences in the mind of a very definite and non-mythical character, comings and goings of dim sensations, subtle variations in the strength and the quality of certain constituents, which are sufficient to destroy the equilibrium and produce transformations in the whole mental state."[2]

To the present writer there is much ambiguity in this last statement. How shall the clause that the evidence is against unconscious ideas be reconciled with the following one that 'there are indiscernible occurrences in the mind of a very definite and non-mythical character * * * dim sensations, etc.? We may well agree with what he says regarding unconscious

[1] *Experimental Psychology and Culture*, p. 74.
[2] *Ibid.*, p. 92.

ideas for the expression itself is meaningless unless we take ideas to mean something quite different from what they are ordinarily supposed to be. Suppose, however, that the very essence of the idea is not that it is conscious, that it is an entity of some sort, a psychic something if we please, which may or may not be conscious, but which may in any case remain an idea. Upon what sort of evidence would such a theory of ideas rest? Manifestly not upon introspection and if not upon that, what remains? Certainly there is no way for the observation of another to furnish proof. The greatest refinement of the means of observing and testing can reveal only more and more refined physical processes.

But notwithstanding the first part of his statement as quoted above, Professor Stratton seems to hold to a belief in something that is psychical, or mental, and yet unconscious, for he says we are led 'to acknowledge that there are indiscernible occurrences in * * * dim sensations,' etc. Thus if there are not unconscious ideas we are at least led to infer that there is at any rate something psychical out of which ideas are formed, shreds of ideas, as it were. For what else can occurrences *in the mind* be if not something psychical or mental? The apparent ambiguity in Professor Stratton's statement is typical of much of the present thought upon these topics. There certainly are activities and events that may be called subliminal. The problem is as to how they shall be conceived and their relation to consciousness be stated.

Dr. Boris Sidis in his recent work, *Multiple Personality*, suggests the most thoroughgoing answer in terms of his theory of 'moments consciousness.' His thought, in brief, seems to be that one's psychic life at any time is made up of several moments (of) consciousness of varying degrees of intensity. Each of these moments has a definite center of interest with various contributing elements organized about it. A moment consciousness is fundamentally a system, within which are synthetized various psychic states.[1] Is the moment (of) consciousness to be conceived as something over and above the psychic states synthetized? He says explicitly that 'the psychic individuality

[1] *Multiple Personality*, p. 231.

cannot be regarded as a series of independent physical events,"[1] but that it is made up of psychic events, which are unconscious until organized into the 'moment consciousness.' It is further held that 'a moment consciousness must not be considered as something apart from its content,' that it exists wherever and whenever psychic states are synthetized; it *is* the synthetized psychic material.[2] Apparently then, he also believes in the existence of a psychic material previous to its appearance in consciousness. Dr. Sidis then proceeds to show that various subconscious activities, the phenomena of double personality, etc., may be conceived in terms of the emergence of one or another system of psychical elements. The system of moment consciousness may be really unconscious in the ordinary sense of the word for the author is careful to distinguish between consciousness and self-consciousness. There is a self-consciousness threshold beneath which 'moments consciousness' may still exist. There are a good many passages that seem clearly to indicate a belief in a psychical substratum beneath self-consciousness.[3] Thus the author in one place speaks of 'the dissociation and disaggregation of systems of central neural elements with their concomitant psychic systems or moments consciousness.' Again, 'In the first cycle of multiple consciousness none of the moments are well organized, each of the leading functioning moments can maintain itself above the threshold of personality only a short time.'[4] "The higher moments, on account of their absence during the state of disaggregation, have no memory for the experiences of the lower moments. A dissociated moment consciousness can remember only its own experiences."[5] "When the higher moment of self-consciousness becomes disaggregated and a lower type of moment takes its place, a break occurs between the two moments, the experience of the lower moment is not transmitted to the higher moment."[6]

Dr. Sidis' theory of consciousness as a synthetizing activity is most significant, as is also his contention that different organ-

[1] *Ibid.*, p. 231.
[2] *Ibid.*, p. 232, italics mine.
[3] *Ibid.*, p. 338.
[4] *Ibid.*, p. 358.
[5] *Ibid.*, p. 307.
[6] *Ibid.*, p. 307, 8.

izations of neural elements may exist in relative independence. We shall take issue with him on the point as to whether there can coexist more than one center, or moment of consciousness, and further, whether there is a psychic substratum to self-consciousness, for it is to be remembered that he distinguishes between consciousness and self-consciousness.

We wish to ask, first of all, whether, assuming that some sort of neural activity is always present with conscious processes, it is also necessary to assume that wherever there is neural activity there must also accompany it some sort of dim consciousness. Marshall, in his *Instinct and Reason*, makes such an assumption. Every neurosis has its psychosis, according to him. Whether he means by this a dim fragment of consciousness, it is hard to say. If he does not mean this, but distinguishes between the psychic and the conscious, his whole position is a mere conceptual fiction. The same is true regarding the distinction, above referred to, between consciousness and self-consciousness. We know in ourselves only conscious states, and these are also states of self-consciousness in so far as they are conscious at all. We hold that is meaningless to use consciousness in any other sense than self-consciousness. If there is little of the one, there is, in proportion, little of the other. In the nervous systems of others we can conceivably observe only physical processes. Where, then, is there any evidence for psychic states, other than those which are consciously experienced?

Dr. Sidis, as well as Marshall, holds that there is something psychical in even the simplest forms of animal life, and that this is an elementary form of consciousness of the same type as that consciousness of man which is not self-consciousness. The question may well be raised as to whether this view is not as extreme as that of Descartes, with which it is contrasted, viz: that all animals are merely automata. What if we cannot tell definitely where consciousness ends in the animal series, are we then forced to conclude that it is at least dimly present in all forms of animal life? To be sure, this assumption is not precisely equivalent to that of Marshall's, to which reference was made above, namely, that every nerve element when active

has its accompanying psychosis. According to this latter view, complete consciousness would apparently be the sum, or resultant, of the activity of all these psychic atoms. On such an hypothesis the problem would arise of how, if there are given to start with discrete elements within a single organism, there can be built up the unity of intention and purpose with consciousness certainly means to most of us. The objection to Marshall's theory, is, in a word, that the psychic atom is purely a conceptual fiction, which may be a legitimate fiction, but, if such, it must prove its worth in explaining the data furnished by introspection. Here it is conspicuously deficient in a most vital particular, viz., in that consciousness, as we know it, is something unitary. It certainly conveys no suggestion of being composed of discrete elements.

Dr. Sidis, in his theory of the 'moment consciousness' apparently avoids this difficulty by defining consciousness as a synthetizing activity, or as the 'synthetized psychic material,' but no matter how synthetized or organized, the elements seem to be still upon our hands. The analogy of the physical organism will make our objection clearer. The various members and organs are organized into one body, but the parts are still *there* objectively. The moment consciousness is, however, a unique experience, the parts of which, if there are such, are transformed by being organized and no longer exist as elements. If such is the case, we assert again that the psychic element is a fiction, the necessity of which in our conception of consciousness has not as yet been proved.

Aside from the particular objection, urged above, to the theory of psychic elements, both it and the other theory, that all forms of animal life have some degree of consciousness, are to be criticized for conceiving consciousness as something existing *per se*, independently of any functional relation to action. That is, just *because* there is a neural process, it is assumed that there *must* be a conscious or a psychical process. There is certainly good reason to believe that there is automatic nervous action in ourselves, and, moreover, consciousness, as far as we are concerned, *does* seem to have such a direct functional relation to action. Is it not then much more in accord with the

facts of experience to assume that neural action is accompanied by psychical processes only when there is some necessity for them?

In the theory, which we wish here to outline, there is assumed, as a background, a continuum of neural processes and tensions. Such a condition certainly exists in the complex nervous system of the human being. Like a delicately adjusted mechanism, it is constantly affected in varying degrees by the infinitely varied changes in its environment. There is no reason for supposing that much of this activity of our nervous systems is in any appreciable degree organized or unified. It is simply a great mass of more or less isolated responses to all kinds of stimuli. If there is any grouping in these responses, it must be along the lines of preëxisting instinct or acquired habit. Now, it is to be noted, under some circumstances consciousness appears in connection with this mass of neural disturbance. As already stated, we are not here concerned with any theory of the ultimate relation existing between consciousness and matter, nor with the philosophical problem as to whether consciousness is an existence or not; we simply note the empirical fact that sometimes there is consciousness and sometimes there is not, and we are seeking to define the objective conditions of its appearance.

As a working conception, consciousness may be held to be definitely related to the facilitation of reactions and adjustments required by the life process but which the automatic arrangements of the organism cannot meet. When the automatic apparatus fails in a crisis and no new adjustment is forthcoming, the form perishes. In some organisms, however, something appears which we call consciousness, which rapidly mediates new and perhaps more adequate adjustments. What it comes from and what it ultimately is, it is not within our province to speculate. We only note that it is present under certain conditions and that it seems to perform certain functions. Now, in its function as an adjusting agency, it *does* synthetize acts and bring to bear upon them various portions of the past experience of the organism concerned. Hence, it seems reasonable to suppose that the neural changes lying back of a con-

scious process differ from the great mass, or matrix surrouding them in being somewhat more definitely organized than they. In other words, we at least so far agree with Dr. Sidis in conceiving of consciousness as a synthetizing process and further in assuming that the neural processes involved have a corresponding organization.[1]

As far as a conscious process is concerned, it may be said to be best symbolized, for purposes of description, as a point. It does not have extent, neither does it consist of parts, so that, at any one moment, it cannot be said to contain elements of varying intensity. Although it may be true that objects do in varying degrees affect consciousness, or that many objects may be in consciousness at a given instant, it does not follow that it itself is composed of states of varying intensities, or that it could be represented, for instance, by a circle of gray, the center of which is white and the circumferance black, with all intermediate shades of gray between these extremes. That is to say, consciousness does not shade off gradually into unconsciousness. It either exists or does not exist; it may be more intense at one moment than at another. It may even at some moments be said to be at a minimum. But at any one moment it is, for purposes of description, a unitary existence without parts which might be thought as clustering about a center with different degrees of intensity and adhesion. That is to say, the 'fringe' conception does not describe a characteristic of the edge of consciousness, in the sense that any conscious state possesses a psychic halo; it rather symbolically represents the fact that the *point of consciousness* is modified by outlying neural processes as well as by those most directly concerned in effecting the required adjustment.[2]

[1] *Op. cit.*, p. 358.

[2] *Cf.* "The whole effect of these obscure contents of consciousness on the attention, fuses, according to the general law of the synthesis of affective components, with the feelings attending the clearly conscious contents, thus forming a single total feeling." (Wundt, *Outlines of Psychology*, p. 237.) We hold that these "obscure contents" are not conscious in any sense except *through* the fact of fusion itself. *Cf.* also Angell, *Psychology*, p. 395: "There is a gradual fading out from a focal center of clearest consciousness toward a dimmer region of partial consciousness, which we may designate the zone of the *subconscious*. This subconscious area," etc. It is just this conception of conscious-

On the neural side we do have a mechanical system capable of spacial representation. There is an organized center with an outlying body of processes more or less directly contributing to the central movement, or tension. Thus there may properly be said to be a gradation in the neural changes according to their degree of connection with a central organization. We hold that it is a mistake to suppose that, since many neural activities may in different degrees contribute to the central activity, there are also varying degrees of consciousness clustering about a central and more intense state. It may be conceived as the concomitant of a certain organization of neural processes, each one of which contributes to its existence, not by furnishing a psychic atom, but merely by contributing to the central physical process. Consciousness is, then, not the sum or the organization of psychic elements, but rather the unique and single accompaniment of a peculiar organization of neural processes.

It is evident that each neural element will determine the complexion of consciousness in proportion as it contributes to the general trend of organized physical activity. If and so far as it is within the central system it has conscious value. If it is outside that system, or only remotely connected with it, it has no psychic value except in a prospective sense, that is, that it may be the raw material for some future system which shall be conscious. The chief reason for its being out of the pale of consciousness is its lack of organization with the adjusting center of activity. In the outer region, which is unconnected with the central organization, are all the neural responses to the vast mass of stimuli which for one reason or another fall in the field of inattention. There can be no doubt that their number is very large. Weakness of neural action is probably another cause of the failure of a process to affect consciousness. Here are to be classed the subliminal sensations referred to by Jastrow and others. Although not conscious themselves, their existence is proved by the fact that consciousness is, in certain instances, appreciably modified by them, because of their presence within

ness on the analogy of a field or zone that is here disputed. It suggests the notion at least that there are *bits* of relatively faint consciousness clustered about a center of intense consciousness.

the central plexus. As Miss Calkins, in her review of Jastrow's article suggests,[1] the subconscious, due to inattention, should be carefully distinguished from that due to diminishing intensities of stimuli. In the former case the neural process is outside the configuration which is correlated with consciousness, while in the latter it may be within the configuration but so subdued as to have, under ordinary circumstances no appreciable effect.

As may be inferred from what has just preceded, we propose to conceive of the subconscious, not as dim consciousness, nor as something psychic, and yet not self-conscious; but rather as a physical mass of neural dispositions, tensions, and actual processes which are in some degree, perhaps, organized; the remnants of habits, experiences, both those which have lapsed from consciousness and those which have never penetrated to the central plexus. Here also are hereditary traits and tendencies which have never chanced to be sufficiently relevant to the trend of processes which lay back of consciousness to succeed in contributing to them. We believe that this theory of the conscious and the subconscious is capable, with possibly slight modifications, of explaining all the phenomena that are usually discussed under these heads. The possibility of such application we shall now try to show.

When consciousness is present, the neural processes involved are much more intense than otherwise. Whether the relationship between intensity and consciousness is one of causality or of concomitance, we need not say. It is probable that the relatively great activity of the central system tends to inhibit, or to reduce to mere dispositions all other neural processes. The ordinary dream-consciousness is, on our theory, a condition in which the central activity is so subdued or dissipated that more or less fragmentary or isolated neural dispositions are aroused, or, perhaps better, liberated. In the hypnotic sleep the center of activity is shifted in a greater or less degree, resulting in the temporary lapse from consciousness of some processes and the incorporation of others which were previously mere neural dispositions. In double and multiple personality there are one or more unusually well organized potential sys-

[1] PSYCHOLOGICAL BULLETIN, September, 1904.

tems of neural elements which, under appropriate stimuli, can separately become sufficiently active to be conscious. The last stages of the case of Mr. Hanna, recorded by Dr. Sidis, apparently necessitate our assuming that there can be two or more coincident conscious systems. But the evidence is not conclusive. The mere fact that the two personalities could emerge at once, indicates that they had in so far begun to be organized into a single system.

Such phenomena as those of post-hypnotic suggestion, so-called unconscious cerebration, and the like, bring to light an important characteristic of this matrix of neural dispositions, namely, the possibility of a certain amount of elaboration, of combination and recombination among them, independently of the assistance of anything psychic. It is certainly not unreasonable to suppose that many combinations may be effected automatically, in part, over the pathways of habit, and in part through the agency of hereditary predispositions to certain forms of organization. Thus a sense impression may be taken up by some neural system, which is, for the time being, without the central plexus, changes may result in the system, combinations of processes may be brought about, which would otherwise have remained separated, nervous force may be redistributed, until such an arrangement of elements and an accumulation of tensions may result as will bring about a connection with the center which is accompanied by consciousness. The only way to account for the appearance in consciousness of fully formed ideas, which apparently have no antecedents, is to suppose that in some neural system, determined either by habit or hereditary tendency, there have been a succession of changes which have eventually led to a connection with the center, or that in the center changes have occurred, which have brought it into closer relation with some unconscious neural system, with the result of raising it to consciousness.[1] If our descrip-

[1] The writer is willing to admit that there is normally even less automatic activity in the outlying neural dispositions, than is here assumed, especially in view of the evidence adduced by Dr. Prince in his recent paper in this journal. Dr. Prince, however, cites nothing which is inconsistent with the theory here presented, *i. e.*, of consciousness as a point rather than as a complex of psychic atoms, although his own theory of the matter is not the one

tion seems too fanciful, we may say that all we care to insist upon is simply that neural action is not confined to the central plexus, but that, even without it, there are changes and seemingly important combinations effected.

Turning from this conception of the subconscious as merely a mechanical mass of neural dispositions and subdued neural processes, let us note further the extent to which it may be conceived as having a certain amount of organization, and how, if it is so regarded, the many evidences of a precisely opposite character may be interpreted.

In the first place, the phenomena of the 'fringe' as discussed by Professor James in his *Principles of Psychology*, are striking evidence that the subconscious is more than a scrap-heap. It is true that here he does not appear to connect the fringe with the subconcious. In fact they are shown to be radically unlike. The latter is called the 'tumbling ground for whimsies' while the former has a perfectly definite significance, and certainly affords no basis for capricious opinion. In other words, with its feelings of direction and the like, which seem to guide one, in a train of thought, from one idea to another, the fringe is obviously closely related to logical processes.

When, however, we come to defining these feelings of relation with care, the antithesis between them and subconscious phenomena is not so evident. Of course, in so far as the fringe is present in consciousness it is not *merely* neural. As already pointed out, the central configuration of neural elements may be and is surrounded by other elements which contribute in varying degrees to the onward movement of the center. They may modify the activity of the center sufficiently to appear above the threshold as 'feelings of direction,' but, as stated before, they are not themselves to be thought of as furnishing a dim psychic halo about a central point of intense consciousness. The 'halo of relations' possessed by each idea or image, is merely the immediate neural setting of the idea. It is certainly much simpler to regard this setting as a part of the subcon-

here presented. The point of this paper is that what is not in self-consciousness is a physical tension or process. Dissociated ideas are not psychical affairs at all.

scious neural activity, to which reference has been made, than to attempt a separate explanation. The chief difficulty, according to our previous conceptions, of classing them together, is the seeming incompatibility of a chaos and a high degree of logical consistency. If, however, there is evidence for a good deal of organization among entirely unconscious neural processes, the difficulty would seem in a measure to disappear.

It has already been suggested that the principle of habit furnishes a basis for a certain amount of organization in the processes not immediately connected with the center. It is well known that the reasoning process is guided largely by habit, preformed dispositions, emotional preferences and the like. The trained reasoner differs from the naïve chiefly in the sort of a background from which he works, not in the way in which he is affected by it. Previous experience is never merely haphazard, and a train of rational thought may be conceived as merely a conscious redefining of limited portions of preëxisting but spontaneous organizations of the elements of experience.

The seeming chaos of the subconscious is more apparent than real. We know it only as its processes chance to form connections with the center, or when the center is so disorganized and dissipated that they can effect a synthesis which is conscious. Under such circumstances they seem by contrast with normal consciousness to be simply masses of rubbish, disconnected tendencies, irrational, uncontrolled impulses. We have already called the central neural configuration, with its concomitant of consciousness, the adjusting point of the psycho-physical organism. Naturally, here all the canons of logical thought have been evolved; the very fact that it is the adjusting center proves that reasoning is its special prerogative. It is *the* center of control. The subconscious is thus apparently a region without a logic and without control. Within limits this is true, but it is equally true that there is another aspect of subconscious activity. As it has here been considered, *it* may represent more adequately the character of its possessor than does the central configuration of any one moment. Hence under certain circumstances there may be a certain corrective value in falling back upon these marginal tensions.

Professor Leuba has given an excellent description of some extreme forms of this in his article entitled 'The State of Death.'[1] It appears in less marked degree in the ideal of self-abasement, dying to one's self, humility, the cultivation of the spiritual life, etc., as these conceptions are held by the ordinary member of the Christian Church. The results aimed at under cover of these terms are real and have a certain value with reference to the rest of consciousness. Professor James put the matter tersely when he said, 'The hubbub of the waking life might close a door which in the dreamy subliminal might remain ajar or open.'[2] We need not and do not suggest with him that some supernatural agent might communicate with the devotee through the fringe regions. It may still be true nevertheless that within these regions there is a certain healing virtue. Its tensions represent, or are in part, the sublimation of the values out of all previous experience. The conscious center, in so far as it is an adjusting apparatus, is inadequate as an index to life as a whole. From its very nature its view must be partial. Thus it may at times be worth while to permit the focus to be dissipated that the outlying regions, in so far as they represent one's life in a truer perspective, may assert themselves. The religious notion of dying to one's self and obtaining instead a divine life is by no means meaningless, even if we reject its mystical interpretation. It is certainly a good thing, sometimes, for one to stop striving and let past values come in as correctives of present stress. Life as seen from the point of stress is bound to be distorted.

It seems to the writer that many of the critics of the latter part of *The Varieties of Religious Experience* have, in their haste to discredit James' suggestion regarding the possibility of extra personal influences through the subliminal, missed an important point in his discussion. May not his really vital point be just here, that the view of life from the center of the struggle is distorted and needs correction from the emotional values which life as a whole has left us?[3]

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[1] *American Journal of Psychology*, Vol. XIV., July–September, 1903.

[2] *Varieties of Religious Experience*, p. 241.

[3] The MS. of this article was received May 9, 1905. — ED.

THE PLACE AND VALUE OF THE MARGINAL REGION IN PSYCHIC LIFE.

Recent discussions of the psychology of religion have focussed attention on the relative value of the reasoned and the unreasoned, the fringe and the center of consciousness, in their bearing upon belief and upon life.[1] Some regard the marginal region as an independent source of knowledge, in some way superior to the intellect, while others disparage the former, and consider only the center of the conscious field productive of anything really reliable. No decision on this point should be made until after a thorough analysis of the marginal region. The purpose of this paper is to make such an analysis and to assign to the region in question its proper place in the totality of mental life.

With this in view a general division of the psychical elements must first be made. And to spare the reader a tedious discussion which is aside from the main issue and which can be found well enough in many psychology books, I will say in brief that I accept the classification of psychic phenomena used by Ebbinghaus and Professor Royce — namely, sensory experience, ideation or thought, and feeling.

I do not include will or conation in this ultimate division, for to my mind will is not an element at all. If we take up a writer like Sully who maintains the elementary character of conation, and read his description of it, the effect is bewildering. One hundred and fifty pages are given to the subject, and a great mass of psychical material is included under the term conation; but all this material turns out to be ultimately either sensation or ideation or feeling, and the will itself or conation, as distinct from the other psychical elements, always eludes our grasp. The truth is, if you look for will as an element you can never find it, for it is a compound — the most inclusive of all psychic compounds. It is a matter of the succession of states of consciousness and is not to be found in any cross-section of the stream. You can never single it out from its psychic context as you can feeling, and say, This is pure will. You can never put your finger on it. It is no more a given *matter* which you *find* than association is. Will and association *occur;* they are not given. They are processes; not elements. To include will in an enumeration of the elements of psychic life is like saying the competitors in a race were A., B., C. and swiftness; or like speaking of the circulatory system as containing venous blood, arterial blood, and circulation.

[1] *Cf.* especially Professor James' 'Varieties of Religious Experiences' and Dr. Irving King's article on the 'Differentiation of the Religious Consciousness,' in the PSY. REVIEW Monograph Supplement, No. 127.

In saying this I do not wish to be interpreted as denying the primacy of volitional, conative life. The whole stream of consciousness may very well be considered a matter of conation; my point is that no one element of it alone can be considered to *be* conation, to the exclusion of the rest. Activity is a very real thing; but psychological analysis never finds it except in terms of feeling, sensation, etc., all of which it combines into itself.[1] This view is well put in Professor Royce's *Psychology:* "All consciousness without exception may be considered as accompanying our acts, or at all events as taking place side by side with the tendencies to action which are at any moment aroused within our organism. And thus all consciousness without exception may be considered as an expression of the will."[2]

To erect sensory experience and ideation into independent divisions is, I confess, more or less arbitrary. That they are nearer to each other than either is to feeling cannot be denied, and the two might very well be considered subdivisions of one large class which would be called the *rational* or the *describable*. The two, however, are certainly far from being identical, and it seems to me simpler and better to regard each as a separate class. Not only do they differ in their physiological causes; they differ also in character. As compared with sense perceptions, mental images are uniformly pale, incomplete, poor in content, and fleeting. Nor does this fully state the difference. Images and perceptions may vary, according to Professor Münsterberg, in three ways, namely, in quality, intensity, and vividness. Will any or all of these variations combined account for the difference between a perception and its corresponding image? Compare the sensation of a gray color to which we pay little attention, and the memory image of it to which we pay much attention. The difference is great; but it is not a difference of vividness, nor of intensity, nor of quality. It is a fourth factor, which may best be expressed by calling it a difference in kind, which separates sensory experience from ideation as decidedly — though not so distantly — as ideation is separated from feeling.

I shall, therefore, as I said, consider sensory experience, ideation or thought, and feeling, as the ultimate elements of psychic life. If feeling, however, is to retain the limited meaning of pleasure-pain, this classification is obviously unsatisfactory, because incomplete. It is too neat and prim, so to speak, for the hurly-burly of our actual inner life. Our psychic experience is not made up entirely of these definite and clear-cut forms. And I, therefore, propose to include under feel-

[1] *Cf.* Professor James' article, 'The Experience of Activity,' PSY. REVIEW, XII., 1–7.

[2] Page 164.

ing the phenomena of the marginal region. The 'fringes,' which weave themselves around our clearest ideas; the vague meanings which are yet no meanings and which are neither ideas nor feelings; sensations unattended to and unlocalized, and so little discriminated that without stretching the term we cannot call them sensations at all; the facts of subconscious mental activity which cannot be denied — in short all that heterogeneous mass of rich but indescribable psychic material which we call the 'background of consciousness' is not to be left out of account and is best classified here. And by this I do not mean to include clearly localized, clearly differentiated, and perfectly describable sensation, to which for the moment we are paying only partial attention, but the subjective and irrational mass of conscious stuff which is not susceptible of scientific description. Whether feeling in its more limited sense of pleasure-pain should be included under the same term used to denote this vast primordial, chaotic mass of psychic material is, I confess, largely a question of ease of exposition. On the one hand, it is true, that some feelings — *e. g.*, an intense pain — come into the center of attention and may be contrasted with the background. Yet between this differentiated feeling and the vague marginal region there is no cleft, but a steady decrease of differentiation in which no line can be drawn; and all pains — if we leave out positive pain *sensations* (Ebbinghaus' proposed 'Stichempfindung,' for instance [1]) — have the same lack of clear-cut outlines, the same irrational and private nature that characterizes the background. Within any of the 'elements' of mind, upon any classification, subdivisions may be made — in sensory experience, for instance, there is great difference between sight and hearing, and even between red and blue, in the same sense. The fact therefore that pleasure-pain when in clear consciousness differs from some of the vague experiences of the background should not prevent their classification under a single head. And that feeling in the narrower sense is at any rate more closely allied to the vaguer constituents of the fringe region than are sensation or ideation can hardly be denied. Höffding defines feeling as 'that in our inward states which cannot by any possibility become an element of a percept or of an image. It is an inner illumination which falls on the stream of sensations and ideas.' [2] If this definition be accepted (and I believe it should), feeling should be classed with the other indescribable and irrational phenomena referred to. It is true that both for feeling and for these other experiences, by an artificial transformation, sensations may

[1] *Grundzüge der Psychologie*, p. 352.
[2] Höffding, *Outlines of Psychology*, p. 89.

in a sense be substituted; but when this substitution has been made the real feeling and the real background phenomena have vanished.[1] There is in every complex which envolves either of these a factor which simply is not to be objectified and described. So far as accurate scientific description is concerned psychology must here 'throw up the sponge.' In this respect, feeling and what I may call the fringe experience differ *in toto* from sensation and ideation. For this reason, therefore, and also because of the facility with which the two run together, I shall class the vaguer phenomena and pleasure-pain under one heading. To me feeling is the type of the entire marginal region; it carries up into comparatively clear consciousness with no great alteration the original psychic character of the latter.

I shall not attempt to coin a new word for this third element of consciousness, but shall use a variety of terms for it, in general sticking to the name feeling. I therefore warn the reader that for the purpose of this paper feeling shall not mean merely pleasure-pain, but shall have the broad connotation above indicated.

What, now, more in detail, are the characteristics of this vast field of feeling? First of all should be mentioned its intimate and direct relation to the life of the organism. Sensation and ideation relate us to the outer world removed from us by time and space; the feeling mass of which I speak is indissolubly connected with our vital functions. So far as we are conscious of these functions at all, that consciousness belongs mainly in the affective life. Cœnæsthesia — as the German term *Gemeingefühl* implies—is a matter of feeling. The conscious rhythms of the bodily processes — especially as indicating the healthy or unhealthy conditions of the organism — are summed up in this common marginal feeling. "Es ist die 'Resultante der sinnlichen Gefühle' (Wundt); das 'Totalgefühl, in welchem der gesammte Zustand unseres sinnlichen Wohl — oder Uebelbefindens zum Ansdruck kommt' (Höffding). Seine Wichtigsten Bestandtheile sind, neben den deutlicher localisirten Muskel-und Organempfindungen, die vollig unbestimmten Totalempfindungen, ein Conglomerat von betonten, aber meist nicht sehr starken Gefühlen, welche ihren Ursprung in inneren Veränderungen unserer Organe haben" (Ziegler).[2] In short we may say that ideation is man's consciousness so far as he is a rational being; the affective background is his consciousness so far as he is a living organism. It is this which is in connection with our vital needs. The instinctive desires and impulses have their

[1] *Cf.* Royce, *Outlines of Psychology*, pp. 107–112.

[2] Elsenhaus, 'Ueber Verallgemeinerung der Gefühle,' *Zeitschrift für Psy.*, XXIV., 203.

roots in it, and get their power from it, the inborn reactions upon the environment, so far as they are conscious, the native antipathies and tendencies, our deepest loves and hates — all these are parts of it or grow up out of it. In fact, so inextricably is it bound up with life and all that life means, that it might well be called the *vital* background.

This vital background seems to be the primary form of consciousness. In all probability the lower forms of conscious life have little beside this. Ideation would seem to belong exclusively to the very highest vertebrates, and sensation also becomes less varied and less definite as we work down in the scale of consciousness. Our own 'lower' senses have the most *feeling* (in the broad sense), and the intellectual ones the least, and as Ward points out, our organic sensations which seem to come nearest to those of the mollusc, lack almost any assignable quale. The infant's consciousness is void of what *we* know as sensations or ideas; it is 'a buzzing, blooming confusion. "In place of the many things which we can now see and hear," says Ward, "not merely would there then be (*i. e.*, in the infant's consciousness) a confused presentation of the whole field of vision and of a mass of undistinguishable sounds, but even the difference between sights and sounds themselves would be without its present distinctness. Thus the further back we go, the nearer we approach to a total presentation having the character of one general *continuum* in which differences are latent."[1]

Out of this 'continuum,' this matrix, this original chaos, big with all the possibilities of conscious life, are gradually differentiated the various forms of sensation and of ideation. Consciousness is not put together from sensations ready made by the outside world, but, from the comparatively homogeneous mass of the feeling background, certain pulses of psychic life more prominent than the rest become more definite, more distinct, and by a gradual process evolve into sensations. The same is true of the differentiation of ideas. The process seems analogous to that of biological evolution, and might very well be described by Spencer's famous definition — 'a progress from indefinite, incoherent homogeneity to definite, coherent, heterogeneity, through successive differentiations and integrations.'

But while much that in the mollusc and the infant belonged to

[1] Encyc. Brit., article 'Psychology.' It will be noticed that in adopting Ward's view of the primitive consciousness instead of Spencer's or Stanley's I have avoided those difficulties which Höffding, Tawney and others urge against he possibility of feeling in the narrower sense being the original form of tpsychic life.

this feeling mass has with the adult human being developed into clear-cut sense perception and thought, a great part of the most developed human consciousness retains its primitive, rich, undifferentiated character. The logical and orderly mind of the most 'cut-and-dried' logician, who thinks in abstract concepts and reasons in fixed syllogisms of the figure Barbara, has still a great mass of 'fringe' and 'margin' and 'background.' The human logic machine is an invention of the imagination: and the most abstract thinker has always more of the 'blooming buzzing confusion' in the back of his mind than he would be willing to confess. And fortunate it is for him that it is so; for without it he would lack one of the most fecund sources of ideas with which human nature is blessed. Thought arising from feeling is a common experience of every one. Who has not listened to an argument and *felt* its fallacy long before he could put his finger on the weak spot? Who has not searched for a lost name and caught the tingle of it, the '*feel*' of it, long before he could grasp its definite ideational or sensational form? And not only is our general *Weltanschauung* determined quite as much by the affective life as by logical arguments, but in their very inception also, many of our most inclusive and most important thoughts and systems of thought come to us in a whirl of feeling most vague and indeterminate at first, and have to be worked out afterwards into clear formulation. The logical form is often the last product; the idea germinates in the feeling background and grows up out of it. Probably most philosophers — certainly many of them — *feel* their thoughts as vague tendencies long before they can express them. "The condition behind discovery is a *sense* or *feeling* of harmony or discord among phenomena, and of adjustment or maladjustment between consciousness and its objects."[1]

The entire psychic life is characterized by varying degrees of differentiation. Between the clearly focalized idea and its fringe, between the discriminated sensation and its feeling-tone there is no impassable gulf that may not be spanned by imperceptible gradations. With respect to differentiation Leibnitz's *lex continui* holds of the mind. Especially is this illustrated in the feeling mass. Some of its material has almost forced itself out of the obscurity of the background into the clear consciousness of ideation or sense perception or some compound of these; some has even reached the focal point of attention, as for instance intense pain. From this maximum of differentiation the feeling mass slopes down through all degrees of discrimination

[1] Starbuck, 'The Feelings and Their Place in Religion.' *American Journal of Religious Psychology and Education*, I., 168.

obedient to the law of Leibnitz, until it reaches the zero line. There is good reason, moreover, to believe that the Father of German Psychology was right in another of his assertions, and that the feeling background does not stop with the zero line, but passes by a continuous transition into the subliminal region. Certainly if there be such a thing as the 'subconscious' it is a continuation of the field of vital feeling; and though psychologists differ in their interpretation of the subconscious region, the existence of that region not many doubt. Not to mention abnormal phenomena, experimental evidence has been adduced by Jastrow, Dunlap, Stratton, and others which seems to point toward the influence of the subliminal upon judgment. Thus in a long series of experiments Dunlap found that shadow lines thrown at certain angles but too faint to be consciously discriminated influenced the judgment of lengths of other lines;[1] and in Jastrow's experiment two weights not perceptibly different, when merely *guessed* many times gave results much nearer correct than could be accounted for by chance.[2] In these cases the feeling background, perhaps in part above and in part below the threshold, seems more delicately adjusted to its environment than the cognitive, rational factors.

How the subconscious should be construed I cannot pretend to say. Myers' hypothesis of a second personality seems to me unsupported by the facts. I can only suggest that from the focus of attention (of the conscious personality, of course) there stretches out an indefinitely extended field of psychic stuff, becoming constantly less differentiated, some of it passing the zero line of one's awareness, and flowing out in what I might call dream waves — or possibly disconnected, split-off pulses of consciousness — beyond. These subliminal dream-waves would be made up of the same kind of psychic material as the feeling background, only still less discriminated, or even cut off from the main psychic mass. Both would seem to be intimately connected with the life of the organism, and, if the experiments cited and others like them are worth anything, to be in some respects more responsive to certain slight sensuous — and possibly other — changes in the environment than is the fully conscious and rational personality.

If the subconscious region be conceived thus as not differing in character of content from the conscious background we should naturally expect its products, like those of the latter, to be good, bad and indifferent; and thus the 'dissolutive' phenomena would be much better accounted for than on the hypothesis of a subliminal person-

[1] See Stratton, *Experimental Psychology*, p. 189.

[2] Jastrow, 'The Status of the Subconscious,' *Am. Jr. of Psy.*, XIV., 343–353.

ality. It would seem, moreover, that different individuals differ enormously in the amount of subconscious material connected with the conscious field. And one thing more may perhaps be added: namely, that as Professor James has suggested, this region *seems* to have another environment besides the conscious one; it *seems* to point to a beyond. All that I have said as to the subconscious, is, however, thrown out merely as suggestion; and even if it be true, it is but a very small part of the truth; it leaves untouched a great many of the facts. I am aware also that the little I have said is most vague — but perhaps its vagueness is its only merit. So little is known as yet about the subconscious region that I for one have not the temerity to attempt to unify it. Of this, however, we may be sure: 'there is actually and literally more life in our total soul than we are at any time aware of.'[1]

The objective, describable, communicable regions of consciousness, ideation and sensation, may therefore be considered as two small islands, bathed in the sea of vital feeling. This sea in its whole extent — from the subconscious up to the maximum of differentiation — seems to be in a constant state of turmoil. It is forever boiling, so to speak, and throwing up upon the shores of the clearer consciousness all manner of products. Emotions are constantly coming and going, and suggesting an endless number of ideas and actions; sensations normally subliminal or nearly so suddenly become clearly discriminated; ideas 'pop into our minds' without any connection with our previous train of thought; the solution of the problem comes without the argument that discovered it; a course of action we find already determined upon, wise but apparently not based on reasoning; intuitions of all sorts shoot out of the dark background; the youth suddenly *discovers* that he is in love and that he has been in love for a considerable time without knowing it; the poet finds the poem half-written before he thinks of writing one. This spontaneous character of the vital background often gives its contributions a sense of foreignness, a feeling that they must have come from some source not ourselves — a feeling pointed out by Professor James in connection with the subconscious portion of this field.[2]

It is largely through this irrational, vital feeling mass that we are united to our own past, to our ancestors, and to the race, — in fact in a sense to all living things. It is the inheritor of our past and forms what might be called a feeling-memory. At every moment our whole

[1] James, *Varieties of Religious Experience*, p. 511.
[2] *Varieties of Religious Experience.*

outlook is colored by our past impressions and ideas. These are not present as such — they are not distinctly remembered — but a general feeling tone and tendency to reaction is established by them and is modified by each event of life; in short the total feeling background is effected by all our thoughts and experiences in such a way that they influence every passing moment. Our total past experience is in a sense summed and massed in the feeling background, which thus becomes a compendium of our history. But it is much more than that, it is largely the store-house of heredity as well. It is in the line of direct descent and inherits an endless amount of the wisdom gained with so much toil by our entire ancestry. Our instinctive reactions and adaptations, so far as conscious, belong here; we do not reason about them but obey necessarily a longing and an impulse which we simply find. This instinct-feeling and impulse is wiser than our reasonings. It is the accumulation of ages of experience and hence may be and must be trusted as against our little store of personally gathered knowledge and vainly reasoned syllogisms. In our personal sensory experience and our logical conclusions we are very young; in our feeling-mass we are older than the race. It is through the promptings of feeling that we respond blindly but surely to the whole of a situation, of which our little conscious selves see only a very small part. Hence feeling may be said to be in touch with a broader environment than the rational part of us, and to keep us in touch not only with the absent in space but with the distant past and even, in a sense, with the future. For it binds us to the whole of nature and to the laws of the cosmos, and hence may well be called prophetic. Through it, moreover, we are united to the race. It is here that racial antipathies and racial tendencies and in fact the solidarity of the entire human family become manifest. Nor can we stop here, for it is also the one conscious tie that binds us to the whole of sentient life.

This fact, moreover, that it is the affective life which in a sense unites us to the brutes, can be no reproach to it in the opinion of any one whose ideal for humanity is anything else than that of an animated syllogism. For it is feeling alone that gives value to life. Sensation and ideation merely report on the facts. If man were only a cold intellect who saw and judged, one thing would be to him as valuable as another — in fact for him there would be no values in the universe but only truths. It is only because man has feelings, emotions, impulses, that anything in heaven or earth has value. Moreover not only does the feeling background create values; it also is often that part of a man's mental make-up which for others *has* value. What

we love in our friend is not his sensations, nor chiefly his ideas and his reasoning power; it is principally that combination of indefinable psychic qualities — impulses, desires, likes and dislikes — which we call his disposition. So far, then, is the feeling-mass from being something which a man should hope in the course of evolution to get rid of, that as a fact, if he should get rid of it, no one would be able to find anything lovable in him, and he himself would be utterly unable either to love or even to value anything.

In short the feeling-mass is wider than the other departments of psychic life, deeper than they, and more closely identified with the self. A change in it means a change in personality. Sensations and ideas have a communicable and universal nature; this irrational residuum is peculiarly private and individual. It is the determinant of character — in one sense it *is* the character and the personality. From it the practical activity gets most of its energy and most of its guidance. On the other hand, though in one way peculiarly individual in comparison with the ideas and sensations, it seems in another sense more universal than they; for it is limitless and seems to extend on beyond any borders we can set, and to become continuous with a region which is not ours.

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A CORRECTION.

In the article entitled 'The Effect of the Brightness of Background on the Extent of the Color Fields and on the Color Tone in Peripheral Vision' in the last (Nov., 1905) issue of the REVIEW by Miss Fernald, an error occurs in the tables on p. 398. These tables are republished below in their correct form.

Nasal Meridian.

Color.	Background.	Seen as Red.	As Orange.	As Yellow.	Not Seen.	Total No. Tests.
Red.	For blue.	19 XVII.	16 IX.	9	3	73
"	" red.	37 XIV.	13 VII.	13	14	98
"	" green.	39 I.	3 II.	6	19	70
"	" yellow.	65	4		16	85

Color.	Background.	Seen as Orange.	As Red.	As Yellowish-Orange.	As Yellow.	Not Seen.	Total.
Orange.	For blue.	XXXII. 2		XI. 12	31	3	92
"	" red.	VI. 13		VIII. 12	28	8	75
"	" green.	XII. 19	II. 15	II. 20	23	8	101
"	" yellow.	24	II. 100	11	3	16	156

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A RECONCILIATION BETWEEN STRUCTURAL AND FUNCTIONAL PSYCHOLOGY.[1]

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In his address, delivered last August in Capetown before the British Association for the Advancement of Science, Professor George H. Darwin thus contrasts the biological and the physical sciences: "The biologist," he says, "adopting as his unit the animal as a whole, discusses its relationships to other animals and to the surrounding condition. The physicist * * * is irresistibly impelled to form theories as to the intimate constitution of the ultimate parts of matter." By these words Mr. Darwin indicates a distinction between two fundamental scientific procedures: on the one hand, the study of the scientific phenomenon as a complex of elements, on the other hand, the study of it as related to its environment. The first is known as the structural, the second — for reasons that I shall later elaborate — may be named the functional method in science.

Mr. Darwin's special purpose in distinguishing between these two scientific conceptions is, as he says, to discuss "the extent to which ideas, parallel to those which have done so much toward elucidating the problems of life hold good, also, in the world of matter. I believe," Mr. Darwin adds, "that it will be possible to show that in this respect there exists a re-

[1] This paper, substantially as written, was presented, as President's Address, to the American Association of Psychology, at its meeting in Cambridge, December, 1905. The third paragraph on page 67 has been added to meet a criticism made in the course of an informal discussion of the paper.

semblance between the two realms of nature which is not merely fanciful."[1] And his conclusion is that communities of atoms, no less than communities of animals or even than political communities, are subordinated to the law of natural selection, in other words that they are in a perpetual struggle for existence. Their 'stability,' he asserts, is "a property of relationship to surrounding conditions. * * * The existence of some is so precarious that the chemist in his laboratory can barely retain them for a moment; others are so stubborn that he can barely break them up. * * * The more persistent or more stable combinations succeed in their struggle for life."

For the purposes of this address, the significant feature of the passage I have quoted is not its specific application of the conception of natural selection to atoms — but its extension, to the whole domain of science, of the doctrine that all phenomena are fundamentally related to environment and must be studied from the standpoint of these relationships. Such an extension of the functional procedure does not, however, it must next be observed, interfere with the constant validity of the structural procedure — the analysis of phenomena into elements. Mr. Darwin does not suppose that the physicist will cease to feel an irresistible interest in the intimate constitution of the ultimate parts of matter because he interests himself, also, in the relations among each other of these very ultimate parts. What Mr. Darwin is trying to accomplish is in fact not the annihilation but the supplementation of the old method of analysis. He is arguing that a physical or a chemical phenomenon has both to be analyzed into its elements and to be described as a complex of relationships with coördinate phenomena. He claims, in other words, that the biologist holds no exclusive right to the functional method, or — as he might well add — the physicist to the structural method.

I have dwelt at such relative length on Mr. Darwin's discussion, because I wish to make his plea for the union of the two

[1] Mr. Darwin extends his supposition, on the one hand, to those communities of negative electricity of which it is now inferred that the atom is composed, and on the other hand to meteoric orbits. (For detail with reference to the hypothesis last named, cf. Part II. of his presidential address, delivered August 30, 1905, at Johannesberg.)

scientific conceptions the basis of this evening's address before the American Association of Psychology. In contemporary psychology, the two procedures, structural and functional, are too often opposed to the point of mutual exclusion. The structural psychologist is often wont to ignore functional relations and the functional psychologist to condemn structural psychology as an artificial, abstract, and inadequate account of consciousness. The object of this paper is to show that the two conceptions, structural and functional, are readily combined, if only the basal fact of psychology be conceived as a conscious self, that is, as a self-being-conscious. The combination of the two procedures is — I shall argue — in this way made possible, because a self-being-conscious is not only analyzable into elements but is also a complex of relations to its environment, social and physical. In more detail, my procedure in this paper will be as follows: I shall first attempt to describe the nature of the psychologist's self, distinguishing it as basal phenomenon of psychology on the one hand from the psychic event — the mental process or idea — and on the other hand from the biologist's, the philosopher's, and the sociologist's self. I shall next try to show that this psychologist's self is rightly conceived as fundamental both to structural and to functional psychology, and that it should therefore be studied by both methods. I shall, finally, point out that psychic experiences may adequately be described in terms of such a self.

I. The Conscious Self as Basal Fact of Psychology.

By self as psychic fact I mean what the plain man means by self, in so far as this does not involve the view that body constitutes part of a self.[1] This conscious self, the plain man's self, in the developed form in which we commonly study it, is in the first place realized as underlying the experiences of the moment — as having percepts, images, and the like, or, more exactly, as 'perceiving,' 'imagining,' and 'feeling.' And, in the second place, every self, besides being fundamental to its own ideas or experiences, is also a related self. That is to say, I

[1] For justification of this omission, cf. below, p. 66.

am always conscious of myself as in some way related to my environment, social or physical.

This doctrine of the self as the fundamental psychic phenomenon must be defended, first of all, from the counter-theory that the basal fact of psychology is the psychic event, and its corollary that a self is a mere series or system of such psychic events. The psychic fact, conceived after this second fashion, has been named by Locke the 'idea,' by Hume the 'perception,' by Spencer the 'feeling.' Titchener, one of the most consistent of modern upholders of the structural doctrine, calls the psychic event 'mental process.' Locke's term, 'idea,'[1] seems to me the simplest and the best to designate the psychic phenomenon from this point of view: the fact of consciousness, considered as strictly individual, in artificial isolation from other facts, and — in particular — considered quite apart from any self or mind. As thus employed, in Locke's fashion, the term 'idea' of course covers emotion, belief, and volition as well as percept, image, and thought.

I have on other occasions argued that psychology, thus conceived as dealing with ideas, that is, with psychic events, is a perfectly consistent science, and that every sort of concrete conscious experience, thought and volition quite as well as percept and image, may be described simply as consisting of certain elements of consciousness. But in spite of the abstract possibility of conceiving consciousness as a series of ideas and psychology as the science of this stream of ideas, I am none the less convinced that not the idea but the self should be taken as the basal fact of psychology. There are two reasons for the superiority of this self-doctrine. In the first place, the idea is itself an abstraction which invariably implies a self. And, in the second place, the description of consciousness through the analysis of ideas is not a full and adequate account of actual conscious experience. These assertions must be separately considered.

Every idea implies a self somewhat as every sector implies

[1] By the use of this term, Titchener seems to me to invalidate his own conception of mind as 'sum or series of mental processes' (*Outline*, § 3; cf. *Primer*, § 4). A process is not something which can be summed or added; it is, as Titchener himself says, 'a becoming something' (*Outline*, § 2).

a circle, or as every cell implies an animal body. No one can conceive of an idea except as the idea of a self: in other words, the idea is immediately and unavoidably known to be somebody's idea. In the words of Lipps, "the immediately experienced I (*das unmittelbar erlebte Ich*) is the central point of the life of consciousness. To every content of consciousness," he adds, "belongs this relatedness to the I."[1]

One may find, indeed, in every manual of psychology confirmation, intended or unintended, of this assertion that the idea, the psychic event, always implies the self as its necessary background.[2] One may gain warrant, also, for the second count in the indictment, the charge that the idea, or psychic event, when conceived as basal fact of psychology, is not merely an abstraction, but an abstraction in terms of which conscious experiences are not adequately described. This follows from what has been said concerning the related nature of the self. Obviously, the experiences of a self, which is a bundle of relations both to selves and to things, need a further statement than that in terms of a succession of its own ideas. This is as evident as that the full description of a given animal must not merely enumerate the different structures of which its body consists, but must indicate its reactions on its environment — must tell, for example, whether it is graminivorous or carnivorous, and whether it swims or walks.

To this inadequacy of idea-psychology I shall recur in the final section of this paper. For the present it is necessary to add to this distinction of the self from the idea as sharp a contrast as can be drawn between the psychologist's self, thus defined, and the biologist's, the philosopher's, and the sociologist's self.

[1] *Leitfaden der Psychologie*, S. 2. Lipps has made, furthermore, what unhappily he does not consistently and systematically use, a fruitful distinction between two fundamental attitudes of the I: *Einfühlen*, in which the I identifies itself with its 'other,' and *Gegenüberstehen* in which the I opposes itself. Had Lipps but applied this distinction, he would have made of the *Leitfaden* a significant contribution to systematic psychology.

[2] Cf. the passage, often cited, of James's *Brief Psychology*, p. 153. Cf. also the passage quoted from Titchener, below, p. 78; and the even more instructive definition of 'a mental process' (*Outline*, § 2) as 'any process falling within the range of our experience in the origination and continuance of which we are ourselves necessarily concerned.'

By self as fundamental fact of psychology is not meant, in the first place, the psycho-physical organism, body plus consciousness or body regarded as possessed of consciousness. To this conception of the psycho-physical organism as psychic fact, the objection is, very briefly, that the doctrine belongs not to psychology at all, but to biology. Biological science may very properly study the nature, the relations and the development of the whole animal regarded as a body which has consciousness,[1] but psychology, if a science at all and not a mere department of biology, is a 'science of consciousness,' and as such cannot properly adopt as its basal phenomenon a complex of physical and psychical. The practical outcome of such a combination is, I think, as Titchener suggests,[2] that the psychical comes to be regarded not as coördinate with the physical but as function of it, so that the fact 'that these underlying processes are psychical becomes an accident.'

It is equally necessary to insist that the psychologist's self is not identical with the philosopher's. A self as psychic fact is not an object of philosophical argument but of immediate consciousness. In other words, no question arises of its ultimate nature: it is taken for granted, as any object of any science is, without further investigation. Just as a mineralogist takes for granted that there are stones, and just as a zoölogist takes for granted that there are animal bodies, so a psychologist takes for granted the existence of selves.

It is impossible to lay too great stress on this distinction between the philosopher's and the psychologist's self, since the tendency to confuse the two is responsible, I think, for the opposition on the part of the structural psychologists to the view here maintained, and thus for the counter theory that the self, as far as psychology is concerned with it, is a mere sum or

[1] Professor Baldwin's *Development and Evolution*, is a good example of such a primarily biological study. It discusses the 'development and evolution of mind and body taken together.' From such a standpoint, as Baldwin says, 'changes in mind and body go on together, and together they constitute the phenomena.' I am not objecting to this procedure, but simply arguing that it is biological, not psychological.

[2] Cf. his paper on 'The Postulates of a Structural Psychology,' *Philosophical Review*, VII., 1898, pp. 449–465.

series of ideas. The strength of this Humian doctrine has lain in the supposition that the only alternative to it is a philosophy of the self. But though sound philosophy is based on psychology and may well start, as Descartes's did, from the myself as immediately observed, yet psychology need not and should not reach over into philosophy. Psychology does not reason about the place of its selves in total and ultimate reality, but simply accepts them on their face value as observed facts.

The related self as basal psychic phenomena should be distinguished, finally, from the fundamental fact of sociology, namely, the social organism. The basal fact of psychology is the individual self in its relations, primarily social; the unit of sociology is the interrelated system of selves. Psychology, in other words, lays stress on the individual, while insisting that the individual is constituted, in great part, by its social relationships; sociology emphasizes the family, the state, the community, though recognizing the individuals as its members. The relation of psychology to sociology is, in fact, closely similar to that between physiology and zoölogy. As the basal fact, or unit, of psychology is the socially related individual, so the basal fact of physiology is the single body — studied, to be sure, as related to environing bodies. And somewhat as the unit of sociology is the community, the unit of zoölogy is the species.

To this conception of the self as basal fact of psychology, it is often objected that self-consciousness is late in making its appearance and that psychology as science of consciousness of every sort must concern itself with psychic facts below the level of self-consciousness. I take direct issue with this common doctrine, believing that there is no consciousness which is not self-consciousness. Of course, there is an illimitable difference between the developed consciousness which is that of every psychologizing self, and the undifferentiated consciousness of sleepy adult, of baby, or of animal. Obviously, the baby, the animal, and the sleepy adult do not make the contrast which the psychologist makes, between the self and its experiences or ideas, nor yet between the self and its environment. But one never has consciousness, the sleepiest or most inchoate, which does not involve an experience qualitatively similar to that later

consciousness which every one agrees to call self-consciousness. This simplest self-consciousness is not a reflective distinction of self from environment, though it may later be replaced by such reflective consciousness. But anything less than self-consciousness would not be consciousness at all: to be conscious is to be conscious of a conscious self.

The only ground for denying this plain outcome of introspection is the old confusion between the implicit consciousness of self, often vague and undifferentiated, belonging to every experience, and either the discriminating self-consciousness of the reflective adult or, more developed still, the philosophically-reflected-on self of the metaphysician. The psychologist concerns himself not at all with this philosopher's self; but he has to do with the undeveloped self-consciousness, a self which one remembers from one's own sleepy states and imputes to animals and to babies, and primarily, he is interested in the developed self-consciousness of the adult.[1]

II. Self-psychology as Reconciliation Between Structural and Functional Psychology.

I have so far been concerned to make clear the conception of the conscious self as basal fact of psychology. I have now to show that this conception facilitates, and indeed necessitates, a union between structural and functional psychology. To make this point, I shall try to show that each of these terms, structural and functional, is ordinarily made to cover both a doctrine of psychological analysis and a doctrine concerning the basal fact

[1] In further elucidation of this distinction, I may quote from my paper on the 'Limits of Comparative and Genetic Psychology': "Animals, if they are conscious at all, must be conscious of selves, for consciousness of any other sort is inconceivable. To be conscious simply means to be conscious of oneself in this or that or the other situation. The only ground for questioning this view is * * * the old tendency to confuse the implicit self-consciousness of every experience, with the definite, reflective self-consciousness of the psychologist or the philosopher. Self-consciousness in the latter sense is as impossible to the animal as to the child, and is properly opposed by the argument: babies and animals because incapable of abstraction are therefore incapable of self-consciousness. Self-consciousness as a vague, undifferentiated sense of what Hobhouse calls 'self as a pervading identity and permanent character,' every animal which is conscious at all must possess." (*British Journal of Psychology*, Vol. I., p. 283, January, 1905.)

of psychology. I shall argue (1) that structural psychologists and one group (but one group only) of functional psychologists are unjustified in their doctrines of the basal psychic phenomenon; but that (2) in their doctrines of psychological analysis, both structural and functional psychology are right: the analysis of the one supplements that of the other — in Professor Angell's words, 'every description of function involves some reference to structural elements, just as the actual functions themselves involve structure.'[1] Finally (3), I shall argue that both sorts of analysis, structural and functional, are essential to an adequate self-psychology.

I shall develop this conception, first, with reference to structural psychology. According to a common prejudice, the analysis into elements, sensational, affective, and the like, necessarily involves the assumption that the analyzed psychic phenomenon is the psychic event or idea. Thus, structural psychology becomes synonymous with idea-psychology. But the artificialness and inadequacy of this conception of the psychic unit as idea has already been shown. Certainly, the idea is not the immediately observed, basal psychic phenomenon. And for this reason, the functional psychologists are wont to decry and to oppose what they call the structural psychology. They overlook the fact that the really characteristic feature of the structural psychology is not at all its atomistic unit, but rather its analytic procedure. Structural psychology consists essentially in the teaching that the task of psychology is first, to analyze typical experiences until one reach irreducible elements, and second, to classify the ordinary sorts of complex experience according as one or another of these elements predominates. The structural psychologist may, and does, supplement this analysis and classification by seeking for each experience or typical class of experiences a scientific explanation — that is, by seeking to link it with other facts, or groups of fact, whether psychic, physiological, or physical. Thus, the percept, for example, is conceived as psychic complex in which sensational elements predominate, is further classified as visual,

[1] 'The Relations of Structural and Functional Psychology to Philosophy,' Decennial Publications of the University of Chicago, First Series, III., p. 57.

auditory, and the like, by the preponderance of this or that class of sensational elements, and is explained by being correlated, on the one hand with the excitation of occipital lobe and retina and of corresponding muscles, and on the other hand, with the vibrations of the ether. It must be borne in mind that the analysis and classification are the only essential parts of this procedure, and that the explanation through physical and physiological facts is a useful addition to structural psychology, not an integral part of it.[1]

Now it is past doubt that this structural analysis of a psychic state is always possible. As actually carried out in the past by structural psychologists, the analysis has, to be sure, been often inadequate. But contemporary structural psychology is characterized by a growing fineness of discrimination. This is evident especially in the modern recognition of relational along with sensational and affective elements of consciousness. What Spencer so long ago insisted on is at last being admitted by almost all structural psychologists: that thoughts and recognitions, volitions and beliefs are not adequately described, even from the structural standpoint, as mere complexes of sensation and affection; and that among the irreducible elements fused together in consciousness are the feelings of 'and,' 'like,' 'more' and 'not' as well as the sensational feelings — say, of 'blue,' and of 'bright' — and the affective elements, as 'pleasant' and 'unpleasant.'

But this analysis into structural elements — it must be insisted — is not necessarily the analysis of an idea or psychic event: it is, on the other hand, quite as easy to discover the structural elements of consciousness regarded as experience of a self, for though every conscious experience is some relation, simple or complex, of a self to its environment, it is also a complex of different elemental experiences, sensational, affective and the like; and these elemental experiences are of course to be regarded as excited and accompanied by specific bodily conditions. In a word, psychology as science of conscious and

[1] It follows that the tendency of some psychologists to treat the physiological and physical analysis as primary is fundamentally untrue to the principles of structural psychology.

related selves may and should undertake the analytic discovery of elements of conscious experiences as such. By virtue of this structural procedure it is truly a structural psychology, though it utterly repudiates the doctrine of the psychic event, or idea, as the basal fact of psychology.

From this effort to demonstrate that self-psychology includes the essential part of structural psychology, I turn to consider the relation between functional and self psychology. Functional psychology, also, is a term which has been used to indicate both a conception of the fundamental fact of psychology and a characteristic sort of psychological analysis. As regards the doctrine of the unit of psychology, functional psychologists are agreed in their well justified opposition to the atomistic conception of the idea as basal fact or unit of psychology. Positively, they present no united front, but many — perhaps most of them — conceive the psycho-physical organism as the basal fact of psychology, holding that the concern of psychology is with the relations of the functioning psycho-physical self, the conscious body, to its environment. This, as I have tried to show, is an unwarranted substitution of a biological for a psychological conception. It seems, furthermore, to form no inherent part of functional psychology, since many functional psychologists do not hold it. Angell, for example, follows up the assertion that the psycho-physical organism is a real unit, by the admissions that 'the separation of mind from body may be made in behalf of some one of our theoretical or practical interests.' He says, indeed — though I do not think that his procedure always conforms to the statement — that the 'primary task' of psychology 'is to analyze and explain mental facts.'[1] Professor Mead, going further, seems to me expressly to identify the basal fact or unit of psychology with the self, the 'I' or 'subject in persona,' as he calls it, 'the subject that is * * * more than an assumption.'[2]

Functional psychologists are, thus, far from unanimous in teaching that the psycho-physical organism is basal fact of psy-

[1] *Psychology*, p. 6.

[2] 'The Definition of the Psychical,' *Decennial Publications of the University of Chicago*, First Series, Vol. III., Part II., pp. 104 *seq.*

chology and are in my opinion, wrong in so far as they hold the doctrine. The truth is, however, that functional, like structural psychology consists essentially not in a doctrine of the unit of psychology, but rather in a type of psychological analysis. As such, it seems to me to embody the following conceptions: first, and fundamentally, the conception of consciousness in terms of the relations to environment which it involves; second, the conception of consciousness in terms of the significance or value of these relations. I shall try to show that functional psychology, conceived after the first fashion, may coincide with self-psychology; and that, viewed in the second manner, it may be supplementary or subordinate to self-psychology.

It can hardly be denied that functional psychology, whatever more it includes, does include this conception of consciousness as experienced relation to environment. This is implied in the reiterated emphasis laid by functional psychologists upon the significance of 'reaction' and 'response.' It is often clearly stated in their definitions. Angell, for example, speaks of sensation as 'the psychical function by which the organism is first brought into contact with its environment';[1] and Dr. Gore describes imagery as functioning 'on the side of response.'[2] But this, which is the characteristic conception of functional psychology, is not merely reconcilable with self-psychology: it is a part of self-psychology. For self-psychology, as truly as functional psychology, regards conscious experiences as relations to environment. Nothing else, indeed, can be meant by the conceptions of activity, passivity, sympathy, and opposition, by which it is necessary to distinguish psychic facts viewed as experiences of a self.[3]

It is true that functional and self psychology, as actually formulated, do not always give identical descriptions of the environment to which the psychic unit is related. The functional psychologist tends to emphasize the physical, or — more pre-

[1] *Op. cit.* in *Decennial Publications of the University of Chicago*, Series I., Vol. III., Part II., p. 58.

[2] 'Image and Idea in Logic,' in 'Studies in Logical Theory,' *Decennial Publications of the University of Chicago*, Series II., Vol. XI., p. 196.

[3] Cf. pp. 76 *seq.* of this paper.

cisely — the biological environment, whereas the self-psychologist lays stress on the social, or personal, environment. Yet even here, there is substantial agreement. For all functional psychologists, at least implicitly, acknowledge social relationships and Angell even says: "We shall regard all the operations of consciousness as so many expressions of organic adaptations to our environment, an environment which we must remember is social as well as physical."[1] Conversely, though self-psychology, as I conceive it, regards the relations of a self to a personal environment as logically and genetically prior, it also takes account of impersonal emotions and of will directed to external and impersonal situations — in a word, of an impersonal environment.[2]

The cardinal conception of functional psychology, that of consciousness as involving internal relation to environment, is evidently, therefore, an integral factor of self-psychology. But functional psychology includes the supplementary doctrine that consciousness is to be conceived and classified, not merely as relation in general, but as 'effective' or beneficial relation — in other words, as a function which has meaning or value. Function, in other words, is defined as 'part played with reference to reaching or maintaining an end.'[3] This doctrine of the functional psychologists — a symptom or an application of the modern movement in philosophy known as pragmatism — hardly needs to be illustrated. It appears in Angell's descriptions of the cognitive functions as 'one of the points at which consciousness is most obviously of value,'[4] and in his statement that 'truth or falsehood are impressive names for relatively complete (*i. e.*, successful) and relatively incomplete (*i. e.*, unsuccessful) operations of adaptation'; and in his teaching that in volition 'consciousness is selective of the beneficial.' And Dr. Arnold, who has recently come forward in defense of functional theory, says that 'perception is studied as giving meaning to the object concerned,' and that 'images are to be considered as logical aids to action.'[5]

[1] *Psychology*, p. 7.

[2] Cf. my *Introduction to Psychology*, pp. 276 *seq.*, 309; *Der doppelte Standpunkt in der Psychologie*, pp. 63, 74.

[3] J. Dewey, 'The Reflex Arc Concept,' PSYCHOLOGICAL REVIEW, Vol. III., p. 365, 1906.

[4] *Decennial Publications*, *op. cit.*, pp. 64, 65.

[5] PSYCHOLOGICAL BULLETIN, II., p. 372, November, 1905. Cf. the common

Whatever the nature of this method of describing psychic facts in terms of their utility, such a conception evidently may be harmonized with the doctrine that the psychic self, not the psycho-physical organism, is basal fact of psychology. For surely not merely the bodily organism, but the thinking, feeling, struggling self as well, is capable of more or less 'successful,' 'useful,' and 'complete' relations with its environment, whatever the standard of utility adopted. Keen perception, vivid imagination, subtle thought may strengthen the self in its conscious opposition to environment or in its equally active adaptation. This is merely to say that all experiences tend to the development of self-activity. There is thus no description of a psychic content as promoting efficiency, or as giving meaning, but may be appropriated by the self-psychologist.

This is not the place in which to discuss the more fundamental question whether it is expedient, as well as possible, to regard use or value as technically psychological terms. If such a procedure were carried to its limits, 'a thoroughgoing-functional psychology,' as Angell frankly recognizes, 'must ultimately issue in investigations which are nowadays the exclusive possessions of logic, ethics, and æsthetics, respectively.'[1] I am myself inclined to the conservative view that psychology, though forming both an indispensable basis and a constituent part of æsthetics and ethics, differs from each in so far that it never assumes either value, beauty, or truth as, for purposes of strictly psychological description, an ultimate term. It would follow that the value of a given sort of consciousness would be, from the standpoint of psychology, an allied but not a constituent fact. But I am not now concerned to argue this point. My contention is simply the following: Admitting the propriety of the functional psychologist's descriptions in terms of value, we may still insist that values are primarily personal: in other words, that the terms apply primarily to the self in social relations and not exclusively or necessarily to the psycho-physical organism.

description of the function of a psychical state as 'that of reconstruction of the disintegrated coördination.' Mead, *op. cit.*, p. 106 *seq.* Cf. Dewey, *op. cit.*, pp. 358, 361, *et al.*; and Bawden, *Philos. Rev.*, 1902, 1903.

[1] *Decennial Publications*, *op. cit.*

From all this it follows that functional psychology, rightly conceived, is a form of self-psychology, that its basal phenomenon is the psychologist's self, and that its significant contributions to psychology are, first, its doctrine of the inherent relatedness of self to environment, and second, its insistence on the progressive efficiency or utility of these relations. Certain writers known as functional psychologists do, it is true, hold conceptions irreconcilable with those of self-psychology. These are the teachings that the unit of psychology is the psychophysical organism and that the concern of psychology is with the sensori-motor processes of this organism, as such. But it has been shown that this doctrine lacks the assent of many functional psychologists, and that it substitutes for a purely psychological a physiological or a biological conception. Pruned of these biological excrescences, a functional psychology — as I have tried to show — is a self-psychology.

The refusal to admit the physiological organism and its processes as genuinely psychological phenomena does not, of course, prevent the acknowledgment of them as correlated facts. The self-psychologist, in other words, takes accounts of the sensori-motor processes, the bodily reactions and attitudes, on which the functional psychologists lay stress, just as he takes account of the neurological phenomena which the structural psychologist emphasizes. He does not, to be sure, hold that either the organism or any movement or attitude of it is in itself a psychic phenomenon, any more than he holds that a nerve excitation is a psychic event. Yet he may and practically does assume that psychic facts are conditioned or accompanied or followed by physiological and biological phenomena. He regards the organism, in other words, as the physiological correlate of the self, and the bodily movements as antecedents, or correlates, or consequences of psychic phenomena. Thus, for him, also, the bodily attitudes and reactions have a special significance in that they serve as adaptations of bodily organism to biological and physical environment.[1]

[1] This way of regarding the bodily reactions as objective external facts, parallel with forms of consciousness, does not of course, do away with the possibility of analyzing the consciousness of any bodily movement into elements

With this conclusion, I have reached the end of the second section of this paper. I have tried to show that self-psychology, the doctrine that the conscious self is the basal fact of psychology, harmonizes the essential doctrines of a structural and of a functional psychology. I have argued this on the ground that consciousness, which always implies a conscious self, is a complex alike of structural elements and of relations of self to environment. Such a doctrine of psychology forms, I have also attempted to show, a basis for the neurological and biological explanations of psychic fact which are current in psychology.

III. The Description of Consciousness in Terms of Structure and of Personal Relation.

In the final section of this paper I shall try to justify my general conclusion by a more detailed reference to concrete conscious experiences. I shall aim to show briefly, first, that these actual experiences[1] cannot adequately be described by enumerating their structural elements, and second, that the conception of them as relations of self to environment involves or allows all the teachings essential to functional psychology. (This second purpose cannot be systematically carried out, since — if I am not mistaken — no functional psychologist has ever attempted a full and consistent description of all classes of psychic fact in terms of efficiency or of bodily activity. The functional conception has either been employed to supplement descriptions in terms of structure, or it has been applied to a few cases only of consciousness.)

In my *Introduction to Psychology* and in a later monograph, I have attempted in some detail the description of conscious experiences in terms both of structural psychology and of basal

of consciousness, mainly sensational. Thoughtful functional psychologists find no difficulty in admitting this. Cf. Dewey, *op. cit.*, p. 364: "Motion as psychically described, is just as much sensation as is sound or light or burn." Cf. also, the sentence quoted from Angell on page 69. For an example of the false opposition of function to structure, cf. Felix Arnold (already quoted on page 73) in the Psychological Bulletin, *op. cit.*, p. 372.

[1] It is perhaps unnecessary to point out that I use the term 'experience,' or the pleonasm 'conscious experience,' not as opposite of 'thought' but as convenient synonym for 'a consciousness,' that is, as a general term, covering perception, thought, emotion — in a word, all sorts of consciousness..

personal relations. There is time, this evening, to consider certain cases only which illustrate the fact that self-psychology supplies a principle of description and of classification wholly lacking to structural psychology, and fundamental to the distinctions of functional psychology. The forms of consciousness which I shall try to analyze are three: imagination, emotion, and will. For the dogmatic brevity of my discussion, the limits of my time are responsible.

From the standpoint of an exclusively structural psychology, perception and imagination are alike complexes of elements mainly sensational. Külpe and Titchener seem to me to have shown conclusively that no invariable difference — of vividness, stability or detail — distinguishes the two.[1] In other words the difference between perception and imagination is, on the basis of structural psychology, physiological, not psychological — it is the occurrence in the case of perception of end-organ excitation.[2] Self-psychology, on the other hand, makes a clear-cut and strictly psychological distinction between perception and imagination: in perceiving, I am or may be conscious of myself as sharing my experience with unparticularized other selves, whereas in imagination this consciousness is inevitably lacking. This description in terms of personal relation is, of course, to be supplemented by a structural analysis. For the enumeration of structural elements, though it does not constitute the complete description of a psychic phenomenon, is an essential part of such a description. Imagination, defined as it should be from both points of view, is a sensational complex, usually lacking maximum stability, vividness and duration, which is reflectively realized as peculiarly the private experience of 'myself.' On the physiological side, the sensational character of imagination is correlated with specific neural excitations.

Such a description of imagination in terms both of personal relation and of structural elements serves, as well as the purely

[1] *Grundriss der Psychologie*, § 33, 6 *seq*; *Outline of Psychology*, § 43.

[2] In a review of my *Der doppelte Standpunkt in der Psychologie* (*Jour. of Psy., Phil.*, etc., Dec., 1905), Professor M. F. Washburn suggests that the 'feeling of realness' should or might be taken as the distinction of perception structurally regarded. Waiving other objections, I may observe that this would obliterate the distinction between perception and belief.

structural conception, as basis for the characteristic functional doctrine that imagination is stimulus for action. Taken by itself, it should be noted, this 'functional' description of imagination would not adequately distinguish it either from perception or from volition.

The study of emotion reveals an even more obvious inadequacy in the structural method. An emotion is readily described by the structural psychologist as a complex of affective elements with sensational experiences, including organic and kinæsthetic sensations. But an emotion is not adequately described in these terms: it does to be sure include the affective and the sensational elements, but it is also the realized personal relation of one self to individualized self or object. This is so evident to introspection that even structural psychologists unwittingly imply the self in their descriptions of affective states, as when Titchener says: "Regarded from the point of view of ordinary life, blue and warm are somehow detachable from oneself * * * whereas pleasantness is always within oneself."[1]

This realized consciousness of self is, of course, most evident in the case of any doubly personal emotion, an emotion for which object as well as subject is a self. Thus it is, in my opinion, utterly impossible, if one adhere solely to the structural standpoint, to distinguish pride from joy, or sympathetic from purely egoistic sorrow. Both pride and joy are pleasant emotions, and, so far as the obscure organic sensations are made out, both seem to be distinguished by consciousness of bodily conditions involving a general well-being. In a word, pride and joy are not fairly distinguishable till we regard them as personal relations. Then, pride is readily differentiated from joy as involving the comparison of oneself with other selves. Similarly, egoistic and sympathetic grief both are characterized as unpleasant emotions; and both include a vague consciousness of bodily conditions characteristic of bodily depression. No constant organic sensation and no distinction in temporal reference sets one off from the other. The associated ideas may be in both cases the same. Only from the basis of self-psychology, as it involves the consciousness of sharing emotion

[1] *Outline*, 32 (1), p. 95.

with other selves, is sympathetic grief distinguishable from grief of the egoistic sort.

Such a view of sympathy, it is evident, is in accordance with the conceptions of functional psychology, if that term be taken in its widest sense to imply a study of consciousness as involving relations to environment. For the selves of whom in pride or in sympathy one is conscious, form an integral part of one's environment. The subordinate features of a functional psychology may also be correlated with this doctrine. For it is certainly possible to describe, in terms of utility, the emotions thus conceived as relations of a self, and the characteristic bodily attitudes which condition or accompany them.[1] It must, however, be admitted that the list of distinguishable bodily attitudes is not so long as that of the different emotions, so that in the end the personal distinctions are necessary for the complete classification of the emotions.

A third notorious instance of the insufficiency of structural psychology is found in its attempt to describe the experience known as will. Introspection seems to bear unequivocal testimony to the distinctive, *sui generis* character of will — sharply differentiating our volitional experiences from our perceptions, thoughts, emotions, and the rest. In accordance with this observation, structural psychologists once supposed the occurrence of a specific volitional or conative element — an element which should label an experience volitional, just as an affection constitutes it emotional. But the modern school of structural psychology rightly, as it seems to me, teaches the impossibility of discovering in experience a peculiar volitional element. Accordingly it defines the volition as a complex of elements in which there is a predominance of the sensational elements involved in the experience of muscular effort, and of certain relational elements, as well, if such be recognized.[2] This analysis is, I

[1] From the structural standpoint, consciousness of these attitudes is, of course, part of the emotion.

[2] I have chosen, in the interests of a convenient terminology, to limit the term 'volition' to idea-psychology, conceiving a volition as an idea distinguished by the accompanying 'feeling of necessary connection with a future real.' (For elaboration of this view, cf. my *Introduction to Psychology*, pp. 299 *seq.*; *Der doppelte Standpunkt in der Psychologie*, pp. 74 *seq.*) Of course, this is an entirely arbitrary limitation of the term volition, which might as reasonably be employed as synonym of will. Whatever the terms chosen it certainly is expedient to distinguish the two conceptions.

think, substantially correct; and yet it does violence to the plain outcome of introspection, which sharply contrasts will with other sorts of consciousness. Obviously, the contrast must be made otherwise than by feigning a fictitious structural element. It is, in truth, a contrast in personal attitude and relation. For will differs from every other conscious experience, in that it involves an active, not a passive, relation of one self to other selves, or — secondarily — to impersonal objects or events. This sharp contrast of willing from all other forms of consciousness is, for the most part, readily admitted. It is a commonplace of psychology that we are passive in perceiving — that we must be conscious of being blinded or overheated or drenched, whether we will or not. Carefully regarded, it will appear, further, that we are victims of our imagination also, that our visions dawn upon us instead of being created by us. Similarly, we lie prostrate, as Goethe says, beneath the weight of our emotions; and even thought is active only as it is voluntary, that is, as it is initiated or accompanied by will. In opposition to the passivity of these experiences, we all of us recognize what we call the activity of will, as of faith. This contrast of activity with passivity is, it is evident, impossible if the basal fact of psychology be the idea. An idea as pulse of consciousness — as mere temporally located bit of experience — is definable only in terms of its elements. It is neither passive nor active, just as it is neither egoistic nor altruistic. And any one who questions this, may convince himself by re-reading Berkeley's "Principles," and by taking note of Berkeley's futile efforts to make the distinction between passive and active ideas, or, in Berkeley's terminology, between ideas and notions.

On the other hand, this conception of the will as active tallies perfectly with the teachings of functional psychology. For, in the first place, it describes will in terms of relation to environment, personal and impersonal; and, in the second place, it may readily take account of the utility for the conscious self of its active relations; and, finally, on the side of physiology, it enumerates the bodily reactions involved in an active relation to one's environment.

Every conscious experience might be shown, in parallel

fashion, to be both a complex of structural elements and a self as related to environment. This conception and no other does true justice to the rich fulness of the conscious life. Naturally, therefore, it harmonizes the truth in the teachings of structural and of functional psychology. And in so doing, it draws psychology into the forward movement of the sciences. For psychology, conceived as science of structurally analyzable yet socially related selves, may be compared with biology, viewed both as the study of the animal in its relation to environing conditions and as a study of cells and tissues; with physics viewed as conception of the struggle for existence of molecules and atoms which yet are analyzable; and with chemistry when regarded both as analysis into irreducible elements and as the study of corpuscles repelled from each other and attracted to the atom as a whole. In truth, the doctrine of self-psychology accomplishes for our science that union of methods which Mr. Darwin outlines as an ideal barely attained by the physical sciences.

SYMMETRY, LINEAR ILLUSIONS, AND THE MOVEMENTS OF THE EYE.[1]

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In a report of some experiments in the Wundt *Festschrift*,[2] evidence was brought forward that our pleasure in graceful curves could not be due to the ease and smoothness of the eye's own motion in viewing these curves. For the ocular movement itself, when photographically recorded, is found to be interrupted and jerky and most unlike the figures we enjoy.

The experiments I would now report are a continuation of the work thus begun, and have to do with three problems, namely:

1. Can the character of the eye's action explain the peculiar preference we show for symmetrical forms?

2. Can that group of illusions in which eye-movements have perhaps most often been assigned the chief rôle be rightly attributed to eye-movements?

3. To what extent is the so-called Wundt-Lamansky law of eye-movements a valid law?

The general technique of the experiments was practically the same as that described in the paper already referred to. An improvement was introduced, in that by modifying the form of the front of the camera the use of mirrors became unnecessary, and the observer looked directly at the drawings and diagrams used. And in order to check any special effect that might arise from a particular position of the light or from any peculiarity in the movement of either the right or the left eye, the relative position of camera, diagram, light and observer was from time to time alternated between what might be called a right-hand and

[1] Read, in part, at the meeting of the American Psychological Association, Philadelphia, December, 1904.

[2] 'Eye-movements and the Æsthetics of Visual Form,' *Philos. Studien*, Vol. XX., p. 336.

a corresponding left-hand arrangement.[1] And by the farther slight change of directing the camera now toward the right eye and now toward the left in each of these arrangements, four combinations were thus employed. It ought perhaps to be added that although the camera was, at any given time, directed to but a single eye the person always observed the figures freely with binocular vision.

The instructions given the observers were at times somewhat different from those in the experiments previously reported. For in the former experiments certain outlines were presented and the observer was asked to 'follow' the line as best he could while giving what should seem to him a free sweep to the eye. In the present case, however, there was very little of even such loose constraint; for the most part the observer was left entirely to his own devices as to the manner in which he should view the object before him, since in most of the experiments the aim was to discover if possible the natural way of looking at the figures. Where constraint was suggested it was usually for the purpose of recording a series of careful fixations of the eye, in order to make clear the amount of distortion which must be allowed for in translating the photographic records into terms of actual movement.[2] That the results might not be vitiated by reason of any special habits of viewing the figures, induced by the earlier instruction to follow the outline, a group of subjects were chosen who, with a single exception, were new to the work.

[1] For those who may wish more definite details it may be said that the diagram to be observed was placed in front at a distance of 72 cm. At one side of the diagram and directed toward the eye was a very long extension camera with a specially constructed narrow front, so that it might be brought near the diagram without cutting it off from the observer. The distance from eye to camera-lens was 51 cm., and the enlargement upon the plate was about four times. Upon the opposite side of the diagram from that upon which stood the camera was the arc light at a distance of 129 cm. from the eye and making an angle of about 60° with the mean line of sight. Camera and light changed sides in different sets of experiments; and although the light was bright, yet it was so far to one side that the observer felt no inconvenience from it. Where sunlight was used, as in a part of the experiments upon the first of the three problems, the general angular relations of the light to the eye, etc., as above described, were preserved.

[2] See *Philosophische Studien*, Vol. XX., p. 341; and pp. 88–89 of the present article.

These observers were six in number, — Miss Nelson, Mr. Bennett, Dr. Dunlap and Dr. Wrinch, at the University of California; and Dr. Baird and Mr. Williams at the Johns Hopkins University. Without the cordial assistance which they rendered the work would have been impossible. To Professor Ames and Professor Whitehead of the Physics Laboratory of the Johns Hopkins University I am indebted for the use of the microscopic comparator in the measurement of records.

I. The Form of Eye-movements as Affected by their Direction.

In examining the negatives obtained in the experiments on æsthetics, the question had arisen, Whether the movements of the eye showed any characteristic differences according to the direction of their course; and particularly was it interesting to determine in how far the eye's action, when tested by the photographic method, conformed to what has been called the Wundt-Lamansky law. This, as the reader will remember, affirms that vertical and horizontal movements are along straight lines, while diagonal movements are along curves, but curves whose particular form has been somewhat a matter of dispute.[1] In order to get additional evidence upon this whole question of the form of eye-movements, a diagram was so arranged that a central point of fixation gave approximately the primary position of sight, while around this and at a uniform distance of 35 cm. from the central fixation-point there were eight small but distinctly visible black areas representing the four cardinal directions of up, down, right and left, and also the four intermediate, or diagonal, directions. The person who acted as subject of the experiment, starting each time from the center, swept his eye rapidly to one or another of these outlying points and the eye's path was recorded upon the photographic plate.

From an examination of some 250 paths obtained in this

[1] See Wundt, *Beiträge zur Theorie der Sinneswahrnehmung*, pp. 140–142, and 201–202. Lamansky, 'Bestimmung der Winkelgeschwindigkeit der Blickbewegungen, respective Augenbewegungen,' *Archiv für die gesammte Physiologie*, Vol. II. (1869), p. 418. *Cf.* Hering, in Hermann's *Handbuch*, Vol. III., pt. 1, pp. 450–452; and Sanford, *Experimental Psychology*, pp. 124–125.

way from five persons it is clear that horizontal movements have a directness far greater than that of movements in any other direction. The eye more rarely starts in a false direction, and consequently there appear here fewer corrective glides or angular changes of direction as the goal of the movement is approached. The eye in moving horizontally often misjudges the distance, and must either piece out its course by adding a short step or two, or must double slightly upon its track, having overrun its mark. But the direction is usually in need of but the slightest, if any, change.

As for movements up or down, they have a markedly different character from that of horizontal movements. Indeed they are so similar in form to diagonal movements that they must be grouped with these rather than with horizontal movements as is done by the Wundt-Lamansky law. For in all these movements other than horizontal, the eye runs an uncertain course. Its path is often irregular or tremulous, with jerky corrections toward the end. In general the downward movements, while making about as large errors in direction as do the upward movements, have perhaps more dash and 'go' in them, and seem to be made with greater ease. And the diagonals which run downward appear to share this greater freedom, in contrast to those diagonals which run an upward course.

But the form of the diagonal movements is by no means uniformly curved. There are upon occasion most beautifully straight movements here, and when the path is curved it is by no means always of the form described by the law in question. It often shows a double curve of slight degree in passing out from the primary position, and even more often runs most of its course along a hardly appreciable curve and then toward the close increases its curvature, like the form of a golf or hockey stick. But even in the same person such curvatures may, in successive experiments, turn in the very opposite direction.

While it is impossible to give any particular form as that to which these motions universally conform, yet there seems to be a strong tendency for the eye to take a course which shows at first too strong an action of the muscles on the inner or nasal side of the eye; so that those curves which

occur, whether in diagonal or in vertical movements, tend to have a different bend according as the record is made by the right or the left eye. The right eye tends to swing at first too far to the left; the left eye, too far to the right; and this error in direction requires toward the end of the course a corrective jerk or glide, which determines the form of the curve. Accordingly, under the particular conditions of the experiment, these tendencies might be set forth in the accompanying scheme (Fig. 1). It is to be understood, however, that such a diagram

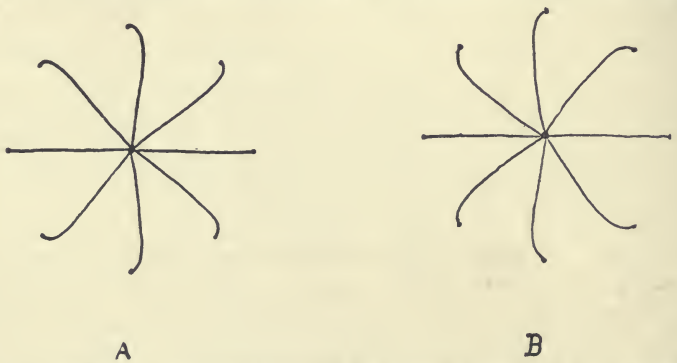

FIG. 1. Schematic representation of the eyes' action; *A* for the left eye, *B* for the right.

is not a picture of the eye's actual paths. For the records themselves are almost invariably more irregular than the curves just given, and at times show no such curvature as is here represented. The selected records shown in Fig. 2 will make this clearer. But that the tendency above described runs pretty strongly through the results is shown by the following distribution of the individual paths in all those directions which, according to the scheme, should show any particular direction of curvature; that is, in all but the horizontal directions of movement:

Subject.	Cases Opposed to the Scheme.	Indifferent and Ambiguous Cases.	Cases in Accord with the Scheme.
B.	5	4	37
D.	4	5	32
N.	5	5	22
Wi.	3	3	21
Wr.	3	1	37
Totals.	20	18	149

A careful examination of the indifferent and ambiguous cases, as well as of those opposed to the scheme, shows that they are distributed about equally between the two eyes and are not concentrated upon any particular direction of movement,

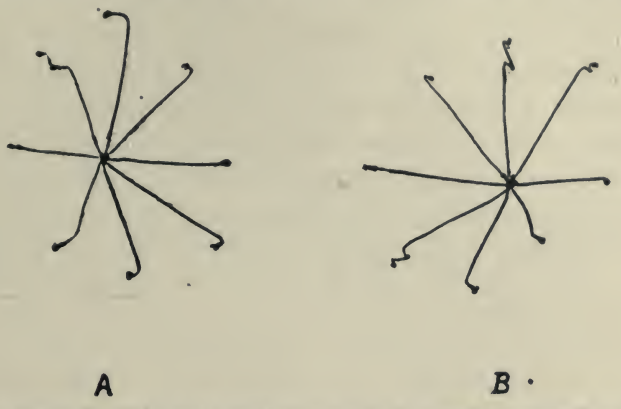

FIG. 2. Records of the eyes' free movements in passing outward from a central fixation point to outlying points in eight different directions. *A* gives the paths of the left eye; *B*, of the right. The actual records were about one fourth this size.

although the four diagonal directions show more of these exceptional cases than do the two vertical directions, and upward diagonals show more exceptions than do the downward.

The direction of curvature in the general scheme I have given is exactly what one might expect to obtain if the eyes in passing from the center of the diagram had relaxed their convergence, but relaxed it more rapidly during the later stages of any given movement than during the earlier stages. Now in the case of the diagram used with subjects *D*, *N*, and *Wr* and described on p. 84, the line of sight when directed to the central point whence all the motions took their start, was perpen dicular to the plane of the diagram, so that the outlying points of the diagram were slightly farther from the eye than was the center. Consequently there was need of some change of convergence in passing from the center outward. But the actual amount of curvature in the records, in the case of those movements in accord with the scheme, is found by careful measurement with a comparator to be, on the average, over four times

what could be accounted for in this way; so that it seems improbable that the greater distance of the outlying parts from the eye could have had much to do with the results.

But to gain more direct evidence as to the possible influence of this factor, the diagram was modified in the experiments where *B* and *Wi* were subjects. The same eight directions were still used as hitherto, but the outlying points of fixation — the *termini* of the eye's sweep, — were now no farther from the eye than was the primary or central point of fixation, — the starting point of movement. The intervening stretch between the central and the peripheral points was a curved extent like a portion of the surface of a sphere at whose center the subject was placed. The continuance of the typical curves under the conditions (as shown by *B* and *Wi* in the preceding table) makes it clear that the mere flatness of the original diagram and consequent need of relaxing the muscles of convergence as the eyes passed outward on the diagram was not the cause of the results obtained from the other objects.

Nor can the direction of curvature be accounted for by the distortion due to the fact that we are recording, not the actual movement of the eye, but the movement of a point of light which is a 'function' of the eye's own motion, since the reflection is from the curved surface of the cornea. Series of photographs were taken while the subject fixated in succession rows of points arranged in lines along each of the eight directions of the regular diagram, as shown in Fig. 3. A specimen record of the left eye is given in *A* of Fig. 4, while *B* is a record of the right eye of the same observer. It is clear from the records that if the eyes took *straight* courses in the eight different directions, one would obtain records showing a curvature similar to that made by the series of dots in these figures produced by the successive fixations of points which lay in straight lines. On the other hand, insofar as the eye during a free movement makes a record different from such a curve, we

FIG. 3. Diagram for showing, by successive fixations, the character of the corneal distortion.

know that the eye at that time *did not* take a straight course, but a curved one. And by comparison we may know in what direction and to what extent it departed from straightness. Now when we compare *A* of Fig. 2 with *A* of Fig. 4, and also compare the *B*'s of these two figures, we find that the free paths of the eye as shown in Fig. 2 are very different in character from the curvature produced merely by the corneal distortion. Indeed in most instances the paths in the one case have an opposite curvature to those in the other.

As to the cause of this characteristic curvature, the results indicate that in free movements of the eye the *rectus internus* muscle is inclined to act too strongly, partly no doubt by reason

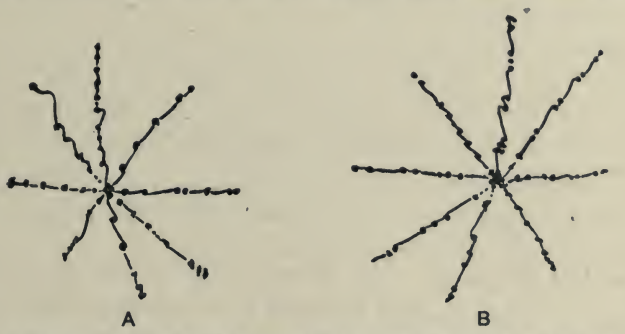

FIG. 4. Records of the eyes' action in fixating the points in Fig. 3. *A* is the record of the left eye; *B* of the right. The character of the corneal distortion is made clear, while the paths between stops show that for short movements there is the same general curvature as for the larger sweeps of Fig. 2. The records are from the same subject as are those in Fig. 2, and were taken under like conditions.

of its relatively great size and strength, and partly perhaps because of an association which has grown up between convergence and attention to objects close at hand, so that the act of attention inclines us to call the muscles of convergence into play.

But why the results here show such a departure from those obtained by Lamansky and by Wundt I am almost at a loss to say, and can only offer the suggestion that their methods did not report with exactness the nicer features of the eye's behavior. When the form of the after-image of a streak of light is used to infer the eye's course, in the experiments which I have tried with this method, the path of the eye when its line

of sight is farthest from the light which produces the after-image is very difficult to examine, since the after-image is then too faint and too far out upon the periphery of the retina to be seen with perfect distinctness. And it is when the eye is far out upon its course and is approaching its terminus that the most marked curves in its course usually occur. Moreover, as Hering has pointed out,[1] the path of the after-image is apt to be modified by torsion of the eye during movement, and only under certain special conditions is it a record, pure and simple, of the course taken by the line of sight. But if, instead of using the after-image, one depends upon catching sight of certain objects during the flight of the eye (as Wundt aimed to do), and from their position inferring what the eye's path must have been, then it must be remembered that the eye would be able clearly to recognize such objects only when it *made stops*.[2] Such a method would give no indication of the path pursued by the eye *between stops*, and it is just here that the characteristic curves occur. It would seem to me, therefore, that the photographic method is the one which can be relied upon here to give a more accurate report of the facts.

II. Eye-movements and the Classic Linear Illusions.

The illusion figures that were chosen for photographic tests were those of Müller-Lyer, Poggendorff and Zöllner. And the general method of experiment was to take pairs of records, one of each pair being taken with the illusion in some one form or direction, while its mate was taken during observation of a diagram whose main lines had actually the same length and direction as before, but with the illusory effect in this case either suppressed or reversed. If eye-movements are actually the source of these illusions the records ought to show a difference regularly in the two members of each pair of negatives.

In examining the plates, care was taken to avoid any effect that bias on my own part might produce. Each plate was measured and adjudged in entire ignorance of the more exact conditions under which it had been taken, — as to whether it

[1] Hering, *op. cit.*, pp. 450-451.

[2] Dodge, Psychological Review, VII., 454.

represented, for example, an illusory shortening or lengthening of a line, or an apparent convergence or divergence of parallels. A microscopic comparator was used for much of this work.

The actual outcome of the examination of the records for the Müller-Lyer diagrams is that in most cases the eye takes a wider sweep when the line seems lengthened than when it seems shortened. We cannot say, however, that the eye invariably behaves in this way. Of the eight successful pairs of plates with this particular figure, five pairs show the eye as making a longer or shorter excursion according as the figure itself seems longer or shorter. In three pairs this tendency does not appear. But of these three exceptional cases, two are ambiguous and might be cited either for or against the doctrine that the illusion follows the eye-movement, according as we measured the widest range of the eye's sweep, or merely the distance between the extreme points of *rest*. In only one instance does the eye behave in unequivocal opposition to the requirements of the eye-movement explanation of this illusion.

In the case of the Poggendorff illusion, there is a somewhat different turn to the results. There are here twenty-two clear records, equally divided between instances where the regular illusion-figure was presented and instances where the observer looked at a diagonal having the same length and slant as the diagonal in the Poggendorff figure, but without the interruption and the parallels which in the regular figure influence our perception.

One who examines the negatives in ignorance can have no certainty, in any given case, as to whether the observer had before him the single continuous line or the full Poggendorff figure. Of the eleven pairs of negatives, six pairs show characteristics that favor, more or less, an eye-movement explanation, while five of the pairs do not countenance such a view. In one case, where the illusion came out clear for the observer, the eye made the jog which the eye-movement theory requires, but made it in the wrong place. In another instance where the illusion came out clear, the eye made its jog, but in exactly the wrong direction. And of the eleven records taken with the illusionless straight line, six show jogs of the character that

would explain an illusion if an illusion had only been there. There could hardly be stronger evidence that the jog in the eye's course cannot be the cause of the Poggendorff illusion.

As for the Zöllner illusion, I have but eight clear records and even these are by no means as easy to adjudge as might be expected. The eye is, in reality, an unruly member, and its wild doings are difficult to describe in geometrical terms. In the present experiments (which were with a single pair of parallels from the Zöllner pattern), one would like to say that in just so many cases the eye's movements diverged when the illusion itself was divergent, and in so many instances it converged. But when one tries to bring the reluctant records under such a classification, he finds that in those instances where there is an approach to parallel sweeps of the eye, the very same plate may show one pair of movements convergent and another pair divergent. Or again the eye's motions may be such a medley of pot-hooks and figure-eights that nothing but the points of rest of the eye seem to bear any intelligible relation to the direction of the lines in the diagram observed.

In the case of five plates it is possible to make from the paths themselves a more or less satisfactory estimate of the relative directions of the movements. And of these five cases, two show movements in accord with the direction of the illusion, while three show movements that are self-contradictory — *i. e.*, movements now in accord with the illusion and now in opposition to it. All the plates however permit a rough estimate by means of the points of rest of the eye; and of the eight cases, three show the rests as having a convergent relation with a convergent illusion, while five plates show a divergent relation with a convergent illusion. It is very significant, too, that in the four instances when the observers reported that the illusion came out with greater clearness, half of the plates show conformity between the eye-positions and the illusion, while half show direct opposition.

The general effect of an examination of such records is pretty clear. In the first place, there is some degree of antecedent skepticism produced by the fact previously reported, that — try one's best — the eye is unable to move with any nice con-

formity to an objective line; and that even its points of rest are far from having any exact connection with the form observed; so that one who becomes familiar with such records is more and more impressed with the general unfitness of eye-movements to serve as the basis for the miraculously fine visual estimates and discriminations which we are able to make.

Nor is this antecedent doubt quieted by the present experiments especially directed to space-illusions. If some special form of the eye's movement is the cause of a particular illusion, such a movement must be present on every occasion when the illusion is felt. But in the actual records we find plenty of instances where the movements which have been supposed to produce a given illusion are present when the illusion is absent, and absent when the illusion is present. One can hardly believe, then, that the supposed causal connection really exists.[1]

For we cannot longer argue that although the peculiar movements which are said to be the cause of the illusion may be wanting, yet such movements are *suggested* and have the same effect as if they actually occurred. For while a suggested movement might perhaps be psychologically potent when the eye is at rest, it is unreasonable to believe that such a merely suggested movement could mentally outweigh a movement of the very opposite character which was not suggested merely, but was actually being performed. The Poggendorff illusion can come out clear when the eye is making a movement the very opposite in character to what is theoretically required; similarly the Zöllner illusion; so also the Müller-Lyer illusion. Indeed the performance of the theoretically inappropriate movement is good evidence that the opposite character of eye-movement could not have been very strongly suggested. The evidence as a whole, then, is strongly against the truth of the eye-muscle explanation of these illusions.

With this, let us pass to the final topic to be considered, namely:

[1] One should add, however, that a causal connection quite the opposite to that so often held is not at all unlikely. For instance, in the Müller-Lyer illusion, it may well be that the relative lengths of the eye-movements are not the *cause* of the illusion but are its *effect;* the line which seems long tends to call forth a long sweep of the eye, while the apparently short line induces a short sweep.

III. Symmetry and its Relation to Eye-Movements.

The figures here used were, in part, the simplest — squares, rectangles and circles; and, in part, more complicated figures, the outlines of Greek vases, with and without symmetrical handles. In these experiments care was of course taken to give the various observers no hint that the symmetrical arrangement in the figure was the special feature under investigation. They were merely told to look at the figure in whatever way seemed to them right and natural, and, if possible, to observe the form as one would in enjoying it.

In examining the negatives one is struck by the almost grotesque unlikeness between the outline observed and the action of the eye in observing it. For the most part the eye moves irregularly over the figure, seeking certain points of vantage from which the best view of important features may be obtained. And these positions are marked by the eye's momentarily resting there. Now these points of rest are evidently of more consequence to the observer than the path by which the eye reaches them; indeed the form of any single path between two stops usually bears no observable resemblance to the outline which the subject was taking in, and which in many cases he believes his eye to be accurately following. But even the points of rest are not so arranged as to supply of themselves a rough sense of the form perceived, after the manner of an outline pricked disconnectedly in paper. The points of the eye's rests in the records are usually too few and too inexact to give any such clear and connected perception of the form as the observer regularly and readily obtains.

As regards the question of the symmetry of the movements of the eye, in some instances the negatives display a rude balance. But it must be said that even the most symmetrical of these records can be called so only by courtesy, for they signally lack that exactness of correspondence of part to part which we demand in the objective form before we are ready to enjoy it because of its symmetry. The more frequent records have not even this rough approximation to symmetry.[1] The

[1] For an example of such a record, see my *Experimental Psychology and its Bearing upon Culture*, p. 242.

observer looks at one side of a Greek vase in detail, and then glances at the other side, and, seeing that it corresponds to the first, is satisfied. By comparing the records with the reports of the observers, it would appear that some of the more symmetrical eye-movements occurred when the person was in doubt as to whether the form before him really was symmetrical. So that balance of ocular sweep may be obtained where the symmetry is doubtful, and where the observer must look closely and compare the sides part by part. But looking for symmetry is psychologically a different thing from enjoying symmetry; it is a condition of dissatisfaction and unrest. And on the other hand observers have expressed especial satisfaction with a vase-form where the record revealed movements unusually ill balanced.

The records do not warrant one, however, in saying that with pleasing forms the eye tends to a kind of equipoise where motion no longer is invited. It has been thought by some that this constitutes the chief pleasure in symmetry — that the eye is drawn equally in opposite directions, and in the presence of opposing forces finds repose. The actual experiments show, it is true, that the eye may at times make relatively slight movements in viewing a graceful form. It may take up some central position, and keep its excursions within a small compass. But even here there seems to be an almost ceaseless twitching, as if rest for more than an instant were the one thing not to be endured. Ceaseless movement seems to be the natural state of the eye, as it is of the attention, and pleasure is found only in this normal state.

The sources of our enjoyment of symmetry, therefore, are not to be discovered in the form of the eye's behavior. A figure which has for us a satisfying balance may be brought to the mind by most unbalanced ocular motions; and during the more symmetrical movements of the eye the observer may have been disquieted by the sense that the figure was decidedly out of balance.

The present experiments, therefore, help to clear the ground. They make it easier for us to see that the explanation of a phenomenon which has its blood-relations in the field of every one

of our senses ought not to be sought in conditions that are confined to any single sense. Linear symmetry is vitally connected with such varied facts as the repetition of a figure in a dance, or the refrain in song, or the working up of a theme in symphonic composition, where the same melodic phrase may be given, now on the strings and now upon the wind instruments, or may without change of instruments be given now with one and now with another harmonic setting. Such a musical translation is not so very far from what we have when a right-hand linear arrangement is given a corresponding left-hand form and the two are joined into a single figure.

Those who in explaining these things would say little or nothing about eye-muscles and would say much about the muscles of the limbs and trunk and viscera — such persons would seem to me to be upon ground from which it would be more difficult to dislodge them. There is no occasion here to follow this other side of the theory which pins its faith upon muscular sensations. The discussion of the present experiments has been intentionally confined to the point of showing, not that they disprove any muscular theory whatever, but that they tend to make the eye-muscles appear a trifle ridiculous when one compares their actual performances with the marvels which have been attributed to them. The mythology of the eye-muscles will some day make an interesting paragraph in the history of delusions in psychology; and we shall not be long, I expect, in gaining the facts which will permit this mythology to be recognized and narrated.[1]

[1] The MS. of this article was received December 20, 1905. — Ed.

ON SECONDARY BIAS IN OBJECTIVE JUDGMENTS.

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I.

The scientist sets before himself the ideal of a perfectly impartial account of the external world. In proportion as he frees his work from personal prejudice is its outcome successful. The facts may be unwelcome, they may run counter to his desires and mean the overthrow of long-cherished ideals; but these elements of sentimental valuation have no place in the world of scientific truth; except, indeed, as themselves matters for investigation and record like all other phenomena. To suppress facts because they are at variance with an already accepted theory, or to warp them in the direction of a desired interpretation, means the destruction of science; it is a denial of the possibility of a system of objective knowledge. For it is the effort of science to transcend the limitations of the individual and to establish those principles which are independent of subjective bias and form the body of truth common to all observers.

Deliberate distortion or suppression of facts the scientist does not discuss. One guilty of such acts manifests a purpose which is radically distinct from that of the investigator. The scientist presupposes sincerity of purpose in the observer together with honesty and reliability in the record, in so far as these results are dependent upon the intention of the investigator. Honesty of purpose, however, is but the starting-point of accuracy in the record; and the advance of science has involved at every stage of its progress a renewed criticism of the conditions of observation, and an investigation of the possible sources of error to which its methods are liable.

The personal or psychological factors of distortion which thus appear in the report of an external event by any observer

may be grouped in two classes, physical and mental. The first of these embraces all the external conditions of observation, including the mechanisms of perception; the second consists of the various sources of unconscious bias which inhere in the intellectual processes of the observer. The former are relatively stable and of comparatively easy correction. The computation of their values is always incidental to the presentation of results. Such are the correction for time and space differences, the calculation of probable errors, the establishment of the observer's personal equation, and the like.

Errors of the second class are of a different nature. Their character is peculiarly personal and unpredictable, their range undeterminable and their value largely unquantifiable. The existence of such subjective bias in any given case may be assumed, but its direction and amount can only be estimated in the roughest and most general way from an acquaintance with the mental habits of the observer. And even this correction can be applied only to certain large features of a man's work, such as his philosophical interpretation of scientific data. In a multitude of cases it is wholly impossible to estimate the correction which should be made in an individual report, or even to guess at the nature of the factors which are operative in the process of subjective distortion; and though the error thus introduced is commonly trivial it may rise on occasion to great and tragic importance.

To give an unprejudiced account of any event is a practical impossibility. It takes shape within each individual consciousness in dependence upon the dominant system of values and modes of organization which that mind possesses; and the variations in the reports given by any person and his fellows will be proportional to the differences in interests and habits which exist between them. These variations need not present discrepancies, — though they commonly extend even to contradictions — but may involve only changes in proportion and emphasis. It is notorious that the violence of the external stimulus alone does not determine the intensity or permanence of the impression which is made upon consciousness in any given case. The general habit of attending to such stimuli and the

openness of the mind at the moment are more important factors than the absolute magnitude of the stimulus. In other words, selective attention working under the guidance of our organic interests operates upon the materials and processes of the external world, adding accentuation and emphasis, seizing upon and preserving certain elements which we call pleasing or important, and relegating the rest to obscurity or oblivion. Often the account in which this recasting results is unrecognizable by a fellow-observer of the event. The existence of subjective bias is thus not an incidental error in our observations but is fundamental to the very character of the human mind. We can conceive its elimination only in an absolutely dispassionate consciousness devoid of feeling and purpose.

This universal bias roots in the fact that at each moment of our experience some one interest is for the time being paramount, and determines both the objects which shall be attended to and the interpretation which they shall receive. The nature of any reality with which the mind concerns itself, whether objective or subjective, is as much affected by every change in this system of inner relations into which it is woven as is the appearance of a physical object by being overturned and regarded from a new point of view. One may identify the object with that of the moment preceding, but at best it is the same with a difference. A new set of angles appears and its relations with other things have changed. The type of new crystallization within the mind has given the object a fresh meaning through the introduction of a novel system of emphases, and its character as a mental object has thereby been transformed. The very hold which an impression or idea has on the mind depends upon the existing system of relations in which it is caught up, and which is expressed in the temporary or permanent disposition of the mind. It must in some way fit the purpose of the moment or appeal to an organic habit if it is to take intelligible shape before consciousness. While reading a book, for instance, one disregards wholly the width of the margins, the smoothness, rigidity and rectangularity of the covers, and the weight of the volume, any one of which might, on another occasion, be the important aspect to take into account in considering the object,

if one were in search, say, of a paper-weight, a straight edge, a writing-pad, or wished to make marginal comments upon the contents. The perception of symmetry in visual forms, again, expresses the fact that the mind wills to attend only to those lines and masses which present geometrical balance; for in every such design the possibilities of unsymmetrical construction are incomparably more manifold than those of the regular systems upon which the eye dwells, and the apprehension of the latter depends upon an ignoring of all that is formless or disproportionate, which can be referred only to the organic disposition of the perceiving mind itself.

This subjective selection and emphasis pervades all mental activities, perceptive, imaginative and rationalizing. It is expressed alike in the construction of an orderly world of objects and space relations to which our senses give rise, and in the determination of the course of ideal association in our purposeful thinking. But this universal aspect of human consciousness once acknowledged, we are no longer concerned with its existence. It is as proper to point out that it is the basis of intelligibility in the world and of a rational adjustment to its changes, as to recognize that the apprehension of that world varies from moment to moment in dependence upon transitions in the point of view and present purpose of the beholder.

It is only when a bias of the second order appears that the detection of the presence and magnitude of the errors involved assumes practical importance, when our types of confessedly selective perception and representative thought are distorted by factors of evaluation of whose presence we are unaware at the moment of judgment. Such are the familiar space and time errors of which account must be taken in reducing observations involving position and movement, or comparisons of events in serial order. Such are also the sources of unconscious prejudice which influence personal opinion of men and events.

The interest of the psychological student in these phenomena does not concern the mere fact of their existence. The presence of such modifying influences may be presupposed in all cases; they are pervasive as gravitation. The judgment made at any given moment reflects, in a way, the whole system of

stimulations, inner as well as outer — which is operative in determining the cast of the mind at the moment. One's judgment of the comparative intensity of a sound, for instance, depends upon both the character of the auditory impressions which have just preceded it, and the whole system of stimuli acting upon the senses at the moment time; as well as upon the physiological activity of the body and conditions of attention and alertness on the part of the subject.

The same holds true of all judgments concerning the qualities and the relations of objects in the world about us; and part of the work of the psychological observer is of course to determine for all important modifying influences of this kind the typical curves of value which they manifest in connection with a series of systematic variations in their concomitants. The investigations of color-contrast, of hetero-sensorial reinforcement, of the influence of distraction upon judgment, are cases in point.

One approaches a more obscure and difficult problem in passing from investigations of sense perception and memory to judgments based upon conceptual processes, or comparisons of objects so complex that many significant relations exist between them and the mind which judges. Especially is this the case with all humanly real objects, those, namely, which do not simply receive a fictitious existence in the laboratory, conferred for the direct purpose of affording material for the judgment in question, but which are reacted upon naturally and seriously because they enter into real relations with the practical business of life. In the latter case every significant point of view from which the object has ever been regarded becomes a possible source of secondary bias; its practical, its political, its æsthetic, its historical, its religious value — each and all may affect one's judgment of even its immediate physical characters.

We exaggerate the size of our gods and heroes, making them "larger than human" not only because the conception of bodily prowess so frequently lies back of the thought, but also because the estimation in which we hold their political or moral significance tends to be reflected in our representation of their bodily appearance. The example is but an illustration of a class of effects which, as in the former case, we may presume

to be present, in some form or other and to some given extent, in all such judgments. The important and familiar places of the world, for instance, we should probably find to be located by each person at points on the average nearer to himself, and places historically or politically obscure at points more distant than their actual geographical positions. In exemplification of this general class of effects I have been at pains to determine the existence and influence of certain forms of such secondary bias in a single selected series of cases, the results of which are presented in the remainder of this paper.

The inquiry arose from a discussion of the variability of individual judgment with regard to the comparative weight of bank-notes and coin, and the sources of constant error which affected such estimation. The raising of this question led Dr. J. F. Messenger to institute an inquiry the results of which were published in the form of a note in *Science*, April 25, 1902. In his report the writer commented upon three things, the comparative accuracy of judgment in the two sexes, the amount of the constant error involved, and the influence upon such judgments of the symbolic value of the bills in question. With the last of these points the present inquiry began, as preliminary to the larger series of comparisons to be reported later in the paper. The question to be answered was of the simplest character: How many bills together equal the weight of a silver dollar? This question was asked concerning two denominations, one-dollar and ten-dollar notes.

It was impossible to ask for judgment on these two points consecutively of the same person, consistently with the object in view; since the naïveté of the subject's attitude which is essential to the success of the inquiry would thereby have been destroyed, and the calling of attention to the point in question would certainly result, though in an unpredictable proportion of cases, in a rectification of judgment, and the elmination of that very error the presence of which in uncritical judgments was the matter under determination. In order to approach the question it was therefore necessary to obtain reports from two groups of observers, taken as nearly as possible from the same class of subjects, and in sufficient numbers to offset the disad-

vantage occasioned by the lack of direct comparison between judgments made by the same individual. Those to whom the question was put were all public school children of the five upper grades. The selection of this class of subjects arose partly from its accessibility, partly from the desire to note any changes in the character of the judgments which appeared in connection with advance in age. Comparison of the judgments made by the two sexes will have to be reserved, as answers have hitherto been received from classes of girls only. The observers were all pupils of a single school, of such a size that each of the grades in question was subdivided into sections, and the two inquiries were made alternately of these groups. The total number of answers received, — exclusive of those cast out on account of defect — was 646, distributed as follows:

TABLE I.

Grade.	One Dollar.	Ten Dollar.	Total.
IV.	67	56	123
V.	155	116	271
VI.	78	66	144
VII.	40	42	82
VIII.	15	11	26
Totals	355	291	646

Of this total the last group of 26 should probably be put aside in considering the results, as the number is too small to form the basis of any reliable conclusion in regard to a question in which the index of variability is so high as it is here.

The average numbers of bills of each denomination judged to equal the weight of a silver dollar by pupils of the various grades are as follows:

TABLE II.

Grade.	One Dollar.	Ten Dollar.	Average.
IV.	215	125	170
V.	98	97	97
VI.	99	44	71
VII.	84	52	68
Average.	124	79.5	101.5
VIII.	112	122	117

The returns from the small group of eighth grade pupils which appear at the bottom of the table, have not been included in making up the averages. The remaining figures show a considerable preponderance, for the whole series, and in each grade at least an excess, in the number of bills of the lower denomination over that of the higher which is judged to make a weight equal to that of a silver dollar.

When the individual variability is so high as to include extremes of five, and twice as many thousands which appear in these guesses at the weight of a banknote, it is only when a decidedly large group of answers is taken into account that the average possesses any real significance. The ratio presented by any single grade may therefore be held undecisive; but the fact that the average number of one dollar bills is greater than that of the tens in the ratio of 24: 79.5 when the whole series of 600 comparisons is considered, may be taken as settling at least the question of the presence of this factor of secondary bias in judgments of this nature.

Whether the prevalence of this type of confusion tends to increase with age the present figures can hardly be said to show, though the evidence which they afford is favorable to such a conclusion. The intimacy of the association between the perception of a bill of any denomination and its representative value undoubtedly increases as one's familiarity with the use and exchange of money grows. Without this experience the source of error which appears in these judgments would of course not exist, and it is during the years comprised within the present series that the child acquires this knowledge. It may be said, therefore, that the factor upon which the distortion of judgments depends is taking on greater reality and importance during this period, and that a progressive increase in the error might be looked for. It is also true that if the series of four grades be divided into junior and senior groups, the error in the latter will be found nearly half as great again as in the former. Nevertheless the construction of such a curve demands both the determination of a large number of points and a more consistent sequence among them than is here presented.

Another developmental feature, it may be noted in passing, is

fairly well-marked in these papers. The number of bills which equals the weight of a silver dollar, if we regard the quantitative average solely, is consistently exaggerated, since its actual value is about twenty; but the amount of overestimation is successively reduced from grade to grade, as appears from the series of averages which is attached to Table II. in the last vertical column. The judgment of the child concerning the weight of bills in general is undergoing the progressive rectification, at the same time that the element of secondary bias is, or may be, increasing.

In any such case as the present, however, the figures already given leave one largely in the dark as to the real distribution of the guesses. We need to know the constellation of the judgments as well as their quantitative averages. The mean of the series, which is the index of this distribution, is given in the following table for each grade and denomination separately:

TABLE III.

Grade.	One Dollar.	Ten Dollar.
IV.	20	20
V.	25	25
VI.	25	20
VII.	50	25
VIII.	100	120

These figures suggest comparison with the results obtained by Messenger, and by Pierce (*Science*, Nov. 7, 1902, p. 745) from college students and other grown persons. In the first of these reports the average (of all judgments) was 201 times and the mean 8 times the actual number involved. In the second (Dr. Pierce's group) the average was 15.8 times and the mean 4.3 times too great. In the present series the average for the four grades considered is 10.2 times and the mean 1.3 times the actual number. The data are perhaps not sufficient as regards numbers for a valid comparison of the two series of judgments and lack continuity through the intervening ages; but the results of the observations so far accessible (based roughly upon 600 reports in each case) do at least show a striking difference in the correctness of the estimates made by school children from

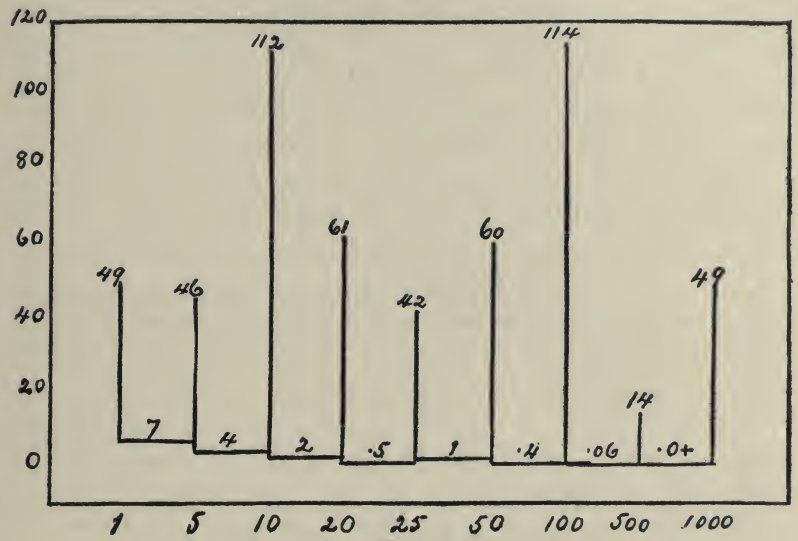
nine to fifteen years of age, in the present series, and by college students or more mature persons, as reported by the two investigators already quoted.

If the two sets of figures representing the quantitative average of the mean value of the median estimate for successive years be compared they will be found to present inverse relations. The average is steadily reduced with age, the mean is progressively increased. Of these two series the change in the first indicates only the elimination of scattering judgments which show an uncritical and excessive estimate. A larger and larger number of the children, as they grow older, are coming to have a more or less intelligent idea of the relations of weight between the two objects. But these averages do not necessarily mean that a more accurate apprehension of their comparative weights is being developed among the members of this group themselves. It does not even show the character and changes of the constant error, if such exist. The index of the latter is found in the series of median values; and these show that while the correction of extravagant misjudgments is steadily lowering the quantitative average of the series, the tendency of the majority of observers to underestimate the weight of the bill is progressively mounting. If we may take the present results and those with which they are here compared as typical — and the averages in each of the two cases are based roughly upon 300 individual judgments — the perception of the child — in these matters is much more accurate and free from prejudice than that of the grown person; and there is reason to suppose from that part of the curve which the present investigation affords, that the carrying up of the reports through the intervening years would show a fairly continuous series connecting these extremes of judgment.

It may be worth while to call attention to another form of secondary bias which these estimates of weight present. It appears in the distribution of individual judgments in relation to odd and even numbers, and to decimal nodes, or 'round numbers.' Out of the total series of judgments even numbers were given in 517 cases, odd numbers — exclusive of unity and multiples of five — in 16 cases only. This preponderance arises

from the frequency of even tens, hundreds, etc.; the occurrences of unity and odd multiples of five amount to 166, while the total number of five-multiples is 590.[1] This clustering of the judgments about decimal nodes and semi-nodes is shown graphically in the diagram (Chart I.), in which the height above zero of the vertical lines indicates the frequency with which the

Chart I.



numbers at their bases occur in the returns, while that of the horizontals between them represents the average for all the intervening numbers. For further elucidation the numerical values are put above their respective graphical indices.

The guesses may practically be said to consist of ones, fives, tens, etc. The whole series of intervening numbers is represented by only one judgment in seven. Of these maxima, '10' and '100' occur with more than twice the average frequency of the rest. The falling off in the '1,000' judgment is due to the

[1] In this later reduction only unintelligible papers were cast out, whereas in the former case all but those which were wholly unambiguous were rejected. For instance the answer '20 or 30' was now retained though previously eliminated. The total number of observations, therefore, appears greater than before.

small total number of guesses which reached this magnitude, but the attraction which 'round numbers' possess is shown by the fact that though this point lies near the upper limit of distribution, the number of cases in which '1,000' was given as the estimate is three times that in which '500' occurred.

For comparison a second diagram (Chart II.) is appended in which I have represented a set of figures given in a paper by A. Williams in the *Scientific American Supplement* for March 16, 1889, entitled 'Favorite Numbers.' These figures were taken from the preceding United States census, and indicate in terms of thousands the number of persons in Alabama who reported themselves to be one of the ages named at the bottom of the chart.

The strongly marked maxima at 30, 35 and 40 years need not be pointed out, but it should be noted also that, as in the

present series of judgments, the maxima at the even tens are higher than at the intervening fives. The peculiar form of this curve must of course be wholly due to subjective distortion, and the more abrupt contrast between the maxima and intervening low plateaus in the preceding diagram is due to the greater freedom of choice in estimating the weights than in reporting ages. It is to be expected that in the upper tens, for example, one should put the number at 70 rather than 69 or 71; but the

fact that a similar constellation appears among the series of estimations running from unity to ten shows clearly the existence of this preference for particular numbers. The sum of the judgments distributed among the numbers one, five, and ten is 207, while the aggregate for the other eight is but 44, or one twelfth as many to each number.

III.

The purpose of the main investigation, like that already described, was to determine the influence exerted by secondary associations upon one's representation of the physical qualities and relations of objects. The special associations which guided the selection of individuals were those of political and historical importance. An exact order of precedence in such a case cannot of course be established, since the valuation is subject to fluctuations dependent upon the individual who passes judgment upon the returns, but at least the whole series may be divided into two groups according as the objects contained in them have more or less importance of the kind in question, and comparison may roughly be made between the upper and lower regions of this scale.

Four series were prepared, each consisting of ten objects concerning which judgment was to be made, and the members of these series were to be arranged according to what the observer conceived to be their real order. In cases of doubt bracketing was to be avoided and the two or more objects put in serial order, even if recourse to guessing was necessary. The adoption of this method in such exceptional cases was based upon the presumed existence of preference even in an allotment of this kind; but when the uncertainty extended to many of the series this recourse would serve no good purpose, and the observer left the returns uncompleted or untouched. As the differences among the objects were fairly large and the order merely relative the occurrence of imperfect lists was rare, and all these were cast out in making up the returns.

The papers were first submitted to two university classes, consisting of 55 women and 19 men of mature age; they were then sent to the Principals of five New York public schools and

were marked under their supervision by 204 pupils distributed as follows:

TABLE IV.

Age.	11	12	13	14	15	16	Total.
Boys.	8	16	28	13	2	—	67
Girls.	—	11	40	43	25	18	137
Total.	8	27	68	56	27	18	204

In the first list ten of the countries of the world were arranged in alphabetical order and the observer was asked to give judgment of their territorial extent, putting the figure (1) before the largest, (2) before the next, and so on in order of size. In computing results the returns were entered one beneath another on a sheet of paper, the series in each individual return running horizontally from one to ten. The average position assigned to each country was then determined by dividing the sums of the several columns by the number of reports received, and the direction and amount of error was recorded in terms of plus and minus deviation from the true position of each in the series. Countries were marked plus (+) when the position assigned was too high in the scale, minus (—) when it was too low. The following illustration will obviate the necessity of referring again to the method, which was followed in reducing all the returns:

TABLE V.

SCHOOL C; GRADE 7 B, GIRLS; AGE 13 YEARS. LANDS.

A, Actual Order; B, Average Order Assigned; C, Error of Displacement.										
A.	4.00	8.00	5.00	7.00	6.00	10.00	3.00	1.00	9.00	2.00
B.	8.14	8.58	2.92	7.00	5.33	6.42	5.92	2.00	7.50	1.25
C.	—4.14	—0.58	+2.08	±0.00	+0.67	+3.58	—2.92	—1.00	+1.50	+0.75

The returns from university students are classified below, the alphabetical order in which the names were arranged in the original list being replaced by that of deviation, the series beginning with the highest overestimation and ending with the greatest underestimation which occurs:

TABLE VI.

Countries.	Men.	Women.	Average.
Palestine,	+ 2.3	+ 2.3	+ 2.3
German Empire,	+ 1.9	+ 2.0	+ 1.9
Switzerland,	+ 0.2	+ 1.2	+ 0.7
Italy,	+ 0.5	+ 0.6	+ 0.5
United States,	+ 0.6	+ 0.2	+ 0.4
Ceylon,	+ 0.4	± 0.0	+ 0.2
Siberia,	— 0.7	— 0.7	— 0.7
Iceland,	— 1.3	— 1.1	— 1.2
Afghanistan,	— 1.1	— 1.9	— 1.5
Peru,	— 2.4	— 2.5	— 2.4

In the returns from public school children which follow, the results from the five schools are given separately from their average under the headings A, B, C, D, E, for comparison as to uniformity of arrangement:

TABLE VII.

Countries.	A.	B.	C.	D.	E.	Av.
Palestine,	+ 2.4	+ 3.3	+ 2.5	+ 2.2	+ 2.5	+ 2.6
German Empire,	+ 1.8	+ 2.1	+ 2.1	+ 2.8	+ 2.5	+ 2.3
Switzerland,	+ 0.9	+ 1.5	+ 1.9	+ 2.7	+ 2.0	+ 1.8
United States,	+ 0.7	+ 0.7	+ 0.7	+ 0.6	+ 0.7	+ 0.7
Italy,	+ 0.4	+ 0.7	+ 0.5	+ 0.8	+ 0.6	+ 0.6
Ceylon,	+ 1.1	— 0.7	+ 0.1	+ 0.6	— 0.4	+ 0.1
Iceland,	+ 0.1	— 0.1	— 0.6	— 0.9	+ 0.1	— 0.3
Siberia,	— 1.2	— 1.5	— 1.8	— 2.6	— 2.4	— 1.9
Afghanistan,	— 1.6	— 3.3	— 2.7	— 2.6	— 2.9	— 2.6
Peru,	— 4.2	— 2.8	— 2.6	— 3.6	— 3.1	— 3.3

Both of these tables present a systematic displacement which differs fundamentally in its curve from that to which the presence of scattering errors would give rise. From the middle of the group it rises by progressive increments of opposite signs to extremes which are separated by five places, or half the value of the series. Setting aside the question of detail, it is evident from this distribution that the separation of the system into upper and lower regions reflects the political and historical estimation in which the constituent lands are held. The important countries are overestimated, the obscure underestimated, and if the whole series should be divided into two groups on this principle, all those called important will be found in the upper half of the scale, all the obscure in the lower half.

The comparison can be carried farther; for the amount of displacement of a country roughly parallels its degree of nearness or remoteness in our interest. The strongest evidence of this is the resemblance which exist between the university and school tables, which are identical except for two exchanges in adjacent names, which in one case are separated by one half, in the other by one tenth of a place only. It should be remembered that when a limited series is taken the actual size of the country may modify the predicted curve of displacement; since as the upper limit is neared the number of minus errors will necessarily predominate, and the plus errors as one approaches the lower extreme. This is shown in the case of the United States, in which all the factors of secondary association which predispose to exaggeration are at their highest, while yet the country is overestimated by only half a point. The United States is however second largest in the series, and the error at its maximum could therefore be only unity.

There is another source of secondary bias which might be expected to show in these tables. Geographical distance is commonly associated with remoteness of interest; and where not submerged by other and dominant factors of error, as in a series of cities of the same class, or minor physical features such as rivers, its influence would doubtlessly be discernible. But in the present case the actual distance becomes an insignificant element in view of the facility of information and intimacy of relation which may exist between places far apart. Peru is nearer than Palestine, but is incomparably more remote in every significant application of the term, and a series of ten countries is quite too short to permit the demonstration of any such minor factors of bias.

The second list comprised a series of ten rivers selected from the four continents according to the same principle as in the case of lands. The two sets of results are given in the tables on page 113, university students in the first and school children in the second:

The same general comments are to be made on these tables as on those which preceded. The first six names are the same in the two tables, though not in identical order, and the division

TABLE VIII.

Rivers.	Men.	Women.	Average.
Hudson,	+ 3.1	+ 3.6	+ 3.3
Thames,	+ 0.8	+ 3.9	+ 2.3
Danube,	+ 1.2	+ 1.4	+ 1.3
Rhine,	+ 0.1	+ 1.4	+ 0.75
Douro,	+ 1.3	+ 0.1	+ 0.7
Mississippi,	+ 0.9	+ 0.5	+ 0.7
Mackenzie,	— 0.7	— 1.5	— 1.1
Petchora,	— 1.5	— 1.2	— 1.3
Orange,	— 2.2	— 2.2	— 2.2
Lena,	— 2.7	— 4.7	— 3.7

TABLE IX.

Rivers.	A.	B.	C.	D.	E.	Av.
Thames,	+ 4.6	+ 4.0	+ 4.6	+ 5.4	+ 4.5	+ 4.6
Hudson,	+ 3.5	+ 3.7	+ 4.2	+ 5.3	+ 5.5	+ 4.4
Rhine,	+ 1.9	+ 1.9	+ 1.3	+ 2.5	+ 2.0	+ 1.9
Mississippi,	+ 0.9	+ 0.9	+ 0.9	+ 0.9	+ 1.0	+ 0.9
Danube,	+ 1.8	— 1.0	+ 0.9	— 0.3	+ 1.1	+ 0.5
Douro,	— 0.1	— 1.0	— 0.2	— 1.1	— 0.9	— 0.7
Mackenzie,	— 2.7	— 1.0	— 2.0	— 2.4	— 2.6	— 2.1
Orange,	— 2.3	— 2.5	— 2.2	— 2.3	— 1.8	— 2.2
Petchora,	— 5.0	— 2.1	— 1.6	— 1.6	— 2.2	— 2.5
Lena,	— 6.4	— 4.7	— 6.2	— 6.4	— 6.1	— 6.0

into plus and minus groups is just such as would be made on the basis of historical importance. The Mississippi River, like the United States in the previous list, falls low in the group because it lies near the upper limit of the series, the greatest possible error of overestimation being unity. The greater influence of association upon judgment in the present case, as compared with that of countries, is shown in the range of variation, which here reaches a sum of seven places in one set of figures and ten in the other.

The factor of nearness or remoteness is also perceptible in the estimate of rivers, as appears from table X, in which the series has been rearranged in order of distance from the city of New York where the returns were made out:

In the judgments of both university students and school pupils the members of the nearer group are overestimated on the average 1.3 places, and those of the more distant group underestimated to the same degree. The strong influence of this factor of bias is shown in the fact that it is not only dis-

cernible but pronounced in a series both so short as the present and marked by such a major disguising feature as that which guided the selection.

TABLE X.

Rivers.	University.	School.	Rivers.	University.	School.
Hudson,	+ 3.3	+ 4.4	Rhine,	+ 1.3	+ 1.9
Mississippi,	+ 0.7	+ 0.9	Danube,	— 1.3	+ 0.5
Mackenzie,	— 1.1	— 2.1	Petchora,	— 2.2	— 2.5
Douro,	+ 0.7	— 0.7	Orange,	— 3.7	— 2.2
Thames,	+ 2.3	+ 4.6	Lena,	+ 0.7	— 6.0
Average,	+ 1.18	+ 1.42	Average,	— 1.04	— 1.66

The third set of returns related to a group of American cities, which consisted of the capitals, together with one other place of importance, of five states of the Union. The names, as usual, were arranged in alphabetical order; and so far as came to the notice of the writer no one remarked the peculiar distribution of the cities in question. In the tabulations which follow, first of university students and second of school children, the names are arranged in pairs from each state in order to bring the errors of displacement into a clearer view:

TABLE XI.

Cities.	Men.	Women.	Average.
Albany, N. Y.,	+ 0.3	+ 0.5	+ 0.4
Rochester, N. Y.,	— 1.8	— 1.7	— 1.7
Trenton, N. J.,	— 0.3	+ 0.3	± 0.0
Camden, N. J.,	— 3.2	— 3.6	— 3.4
Harrisburg, Pa.,	+ 1.7	+ 1.8	+ 1.7
Allegheny, Pa.,	— 3.6	— 3.4	— 3.5
Springfield, Ill.,	+ 5.0	+ 3.5	+ 4.2
Quincy, Ill.,	— 0.8	— 0.5	— 0.6
Frankfort, Ky.,	+ 4.1	+ 3.0	+ 3.5
Newport, Ky.,	— 1.1	— 1.1	— 1.1

In both these sets of figures the influence of secondary bias is strongly marked. The size of the capital is almost uniformly exaggerated, while that of the other cities is underestimated. The error of displacement, whose extremes are separated by

almost nine places, is greater in regard to the distant cities, smaller in those which are near, with the exception of Newport, Ky. I can conceive no reason for this wholly anomalous case unless it has been confused with Newport, R. I., the social prominence of which might raise it to a position among the places overestimated. With this exception the second table, like the first, is consistent throughout.

TABLE XII.

Cities.	A.	B.	C.	D.	E.	Average.
Albany, N. Y.,	+ 1.3	+ 1.4	+ 1.0	+ 0.8	+ 1.1	+ 1.1
Rochester, N. Y.,	— 3.4	— 2.5	— 3.3	— 2.0	— 2.9	— 2.8
Trenton, N. J.,	— 0.3	— 0.1	+ 0.3	— 0.2	— 1.5	— 0.2
Camden, N. J.,	— 3.3	— 2.9	— 3.4	— 3.1	— 3.4	— 3.2
Harrisburg, Pa.,	+ 3.4	+ 2.3	+ 1.5	+ 2.5	+ 1.1	+ 2.2
Allegheny, Pa.,	— 5.3	— 5.7	— 3.8	— 4.1	— 4.1	— 4.6
Springfield, Ill.,	+ 3.8	+ 4.8	+ 4.4	+ 3.7	+ 3.7	+ 4.1
Quincy, Ill.,	+ 0.4	— 1.3	— 0.7	— 1.7	— 1.3	— 0.9
Frankfort, Ky.,	+ 3.1	+ 3.5	+ 2.9	+ 3.9	+ 2.9	+ 3.3
Newport, Ky.,	+ 1.5	+ 0.9	+ 1.5	+ 1.1	+ 1.4	+ 1.3

In this series it is useless to look for a demonstrable error of displacement due to distance. The number of cities is altogether too small for such a curve to be seen across the dominant bias of political significance. Were the group enlarged, or taken from cities of the same class, it would undoubtedly appear.

The fourth and final list consists of a series of historical characters, monarchs, statesmen, explorers — belonging to various nations, and covering in their range a fairly extensive period. The observer was asked to arrange these in order of time, with a view to ascertaining whether the important and familiar personages were conceived to have lived in more recent, the obscure and unfamiliar in more remote times than those in which their lives actually fell. The results are given as before in order of error quantitatively from plus to minus, the former indicating in the present case an underestimation, and the latter an overestimation, of the intervening period. The first table gives the rating by university students:

The making up of such a list of men presents more difficulties

than any of the preceding series, on account of the variability of their associations not only among individuals but also among groups, in consequence of which the form of the curve is subject to modification by other important forms of secondary bias than that considered in the selection. For instance, it is to be expected that the lines of national relationship should be accentuated wherever the parentage of the observers is relatively homogeneous, or that characters treated in pure literature should present increased bias in the reports of educated and reading subjects. It is probable, in this connection, that the fascination which personages of romance and glory possess for children has raised Harun al Raschid and Charlemagne to the level which they hold in the returns from the public schools.

TABLE XIII.

Names.	Men.	Women.	Average.
Drake,	+ 3.3	+ 2.3	+ 2.8
Champlain,	+ 2.5	+ 1.5	+ 2.0
Joan of Arc,	+ 1.3	+ 2.0	+ 1.6
Charlemagne,	+ 1.0	+ 1.8	+ 1.4
Harun al Raschid,	+ 0.1	+ 1.1	+ 0.6
Richelieu,	— 0.5	± 0.0	— 0.2
Franklin,	— 0.3	— 0.5	— 0.4
LaSalle,	— 0.6	— 1.6	— 1.1
Gustavus Adolphus,	— 3.0	— 2.9	— 2.9
Mazeppa,	— 3.9	— 3.7	— 3.8

TABLE XIV.

Names.	A.	B.	C.	D.	E.	Av.
Charlemagne,	+ 3.3	+ 4.4	+ 4.9	+ 3.9	+ 4.5	+ 4.2
Harun al Raschid,	+ 2.9	+ 2.5	+ 4.1	+ 2.1	+ 3.9	+ 3.1
Drake,	+ 1.1	+ 1.9	+ 0.9	+ 2.3	+ 2.5	+ 1.7
Joan of Arc,	+ 1.6	+ 0.4	+ 0.8	+ 1.6	+ 1.8	+ 1.2
Champlain,	+ 1.2	+ 1.5	+ 0.8	+ 1.2	+ 0.2	+ 1.0
Richelieu,	— 1.3	— 0.9	— 0.6	— 1.3	+ 0.2	— 0.8
Gustavus Adolphus,	— 2.4	— 1.3	— 1.3	— 2.2	— 2.0	— 1.8
Franklin,	— 0.6	— 1.4	— 2.3	— 1.8	— 3.9	— 2.0
LaSalle,	— 3.1	— 2.1	— 3.3	— 2.1	— 3.5	— 2.8
Mazeppa,	— 4.0	— 4.1	— 3.1	— 3.8	— 3.2	— 3.6

The aim in selecting the names comprised in the list was to avoid such special forms of bias by scattering them widely while ensuring general acquaintance with the characters chosen. The most unsatisfactory single feature of the group is of course

that of Franklin, who is at once the most recent and probably the most familiar of the series. No positive error therefore can ever occur in his case; and the name which would head the list were free displacement allowed appears here in the lower half of the scale. Nevertheless in spite of the change of direction in general interests which comes with age, the plus and minus groups are identically constituted in the two sets of returns. The illusion of relative perspective in time which is established in childhood concerning the great names of the world is neither corrected nor importantly modified in later life.

Several minor points remains to be noted in connection with the results in general. The reader may wish, in the first place, to know the relative magnitude of the average error for each class of objects respectively; in other words, which of these four groups of judgments manifests the greatest influence of secondary bias. This is shown in the following table:

TABLE XV.

Class.	Lands.	Rivers.	Cities.	Men.	Average.
Schools,	1.6	2.6	2.4	2.2	2.2
University,	1.2	1.7	2.0	1.7	1.6
Average,	1.4	2.15	2.2	1.95	1.9

A question may arise as to the nature of the prevailing type of error which gives form to the curves presented in this paper. A single displacement will produce in the results as many individual errors as the number of places it is removed plus one, and all of the series but one will be of the sign opposite to that which attaches to its own error. Thus if the fifth river of the series were put tenth its displacement would be -5, and the five rivers passed over would each suffer an error of $+1$. The frequency of plus and minus errors, independently of their quantitative values, therefore indicates the tendency which prevails in the judgments. These totals have been made out for the school children in relation to the ages of the pupils as shown in table XVI., which gives the average number of plus errors per series of ten judgments:

The two sexes are given separately, as their average would tend to obliterate the differences which exist. At all ages plus

errors are in the majority among boys, while in the case of girls an excess occurs but once. In so far as the figures have significance boys tend to err through the presence of positive underestimation of the less important members of the series, girls through overestimaiion of the more important. The intellectual illusion arises in the boy's case from ignoring the things which are of little interest; the girl errs through unduly magnifying the objects which she values. There appears also in the former case a progressive reduction in the excess of plus errors, which indicates the replacement of fewer and extravagant displacements by more frequent and systematic errors of interpretation.

TABLE XVI.

Class.	11.	12.	13.	14.	15.	16.
Boys,	5.7	5.5	5.5	5.4	5.2	—
Girls,	—	4.9	4.9	5.4	5.0	4.7

In the next place, the influence of these forms of secondary bias is manifested to a greater degree in the reports of school children than in those of university students as shown in Table XV., above, in which the figures indicate the average error of displacement in each series of objects for all observers concerned. In every class of judgments the mature group of subjects shows a more correct apprehension of the actual character and relations of the things compared than do the school children. Better acquaintance with the nature of these things through travel and reading, with possibly a more or less conscious recognition of and allowance for the element of subjective bias itself, has clarified the imaginative representation of them in the minds of the older persons.

Within the series of ages which the school returns comprise no correlation between age and decreasing error can be traced, the indices running as follows:

TABLE XVII.

Age.	11.	12.	13.	14.	15.	16.
Boys,	2.3	2.0	2.2	2.5	2.3	—
Girls,	—	2.4	2.3	2.3	2.3	2.8
Average,	2.3	2.3	2.2	2.4	2.3	2.8

The sexes are distinguished by an almost invariable difference in the magnitude of the errors involved. Men are more correct in these classes of judgments than women, and boys than girls. The figures for university students are given in the first of the following tables, those for the school children in the second:

TABLE XVIII.

Classes.	Men.	Women.
Lands,	1.14	1.25
Rivers,	1.45	2.05
Cities,	2.19	1.94
Men,	1.65	1.74
Average,	1.61	1.72

TABLE XIX.

Class.	Boys.	Girls.
Lands,	1.59	2.00
Rivers,	2.56	3.20
Cities,	2.57	2.60
Men,	2.23	2.70
Average,	2.24	2.62

This slight but persistent excess of error on the part of girls and women falls in with popular judgment concerning the susceptibility of mind in the two sexes to factors of subjective bias in general. The woman is supposed to be more prone to have her judgment of things and their relations in the external world distorted by the influence of their various symbolic values; the man is regarded as more objective and impartial in his apprehension of the contents of experience. Man's knowledge is discursive and the manifold aspects of reality are held in relatively independent regard, while in woman's mind the various interpretations of the world tend to overflow and confuse the classifications to which their special points of view give rise.

For the convenience of those who may wish to compare their own series of judgments with the results here presented the various countries, rivers, cities and men are given in correct order in table XX.:

Table XX.

Lands.	Rivers.	Cities.	Men.
Siberia	Lena	Rochester	Charlemagne
United States	Mississippi	Allegheny	Harun al Raschid
Peru	Mackenzie	Albany	Joan of Arc
Afghanistan	Danube	Camden	Drake
German Empire	Orange	Trenton	Champlain
Italy	Rhine	Harrisburg	Richelieu
Iceland	Petchora	Quincy	Gustavus Adolphus
Ceylon	Douro	Newport	LaSalle
Switzerland	Hudson	Springfield	Mazeppa
Palestine	Thames	Frankfort	Franklin

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MIND AS INSTINCT.

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The Problem Stated.

The thesis I wish to maintain in this paper, for purposes of simplification, is that all of our adjustments or categories, viewed from the individual or causal point of view, are instinctive or organic adjustments; that the stimuli, which constitute the environment, are simply the occasion for calling into play the structural tendencies of the organic growth series and that such categories, as recapitulation, imitation, and accommodation are pseudo-categories, stating certain results from the point of view of another consciousness, but not explanatory of the real process of consciousness. This I believe to apply to the whole history of individual consciousness, and not simply to its initial stages. If this thesis is true, there is no such thing as acquired characteristics, and progress must take place through spontaneous variations and natural selection.

The old idea of the evolution of consciousness as a continuous series, statable in terms of simpler processes from which the more complex were supposed to be compounded, has gradually become a thing of the past. Sensationalism, simple and plausible as it seemed, has been proven inadequate, and psychology is now looking not to chemistry, but to evolutionary biology for its cue. The reason for the discontinuity of the psychic series or its leaps and starts is that psychological process waits upon biological structure; and only when the biological conditions are complete do the new forms of consciousness leap forth as mysteriously as the wonders in rubbing Aladdin's lamp. The lamp is the thing, and just that kind of lamp, though of course the magic result would not follow unless the lamp were rubbed. With the perfection of the mechanism of the eye, to use Loeb's illustration, and the complicated structural conditions

for sight, light leaps into being. So with the mechanism of the ear and the wondrous world of sound.

The stages of consciousness at any rate are abrupt, however graded may be the development of the structural conditions. First of all, whether there is prenatal consciousness or not, consciousness waits upon certain antecedent structural conditions before it appears at all. Before the appearance of consciousness the fœtus in response to certain stimuli of temperature and blood supply has already unfolded a structural series embodying the revolutionary results of variations and survival of untold ages. But the unfolding of structural characteristics does not stop with the appearance of the first vague consciousness. In obedience to stimuli, intra- and extra-organic, the organism continues to grow and to develop new structural characteristics, and as the structural conditions reach certain stages of complexity there appear new forms of conscious response. Let us for our purpose state the dramatic stages as three: First, sensitiveness or immediate consciousness; secondly, associative memory and expectancy; thirdly, reflection, the analyzing out or making focal, to use Lloyd Morgan's term, certain relations and abstracting them for the better manipulation of the concrete situation. Now the thesis here maintained is that the successive appearance of each of these stages of development, with all their intermediaries, is equally organic and abrupt, the unfolding or growth of a structural series in obedience to certain stimuli, which do not make the series any more than the heat of the incubator makes the chicken, but which are simply the conditions calling forth the series; the stages of development from first to last, as well as what stimuli are effective, being determined by the nature of the organism, which again is what it is as a result of spontaneous variation and natural selection.

It is wrong to suppose with many recent psychologists and biologists that the human brain is essentially unorganized and that the environment organizes it. The environment, whether physical or social, can only furnish stimuli. The human brain is far more complex and minutely organized than that of any other being. But while the brain of the animals below man has a comparatively short dynamic span and the few instincts appear

practically together and mature shortly after birth, the human organism has a long dynamic span with an organic series of instincts maturing in a certain order. Natural selection has here provided for an hierarchy of instincts. But the law of development is the same: a certain congenital structural order unfolds itself in response to certain stimuli. That this structural development is in response largely to post-natal and extra-organic stimuli in the human being does not alter the instinctive character of the process. If we define instinct as a response to stimulus determined by congenital structure, then we may reduce all mental process to the category of instinct. The only question is as between earlier and later or simpler and more complex instincts. What must not be forgotten is that the growth order of our instincts, as well as the number of our instincts, is congenital. How it is that a growth order can be inherited and in what way the seemingly indefinite protoplasmic material can develop in mere response to stimuli a series of tendencies is as dark as is the problem of causation generally, and of transmission of characteristics at all in particular. We do not doubt, however, the innateness of the sexual response, though it is conditioned in the case of a human being by a complex and long series of structural growth. This one instance ought to convince us that the survival variations operate not only sectionally, but longitudinally in the stream of development. The absurd supposition of the English empiricists that innate is synonymous with that with which we are born and that the rest is acquired, is once and for all exploded by biology. Development before and after birth is due alike to an inner structural tendency unfolding in response to stimuli.

To suppose, therefore, as contemporary psychology still does, that the higher mental activities are complications of lower activities, that, for example, associative memory is simply the result of sensations and habit, that concepts are only a specific kind of association, and that thus the higher strata of experience are built right up from the lower is simply substituting chemical metaphors for explanation. If images were the complication of sensations merely, why is it that some of the animals lower in the scale, which show signs of sensation and habit, never

acquire images? They must have sensations enough — probably a larger variety than Helen Keller. And, again, if concepts and judgments are simply associations, why is it that animals with complex associative mechanism do not show any sign of abstract analysis? It is surely not the fault of stimuli, as they are surrounded by the same world in which we exist, hear the same sounds, and have the same variety of light and color. The higher types of reaction are not, therefore, compounded out of the simpler, though they may presuppose these. They are the result of structural development, not of functional adaptation. Given the inner structural equipment and we cannot help remembering and reasoning, but without that stimuli are of no avail. Let us now inquire a little more in detail into the stages of instinct.

Stages of Development and Their Characteristic Instincts.

Each of the stages or leaps of development mentioned above, sensitiveness, associative memory and reflection, has its own characteristic instincts, which emerge with the structural growth of which the above stages of consciousness are the coefficients. I do not deny that there are intermediary stages less dramatic, but those we can afford for our purposes to neglect. Nor must I be understood as holding that associative memory and reflection are in any sense creative of instincts. On the contrary, the later instincts may be said to be creative of them. They are simply the structural machinery which has proved serviceable, if not essential, in the unfolding of certain instincts, and hence this machinery has been grafted on the instincts or become congenital.

1. *The Sensitive Stage and the Primary Instincts.*

The instincts on the sensitive stage, and before that on the merely physiological, are relatively simple and general in character. They respond to a relatively primitive environment.

Looked at from a later point of view they are altogether egoistic, *i. e.*, they have to do with individual preservation, in the way of defensive and food getting series of reflexes. An

intricate series of structural adaptations has become purely mechanical when we have a chance to observe, such as the machinery for digestion, circulation, breathing, etc. If natural selection, acting upon spontaneous variations, has been able to perfect such a network of interrelated processes, with such continuity of operation as we find, for example, in digestion, from the preparatory seizing, deglutition and swallowing until the substances are converted into blood or carried off as excrement, we ought not to be staggered at the thought that our adjustments in general are a chain forged by natural selection and simply rattled off by the environment, making due allowance for the mechanical character of this figure.

The instincts that are usually credited to a human infant are such as grasping, sucking, crying and sneezing. A comparison is drawn between the human infant and the chicken, for example, to the advantage of the latter. That is misleading, however, as the human chick is still being fledged in response to external stimuli. Thus the development of sense and motor coördinations, and the coördinations of the senses with each other during the first weeks of the human infant are no less instinctive though they take place partly in response to extra-organic stimuli. It is the growth series of the organism that produces the instincts. The extra-organic stimuli stand in no different relation to the child than the prenatal stimuli to the chicken. The superiority of the child's development lies in the larger range of its stimuli, not in its less instinctive character. The same may be said of the more complex motor coördinations for walking. These are not learnt by experience. They de veloped even when an absurd system of swaddling clothes prevented functional adaptation. The human being is simply a long time being fledged. Using later categories, as we are forced to, we may say that the infant reactions at the outset are more general than those of the chicken, though here too we have to be cautious, as the reactions of the chicken are probably much more general than was supposed by early investigators. The chicken, according to Morgan, does not have a special response for the hawk, though it has a certain response for a certain *kind* of stimuli that have instinctive terror. It is probable that

instincts even lower down start as universals, but that does not prove that the process for making them more definite is any less instinctive. Only that natural selection has deferred this part of the series until extra-organic stimuli should be available.

If we look at the conscious side of the more primitive instinctive adjustments we find ourselves on a rather speculative foundation. Where consciousness is not efficient, its presence must naturally be conjectural, and a large number of reactions not only in the lower animals but in human beings can be treated as tropisms. The going off of the early instincts is largely a penny in the slot affair, to use Lloyd Morgan's figure. Consciousness is at first at most a spectator. If consciousness is present the proper working of the slot is accompanied by a pleasure value, the improper by pain. Thus likes and dislikes on one hand and reactions, advantageous and disadvantageous to the organism, on the other tend to coincide. But it would be wrong on that account to emphasize the part of pleasure-pain in the evolution of instincts, for, on the one hand, complex structural adaptations exist which seem purely physiological, and on the other hand, where pleasure and pain now indicate survival value, it is simply because as a result of the sorting of natural selection they have survived. Where the environment changes rapidly and where the law of natural selection has not chance to operate, pleasure and pain are not sufficient guides. Witness the cows transplanted to South America, which took pleasure in poisonous weeds, and the birds on the South Sea Islands spoken of by Darwin, which lacking the instinct of fear toward man paid the penalty until they were either exterminated or established the instinct. Witness, too, the large number of pleasures in human beings such as indulgence in opium, alcoholic liquors, and various forms of sexual excess which are pernicious and on which the law of natural selection has yet failed to operate. Pleasure and pain have indeed become a vital part of the functioning of some instincts, though of others not. It surely would be absurd to try to state our primary instinctive reactions in terms of mere subjective teleology, as some seem inclined to do at present.

The stimuli which make the slot work may be qualitative

differences, such as loud sounds or brilliant lights, or they may be behavior stimuli, which call forth similar movements in the individual. But in either case we have simply a stimulus as setting off a congenital structure. The reaction on behavior stimuli is sometimes called imitation. But this is the significance of the reaction to the psychologist, who compares it with the behavior stimulus. It is not imitation or accommodation to the child or animal. It is simply a case of a fascinating stimulus, which is only another name for fitting the slot and the slot going off. Interest always waits on tendency. If the child prove to deviate or to be original in its imitation from the spectator's point of view, that is because it does not imitate but responds to the stimulus in a way dictated by its structural tendencies. If it continues the process, that is not for the sake of approximation, but because given such structural tendencies it cannot help going off and feeling a satisfaction in the process.

Sometimes instincts are explained as recapitulation, and they do indeed have a long survival history back of them. But to call them recapitulatory is again the point of view of the external observer who compares the reactions with those of ancestors. But the individual on the level of sensitive consciousness at any rate does not act to recapitulate his ancestors. The spring for the action must be found in his own organic machinery, whether it agrees or disagrees with that of his ancestors. There is no such thing as evolution in the sense of simply marching the old categories upon the stage again as implied in recapitulation. The machinery for imitation, accommodation, and recapitulation only exists when the individual has in mind a copy of the behavior of others, whether past or present. But even on that level the springs for the action must be sought in the individual structural tendencies. He does not imitate because of imitation or recapitulate because of recapitulation, but because he is wound up in such a way that such stimuli appeal to him or set him off. Such categories as imitation, accommodation, and recapitulation are not explanatory categories, they are simply comparisons as made by an observer external to the process. They are pseudo-categories.

2. *Associative Memory and the Secondary Instincts.*

While the stimuli are playing the primary tendencies and under the shelter of the parental and other social instincts of the individuals of its immediate environment, the organism is busy perfecting the structure for the later instincts with their more complex machinery. These we may call secondary, though that does not mean that they are less instinctive. They only presuppose a greater structural differentiation. Lloyd Morgan speaks of the mother hen protecting the chick from the law of natural selection. That is true in the chick's individual capacity, but we must not forget that it is as a result of natural selection that the parent has its parental instincts which shelter the newly developed chick. Before the chick has social feelings it has the shelter of social feelings. Natural selection has operated to produce a group supplementation of instincts. It can thus telescope the undeveloped structure into the later structures of other individuals, at the same time providing in the behavior of the more developed members of the group the stimuli to call off the dynamic tendencies of the immaturer developing structure, thus lengthening the dynamic span and increasing its developmental possibilities. It must be remembered, however, that the social environment occupies exactly the same relation to the developmental series as the physical. It can only furnish the occasion or stimuli for calling off the dynamic series. There is no social heritage in any other sense than there is a physical heritage, a set of stimuli, pennies for the slot that will make it go off, if they fit.

Looked at from the point of view of race history, the mechanism for associative memory must be regarded as a lucky variation or an accumulation of variations which make it possible to live an experience again, given an internal or external cue; which make it possible, therefore, to guide the present beck of stimuli with reference to consequences of past experience, thus making instinct more definite and serviceable, a reaction on particulars and not merely on a vague kind. The survival value of such an organic leap must have been momentous. For whatever history of accumulations of survival this machinery may represent on its structural side, from the point of view of con-

sciousness it is a radical leap. There is no way of reducing efficient consciousness into simply mere consciousness of the concomitant or spectator kind; no way in which the play of immediate impulse with its simple machinery of tedious trial, gradual elimination, and dumb, monotonous habit can be made to yield a picture of the past result and a short cut to reaction on the basis of it. Using the penny-in-the slot illustration again a new mechanism has been introduced into the slot that not only makes the slot register its going off, but also uses as guide the structural picture in its next going off.

But the new machinery is still essentially a slot. It is conditioned through and through by organic tendencies: organic tendency in the form of instinct conditions interest; organic tendency in the form of habit makes dynamic continuity possible; and organic tendency as specialization of structure conditions the kinds of imagery or content the operation shall have. While the machinery, therefore, is vastly more complex and immensely more efficient in its greater scope of coördination and its greater economy of effort, it remains as organic or instinctive in character as before.

With the perfecting of the machinery of associative memory there leap into being in their proper order a totally new group of instincts, the social instincts. While these instincts are conditioned by the more complex structural machinery, that does not mean that they are the result of associative memory. The latter might make us more efficiently egoistic, but could not change our fundamental attitude. The social instincts are rather the rationale of the more complex machinery than vice versa. Only thus could the social instincts become efficient. But with these instincts and the associative mechanism the individual is equipped for the beginnings of group life with new possibilities and necessities of survival variations.

That associative memory and the fundamental social instincts are interdependent is shown not only by observing the coincident appearance of the two in the development series, but more conclusively by the vivisectional and pathological methods. In the experiments of the removal of the hemispheres of the dog, the pigeon, and the frog, for example, it has been shown

that all social, which here means primarily sexual, response vanishes together with associative memory. The same is shown in wide-spread injury in the human brain, in such a case as that cited in Huxley's essay on Animal Automatism, and in the recent case in Paris of a human being born without hemispheres. Regarding the matter merely logically, it is hard to see what social could mean apart from representation, though representation can be conceived without sociability. But while the social instincts thus wait upon a certain structural development that makes them no less organic and fundamental in nature.

There are, properly speaking, no such things as social categories. Imitation, sympathy, the whole list of sexual, parental and more general group responses, constituting social fitness, must be reduced to individual variations, which have proved to have survival value and which in turn have come to condition the survival of individuals exceptionally lacking or over-redundant in such variations. What environment furnishes and all it can furnish is the stimuli and the survival conditions.

3. *Reflection and the Tertiary Strata of Instincts — The Ideals or Sentiments.*

While the environment is finally playing the primary and secondary instincts, and under the shelter of the later ideal tendencies or sentiments of the group, the human organism is perfecting its structural machinery for the issuance of a new set of instincts — demands that have to do with the unity and meaning of experience. Given a certain complexity of our registering slot, and there appears the power of analysis and abstraction. This again is a leap, perhaps the most wonderful leap of all. Consciousness by a new device is able to hold its head above the passing stream and survey the before and after. It no longer merely *is* but *sees* the passing events. From the point of view of race history it means a lucky structural variation or accumulation of them, which changed the whole course of evolution by giving meaning to the process and thus establishing new survival values. With the individual, however, reasoning, as habit and associative memory, is congenital, appearing when the proper structural series has been passed through in

response to the stimuli of the environment, which now first become problems.

Some psychologists have held that reasoning has its beginning in language and that it is in language that man is especially superior to the animals below him. But language in some form can exist without reasoning, as is shown in animal life and as people's creeds and platforms still testify. Given the structural machinery for abstraction, and language becomes an indispensable instrument and so has developed to answer the demands of reflection. Nor can reason or meaning be reduced to lower forms of consciousness. It is not more of dreamy association, however complex the latter may become. It is a new attitude. However much its genesis may exceed our comprehension, we have now the structural machinery for holding ourselves, *i. e.*, our primary and secondary instincts, at arm's length and looking at ourselves, a mechanism which furnished us with those tools by means of which we can break up our world and select those relations and objects that have meaning and value for us, instead of dealing with the world as a collection.

With the structural machinery for reason there appear a new group of tendencies, demands for simplicity and consistency, for unity and wholeness, for truth, for right, for happiness, for beauty, for a religious and philosophic setting for our tendencies or needs. From the vantage ground of this new structural differentiation the primary and secondary instincts can be surveyed and evaluated, and a whole constituted. Yet our bias for simplicity and consistency, our sentiments for truth and beauty, are in their deepest roots instinctive, however luminous they have made the pathway of life. The deepest attitudes towards the universe were never invented by man; they are not the result of a consensus of opinion; they are presupposed, on the contrary, in all our reflections upon life. Without them we should not have raised the question of why and wherefore nor have felt the need of a consensus of opinion. Our highest activities, therefore, no less than the most primitive, move within instinct, are the response of our organism to the call of the environment. Before these instinctive demands existed there

was no call, for the environment spoke to deaf ears; there was no riddle of the Sphinx, only a vacant stare; no order, but only the passing show of meaningless events.

It has been said as a criticism against Kant that his categories are shot out of a pistol. This is true of reflection generally, as well as its fundamental categories. Reflection, analysis or meaning, when it appears is not more complex associations merely. It is a radically new attitude. It did not grow out of previous non-reflective experience, however complex. Stimuli, intra- and extra-organic, have been acting upon the organism. These have been the occasion for the organism unfolding its structural series, according to its own inner dynamic unity, until at the beck of the ever-active environment there leaps forth reason, abruptly as Athena leaped from the head of Zeus and mysteriously as Aphrodite rose from the sea. The self is awake instead of dreaming. This could not be due simply to the call of the environment, for that has been comparatively stable. Rather the reason for the call being a call must be sought in the new structural conditions perfected for the purpose. Just as sexual love appears at a certain stage of development, when certain structural conditions have been completed, and a totally new response is made to old stimuli, so reason appears suddenly and unsolicited, when the structural series reaches a certain stage. We ought to speak, therefore, of falling into reflection as we speak of falling in love. This I need not say has nothing to do with Flechsig's attempt to establish a distinct anatomical center for higher mental processes. This theory no more stands or falls with his success or failure than does the instinctive character of sexual love with the phrenological bump of amativeness.

What has been said of the more general categories holds equally for the more particular preferences and tastes that go to differentiate one individual from other individuals. Imitation no more on the higher than on the lower levels creates tendencies; but a certain stimulus is the fascinating thing, because a certain structure is set off. The illuminating sanity of James, Royce's æsthetic bias for an Hegelian absolute, and Münsterberg's love of diaelectic — all are organic, *i. e.*, condition, and are

not made by environmental stimuli. There is a certain sameness indeed in our categories and preferences, in-so-far as we are normal, due to survival conditions. This is especially true of our moral tendencies which would be especially concerned. Beyond the dead level, however, which keeps us out of the penitentiary or the insane asylum, our tendencies or preferences vary vastly. Here natural selection is tolerant of sports, and the more so the more evolution progresses. This helps us to understand the different tastes which become creative of such different types in philosophy and art. It also accounts for the utter lack of finer æsthetic or philosophic appreciation in the larger number of men. These are so far aristocratic variations.[1] Yes, if we are poets or artists or philosophers or scientists at all, we are born such, and not only to the class but to that particular type that characterizes our contribution from that of others, though of course owing to a defective environment our tendencies may never be played so as to develop the possible scale of values. Only the other day I was startled by the striking resemblance between a cabman and a great philosopher that I know. Had the environment played the scales with some degree of skill, the cabman might have been a philosopher and with a different set of stimuli the philosopher might have been a cabman. Again, we find too often those lacking evolutionary qualifications holding down the job; and men without philosophic insight respond with a feigned adjustment of mere words, as the color blind man classifies the beautiful world of colors in his own series of dull grays. Sometimes the lack of native equipment is in more elementary tendencies as in the incapacity shown by some people for the rudiments of number or language, sometimes it seems a lack of the more fundamental moral tendencies, though the clumsy and unnatural order of our stimuli may be responsible rather than the native equipment. Out of the young criminals committed to the Iowa Industrial School at Eldora about eighty per cent. turn out honorable men.

[1] Of course, in the progress of civilization, tendencies such as the higher æsthetic may become more universal as an equipment of the race; and 'he that hath no music in himself' may in such a state of society be regarded as 'fit for treasons, stratagems and spoils' and dealt with accordingly. A higher moral equipment, at any rate, is gradually demanded.

If we say that what is native is docility, then at least we shall have to use the plural or docilities, because docility in one direction need not mean docility in another. But what does docility mean? Is it not like imitation, a mere name for a result? Is not man docile in very much the same sense that the slot is when the proper coin is put in and it works? A man may be docile as regards things intellectual and not to things æsthetic, to one kind of intellectual things rather than to another, and to one kind at one stage of his development, to another kind at another stage. Docility, then, must find its explanation in the fact that certain tendencies or instincts can be set off by a certain kind of stimulus.

While the machinery of reason was evolved for the sake of the earlier instincts and those that came into being with it, the machinery in some individuals, as a result again of variation, has become detached from the earlier strata and runs with wheels free. This is one of the forms of play, in other words, and the mechanism of reflection thus subserves a double purpose, that of coördinating the more primary tendencies and that of mere play, whether as abstract reflection and system making or perhaps working in the more picturesque material of concrete images, instead of words, in obedience to the sentiment for the beautiful. This play purpose of the reflective machinery may altogether eclipse the primary purpose, but even here the machinery is run by instinctive demands.

We have sketched broadly three stages of mind with their characteristic instincts and their characteristic mechanism for making the instincts effective: First, the stage of physiological or sensitive reaction, where consciousness is a mere spectator. Here appear the egoistic preservative instincts. The mechanism here is trial with gradual elimination and habit. Secondly, the stage of associative memory, where an image or past result can guide the reaction. Here appear the social instincts. This stage is vastly superior to the preceding in its coördination, in the complexity of its instincts and the economy of effort. Last of all we sketched the stage of reflection or meaning with the apparatus for survey, for selection, abstraction and substitution. With this appear the ideal instincts or demands. We have

seen too that each earlier stage as a result of natural selection can be telescoped into a later stage of the group by the providential arrangement that all individuals are not of the same age, but that the parents by the virtue of becoming parents have developed a later set of instincts, sheltering the offspring in their earlier stage and furnishing stimuli for the development of the structural series. As the later instincts appear, however, the earlier are telescoped into the later in the same individual and the later become the guides and the sheltering foster-parents of the earlier. Even on the reflective level the instinctive stages retain something of their integrity. We are not always, indeed very seldom, reasoning. In that case the next lower court presides. But even this may sleep or be disattached from the lower centers, and then the lowest presides. Or, taking a cross section of the reflective stage, while attention selects certain aspects as focal, in the marginal field we shade off into the more primitive stages of consciousness through borderline associations into dim awareness. And so the stages of race history repeat themselves in their general outlines, not only in the stages of individual history, but every day and, in fact, coexist in one attention moment the whole distance from tropism to reflective meaning.

The purpose of the mechanism of instinct, whether habit or associative memory or abstraction, is to make instinct more definite. Instincts are at first universal. They are fitted to go off at a certain kind of stimuli, on the lowest level a very vague kind indeed, but more limited with each stage. There is a good deal of difference between taste in general and taste for music. Habit is at best a clumsy device for limiting the kind, but memory makes possible reaction upon a particular, while the reflective machinery makes possible descriptive definition.

The whole series of life can thus be expressed in instinctive terms, both as regards content and mechanism — meaning by instinctive reaction a response that is called off as a result of organic structure, given the proper stimulus. We are such mechanisms as to develop in a certain structural order and to respond at certain stages in certain characteristic ways given a certain range and order of stimuli. The failure to call forth a

certain tendency in its dynamic order may fail to call forth other tendencies, as some tendencies are dynamically conditioned upon each other. Thus the failure to respond to sexual love must mean the failure to call forth the paternal tendencies and the failure to present the situations of danger and sacrifice must also fail to call forth the heroic tendencies. It is here that we are helped to some extent at least by the ideal situations of poetry and art.

Tendency and Environment.

It is clear now that the nature of the environment and with it the survival value of tendencies varies at each stage of development. In the early stages of evolution, survival is a matter of individual fitness based upon certain primary tendencies and their gradual definition by means of habit. Then the social tendencies emerge and survival value must be writ in tendencies that supplement each other so as to make group life possible. The primary instincts are thus telescoped into the more complex secondary instincts with their mechanism of associative memory. Last come the ideal instincts, that appear with the power of analysis and abstraction, and primary and secondary instincts must be telescoped into these tertiary instincts in order to meet the conditions of survival. With each stage of evolution instincts become more numerous and complex, and as the later individuals become part of the survival conditions to be met, the survival conditions become more complex.

But with greater complexity goes also greater freedom of development. The transmitting of variations is not limited to those immediately involved in survival; and in the greater differentiation of labor possible under an industrial regime, survival takes many directions. Thus a greater variety of tastes makes possible a wider range of survival. There is room for the musician and actor and sign-painter, as well as the mechanic. Then, too, the instinct of pity or sympathy shelters the unfit, for the time being at least, thus complicating survival conditions.

Survival conditions never change more rapidly than in a

civilized environment. While in one generation an artistic genius starves to death on his art, in another he can dictate his own terms provided his style of art becomes a fad; while in one generation a man would be deemed insane for printing or making furniture by hand, when factories can turn out as serviceable goods by the millions, in another he can become wealthy and famous besides; while in one generation the stake, the cross and the gibbet cut short the opportunity of the heretic from propagating his doctrines and the species, in another he gets the praise of men and the fat salaries, while the orthodox man is doing the starving stunt. And so it goes, all because different ages produce or at least stimulate different tendencies.

It is clear, then, that Spencer's idea of a finite static environment which would permit of absolute adjustment once and for all, and a consequent relapse to the level of the primary instincts, neglects the fundamental nature of the evolutionary process. Environment is not merely the mechanical and stereotyped part of nature, but first of all man, and in man the evolutionary process so far from having stopped is going on only with more rapidity as it becomes more complex. Our environment never was more in the making than now and never furnished as large or rapidly shifting a scale of selective values. If the old men just now are in danger of being shelved, as is often complained, it is not so much because they are old as that they grow stereotyped and cannot keep up with the rapid rearrangements. The young old men, the geniuses of the race, were never more valued.

What the social environment does, then, as embodied in human behavior and in the products of mind, is to furnish ever new stimuli and more complex survival conditions. What the individual must do to respond to the fullest extent is to meet the new demands with the corresponding variations. Fortunately it is not necessary to respond to more than a small number of the physico-social characteristics in order to survive. Only an absolute being could be equipped to respond to the universe point for point. A man may reach the highest eminence of social usefulness by the narrowness of his speciality, if for the rest he conform to certain general survival tendencies such as honesty and truthfulness (and I regret to say that does not always

seem necessary at present). Thus he may rise to the highest efficiency in the business world without responding to things philosophical, artistic, or even religious. A genius is one who is gifted with an unusual variation, either in the direction of that which has no direct survival value but calls off the play tendencies of man, such as art, or in the direction of greater survival advantage, as in the case of the moral prophets or the inventors of tools. Nothing is more obvious than the marked difference in the range as well as quality of response in different individuals. Some brains, as those of the idiot, are remarkably opaque, others, like those of the genius, show a wonderful power of refracting light in brilliant and unusual ways, but each mind reflects the light by virtue of its own constitution as manifest in each stage of the series.

We get as much value and significance out of nature and institutional life as we have corresponding tendencies. To the man who lacks the play of æsthetic tendency and who is preoccupied with the primary and secondary instincts 'sunset and evening star' are nothing, except perhaps a weather sign. In the words of Coleridge,

> 'O Lady, we receive but what we give
> And in our life alone does nature live.'

And so with the institutional equipment of the race. Our religious tendencies determine our religion, not the opposite. If we lack the feeling toward the supernatural and the sense of dependence, religion is not for us. If we are lacking again in æsthetic appreciation it is very natural that we should deem art useless or worse and proceed to make bare the temples, or even destroy them as some would-be reformers did. As the difference in creeds and the dread of hell disappear, religious denominations will separate in their worship on the ground of the real psychic preferences of individuals as regards the emphasis of the ethical, the mystical, the æsthetic, or the philosophical tendencies, always with the possibility of course that the more primary tendencies of custom and loyalty may keep a man where he does not psychologically belong. Institutions are created by our tendencies and they are properly selective of us only as they make tendencies go off in us.

That is as true of the state and family as of religion. The fundamental virtues which underlie social life, such as honesty, truthfulness, and kindness cannot be produced in people. The exciting of other tendencies, such as fear and gain may produce counterfeit reactions for those mentioned above, inhibiting the original tendencies. And some people live a respectable life that way no doubt. But it is a great mistake to suppose that because the child at one stage of its development reacts largely on the basis of the primary instincts and shows no sense of truth, or honesty, or kindness, or beauty, that, therefore, these tendencies are produced at a later period. They are acquired no more than love is acquired as the nervous system matures, though an awkward regime of stimuli may indeed fail to set them off. Our bias for landscape painting instead of character sketches; Ingersoll's fondness for the babble of the brook and fear of Niagara; our preference for the cathedral to the Quaker meeting house, in so far as preference is active; our enjoyment of lyric sweetness rather than the searching of tragedy, — all these preferences are conditions or presuppositions of our experience; and while they may be violated or forced by the environment, cannot be produced by it.[1]

[1] I take pleasure in acknowledging my indebtedness to other workers in this field, especially Principal C. Lloyd Morgan and Professor James Mark Baldwin, who by their splendid works have directed me into this field of thought.

The MS. of this article was received July 1, 1905.—Ed.


Gustav Theodor Fechner
·Born April 19, 180· Died November 18 188·

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The Psychological Review.

THE FECHNER NUMBER.

We are glad to devote this issue of the Review to the memory of Fechner, and count the Review fortunate in having so worthy a contribution to æsthetics with which to mark the year. For it will be remembered that it is just forty years since Fechner[1] — in 1866 — laid down his principle of Association. The time of year is also appropriate; his birthday is in April. We fully concur also in the hope expressed by Professor Martin — adding it as our opinion — that the striking case of semi pseudo-chromæsthesia,[2] reported in her article, and the evidence that illusion plays such a part in the æsthetic judgment, give greater content to Fechner's law of Association than has been heretofore supposed. We are indebted to the Open Court Publishing Co. for the privilege of using the portrait of Fechner that serves as frontispiece of this number. — J. M. B.

[1] See Fechner, *Vorschule der Æsthetik*, Part I., Vorwort, p. 5, also Part I., pp. 86–135.

[2] Called 'semi pseudo-chromæsthesia' appropriately by Miss Martin, I think — expressing a personal opinion — since it is so largely associative in its origin and also in some degree variable. It would be difficult, on the basis of this case, to hold that the inherited and constant synæsthesias are due to association.

AN EXPERIMENTAL STUDY OF FECHNER'S PRINCIPLES OF ÆSTHETICS.

BY PROFESSOR LILLIEN J. MARTIN,

Leland Stanford Junior University.

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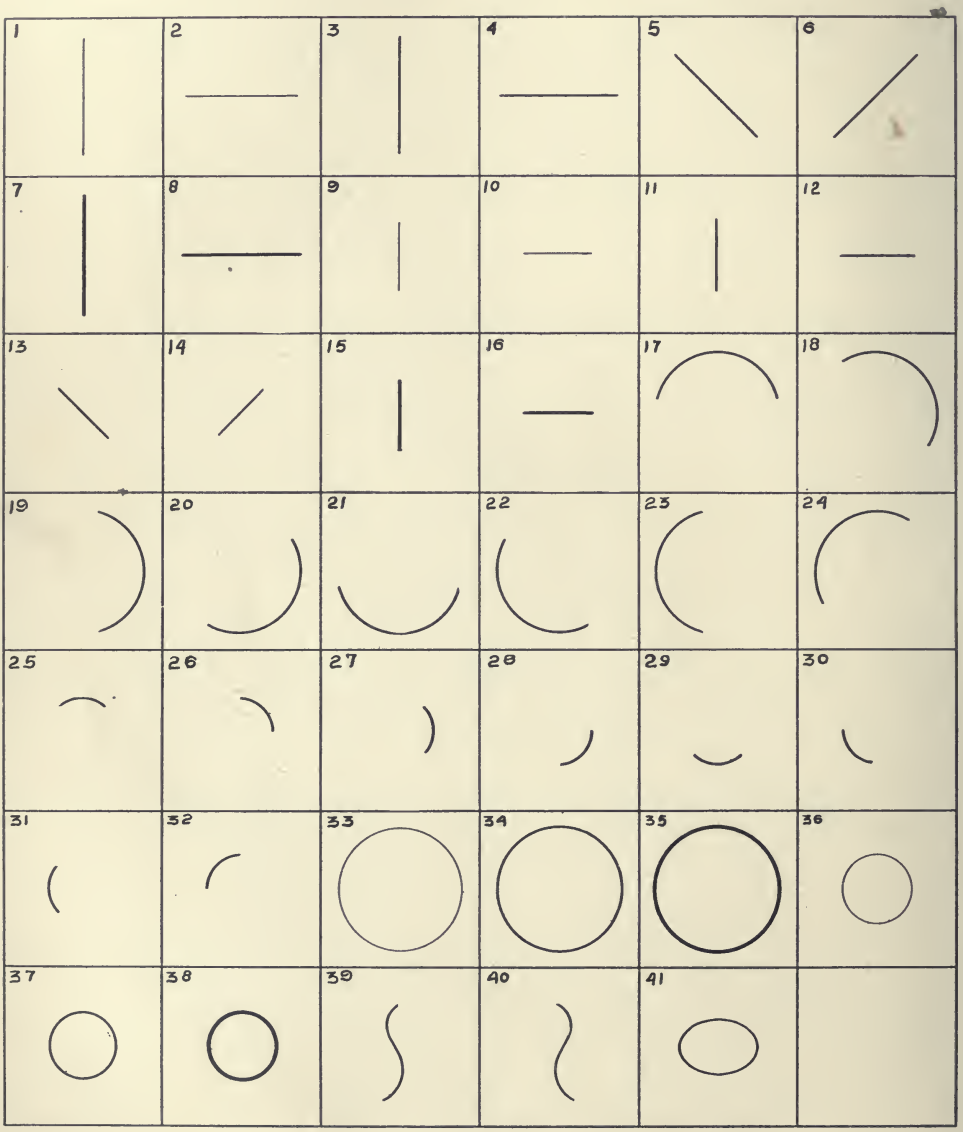
In the first part of his *Vorschule der Æsthetik*, Fechner has laid down five principles of æsthetics — the principle of the æsthetic threshold; of æsthetic help or increase; of the unified combining of the manifold; of noncontradictibility, of agreement or truth; and of association. In the second part of this work he has added seven subordinate æsthetic principles — that of contrast, sequence and reconciliation; of summation, practice, blunting, habit or custom and of satiety; of persistence, of change, and of the amount of occupation; of the expression of pleasure and displeasure; of secondary pleasurable and displeasurable ideas; of the æsthetic mean; and of the economical application of the means. This study was undertaken for the purpose of testing the validity of certain statements made in the principles themselves or in their discussion. Such an investigation seemed desirable in that Fechner's illustrations, especially those given in connection with the subordinate principles, would lead one to suppose that the conclusions drawn were based, partially at least, upon phenomena which are, properly speaking, scarcely within the field of æsthetics. It was thought, moreover, that in a study of this kind something of value might be contributed regarding methods in experimental æsthetics although, of course, any contribution made in the present undeveloped state of this subject must necessarily possess a somewhat pioneer character.

It should perhaps be added that the writer does not 'append[1]' at the close of this study any new principles of æsthet-

[1] See review of Martin's *Psychology of Æsthetics*, I., 'Experimental Prospecting in the Field of the Comic' published in the PSYCHOLOGICAL BULLETIN for September 15, 1905, in which the writer regrets that the author did not 'append' a 'theory of the comic.' As a matter of fact the author did state (see p. 111) the theory of the comic that was 'most fully sustained by the answers to the questionary and the results of the experiments,' although it was intended merely as a statement summarizing the results obtained with one class

ics. In fact she has none to offer at this time, nor does she feel that it will be possible for any one to lay down satisfactory and complete æsthetic principles until a very much larger amount of experimental data has been collected. She feels that orientation in regard to the facts is what is most needed in æsthetics at present — valuable theories will be formulated only when we have some undisputed data to explain. If the data obtained in a given set of experiments from different reagents do not agree it may possibly be because the words used in æsthetics cover different constellations or groups of experiences in different persons — in that case we should have of course no one theory of æsthetics. On reading works on this subject most persons, trained under the men belonging to the new school in psychology, must feel that there has been an enormous amount of unjustifiable theorizing in æsthetics and that there should be no further making of theories until we have more exact data upon which to base them. When one finds, for example, that the mere placing of a picture in a different position actually reverses our judgment of it, is it strange that some of us wish to know something more regarding the determining factors involved in a given æsthetic judgment before we draw widespread and very probably inadequate, if not actually untrue, conclusions? While, then, very broad generalizations are not attempted in this paper, the writer on testing a given principle, has drawn, at the close of the experiments relating to it, such conclusions regarding it as she believes to be warranted by the experimental data. This work may be regarded in some sense as a laboratory contribution, since it was undertaken and has been carried on by the aid of the writer's students.

of comic material and of a comparatively limited number of experiments, made by one person, and was not considered by any means as a final theory. In reading this resumé of her work a story of Benjamin Franklin came to the author's mind, which she does not consider an illustration of a 'freisteigende Vorstellung.' Franklin presented a paper before the Royal Society on the subject of balloons, which was commended for its completeness. To someone who asked the use of the new invention, Franklin replied by asking, 'What is the use of a newborn baby?'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I. Experimental Study of the Principle of the Æsthetic Threshold.

"*As one considers the outer or inner conditions of pleasure or displeasure one can speak of an outer or inner threshold which must be surmounted if that which is pleasurable or displeasurable enters consciousness possessing an actual pleasurable or displeasurable character.*"[1] (Fechner, *Vorschule der Æsthetik*, I., 49. References to this work will be indicated hereafter by V. d. A.).

Series I. Object: To ascertain whether lines are available as material in making investigations in æsthetics. — In view of the fact that lines have been used in investigating the sensation threshold it seemed desirable, if possible, to employ them in finding whether the æsthetic threshold is coextensive with the sensation threshold, and the first experiments were for the purpose of learning whether they possessed the essential æsthetic value. *Material:* The forty one lines of Plate III.

It will be observed that the above lines differ in (1) form — straight lines, arcs of circles, 'waving lines' (Hogarth's lines of beauty), circles, and the ellipse being used. (2) As regards direction, the straight lines are vertical, horizontal and oblique. The oblique lines slant 45° from the horizontal, two (Nos. 6 and 14, called, to avoid circumlocution, the right obliques) to the right and the other two (Nos. 5 and 13, the left obliques) to the left. There are two sets of eight arcs each — the eight arcs in the same set differing as regards position with respect to each other, but in the two sets having corresponding positions. (3) As regards length, the straight lines of one set (Nos. 1–8) have a length of 12.6 cm. and of the other (Nos. 9–16) 7.6 cm. The circle of which the eight arcs (Nos. 17–24) of 155° each form a part, has a diameter of 12.6 cm. The eight arcs (Nos. 25–32)

[1] In the discussion of this and several other principles there is neither italicizing nor anything else in the context showing what is the formal statement of the principle or what is in the nature of its amplification. Here and in other similar cases I have selected one or more sentences which seem to me to express adequately and succinctly Fechner's idea. For various reasons it has seemed best to translate such statements into English. In a few cases the translations have been somewhat free, and, in order to secure clearness, interpolations, fully justified by what precedes or follows, have been made.

are each 90° and the circle of which they form a part has a diameter of 7.6 cm. The diameters of the three larger circles (Nos. 33–35) are 12.6 cm. and of the smaller (Nos. 36–38) 7.6 cm. The long axis of the ellipse (No. 41) is 12.9 and the short 8.9. The 'waving lines' (Nos. 39 and 40) are 12.9 cm. in vertical diameter and are reversed as regards position. (4) The lines are not equal in width. Those marked *N* have a width of .1 mm., those marked *M* a width of .5 mm. and those marked *W* a width of 1.5 mm. These lines were drawn with Higgin's India ink by means of a ruling-pen on square sheets of white Bristol-board 22.8 × 22.8 cm. As regards technique the lines used were practically perfect, for those showing imperfections or not meeting the requirements just given were discarded and others substituted.

Method. — That of *Constant Differences.* To bring the experimental study of æsthetics into line with other experimental study in psychology, the name, constant difference, is applied to the method in æsthetics which usually goes under the name of the method of paired comparison and which is simply the method of constant differences in which a large number of norms has been introduced.[1] In this series of experiments the method of constant differences is used in a qualitative way as it has been used in other æsthetic fields, although from the results of this and the following series of experiments it would seem that it can be applied in æsthetics also, to the making of quantitative determinations, to finding, for example, by using appropriate material, the numerical value of the absolute and difference æsthetic thresholds. To eliminate unusable material, it will be necessary, however, in quantitative work by the method of constant differences, to make preliminary experiments by the method of serial judgments.[2] This will be seen at once, if one

[1] Compare Müller, *Die Gesichtspunkte und die Tatsachen der psycho-physischen Methodik*, 11.

[2] I understand Professor Müller (*Die Gesichtspunkte und die Tatsachen der psycho-physischen Methodik*, 10 ff.) to regard the methods of experimental æsthetics also as falling under his three methods: the Konstanzmethode, the Grenzmethode and the Herstellungsmethode. I confess I am at a loss to know under which of these to put the method of serial judgments, which even in its crude form as regards quantitative measurement (compare Külpe, *Outlines of Psychology*, 233) seems to me to be needed in other fields as well as that of

considers but a single judgment made in connection with the method of constant differences. The reagent says one line is liked better than the other when that other is liked, disliked, or a matter of indifference to him. Even in qualitative experiments of this kind such a supplementation is necessary if one is to obtain a correct and adequate view of the reagent's feeling for lines. In this work the serial method was employed but once in the examination of the cards by a given reagent. That is, each card was placed in turn before the reagent and he was asked whether he liked the line (recorded in Table I. as +), disliked it (recorded as —), or was indifferent to it (recorded as o). Where he did not know what judgment to give on a given line a question mark (?) has been placed under the number corresponding to the line. It may be asked why the serial method was not used alone. Until the matter is brought to their attention through comparison many persons not only do not know that they have any feeling for lines, but are inclined to be skeptical when any one else expresses a liking for them. Moreover, in using such a large number of lines, the number of judgment terms would have had to have been too greatly multiplied to have been satisfactorily applied, or the number of experiments too much increased considering the preliminary nature of this work.

In employing the method of constant differences each card was used in turn as norm. It was always placed on the table before which the reagent sat, at his right. For comparison the other cards were placed on the table at the reagent's left, at the side of the norm. For example, line one was used as norm until all the other lines had been compared with it and the preference noted. It was then removed and line two substituted in its place and all the remaining lines except one compared with it. This was continued until each line has been compared with all the other lines once. The procedure was then reversed in cases of reagents *W*, *B*, *McG*, *D*, and *C* and the line which had been used last as norm was now used first and the others compared with it as before. The introspections of the reagents and the results themselves show that the position of the lines

æsthetics. In fact, I have asked myself whether it should not be added to the three methods just mentioned in order that they may be sufficiently inclusive as regards psychological phenomena.

with respect to each other is a factor in the determination of the judgment, and in experiments of even a qualitative kind it would therefore of course, be desirable to entirely eliminate this influence. In the order of procedure here used each card is compared with the others both when at the right and when at the left of them. It seems to me that this mode of procedure compensates for space differences more effectually than does that suggested by Titchener in Exp. XXI., of his *Experimental Psychology, I*, although the following words would lead one to suppose that his mode of procedure actually eliminated such differences. 'Let *I* be on the right in exp. 1 and on the left in exp. 2, etc., so as to avoid any possible error in the comparisons.' The compensation of space differences seems to me one of the most difficult problems in experimental æsthetics. For example, a card may in itself be preferred at the right, but with another card it may be preferred at the right and with a second at the left (see above). As to the manner of expressing his preference, the reagent was directed, if one card was liked better than the other, to tell which he preferred, where lines were equally liked to say 'equally liked'; or if he did not know which he preferred, 'doubtful.' Reagents *W*, *B*, *McG*, *D* and *C*, were also directed to give to protocol whenever a line was very much preferred. The total number of preferences includes not only the number of actual preferences, but also the number obtained by adding one half a preference for each of the two lines concerned where the judgment was 'equally liked' or 'doubtful.' Custom has been followed in working up the results in this way. A comparison of the results in Tables I. and II. in case of *My* shows that this mode of computation has given a false picture in at least one case. From Table II., it would seem that *My* liked all the lines equally well, but a glance at Table I. shows that he was indifferent to them all. This contradiction brings up the question whether one is ever justified in working up the results obtained through using the method of constant differences without previously ascertaining, by using the serial method whether the above mode of computation was legitimate.

Reagents. — The persons who acted as reagents in these as well as the other experiments were university students who had

been selected not only for their intellectual attainments but for their reliable character, as it was felt that not only the ability to introspect closely, but conscientiousness in the making of judgments and in the giving of introspections to protocol was highly important. Of the reagents who took the leading part in these and other experiments, *C* is an advanced student in psychology who has worked in the laboratory several years; *K*, *W*, *B*, *McG*, *D*, and *My* had taken the beginners' laboratory course in psychology; *H*, *M*, *Mc*, *Km*, *F*, *P*, *R*, *S*, and *M. W.* had heard lectures on the subject for a year, but had done no laboratory work. It is scarcely necessary to add that in this and all other series the reagents were kept, as far as possible, in ignorance of the object of the experiments. They were in no case told the results and they were instructed not only not to talk over the experiments with other people, but as far as possible to avoid thinking about them when not engaged in experimenting.

Results. — Those recorded in Tables I. and II. below. It should be added, however, that these experiments have been repeated as a class exercise and what is here found may be regarded as typical.

TABLE I.

Reagents.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
H	o	o	+	+	+	+	+	+	o	o	+	+	+	+	+	+	+	+	+	+	—
M	+	+	+	+	+	+	—	—	+	+	+	+	+	+	—	—	—	+	o	+	—
W	o	—	+	+	+	+	+	+	—	—	+	+	+	+	+	+	—	—	—	+	—
Mc	+	+	+	+	—	+	+	+	+	—	—	—	—	+	+	+	+	+	—	+	+
Km	o	o	o	o	o	o	—	—	o	o	o	o	o	o	—	—	+	+	+	+	+
B	+	+	+	+	o	o	+	+	+	+	+	+	—	—	+	+	o	o	o	o	o
McG	+	+	+	+	o	o	+	+	+	+	+	+	o	o	+	+	—	—	?	—	—
D	—	o	+	+	+	+	—	—	o	o	+	+	+	+	—	—	o	?	o	o	—
C	+	+	+	+	+	+	—	—	+	+	o	+	+	+	—	—	+	+	o	+	o
My	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

Reagents.	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
H	—	—	—	—	+	—	+	+	—	—	—	+	+	+	+	+	+	+	+	—
M	+	+	+	o	o	o	?	o	o	o	o	+	+	—	+	+	—	—	—	+
W	+	—	+	—	—	—	—	—	—	—	—	—	+	+	—	—	+	?	+	+
Mc	+	+	+	—	—	—	?	o	—	—	+	+	+	+	+	o	+	+	+	+
Km	+	+	+	—	o	o	+	o	+	—	o	+	+	—	+	+	—	+	+	+
B	o	o	o	—	—	—	—	—	—	—	—	+	+	+	+	+	+	o	?	o
McG	—	?	—	?	?	o	—	—	—	o	—	+	+	+	+	+	+	+	+	?
D	o	o	—	—	—	—	—	—	—	—	—	—	o	—	+	+	+	—	—	—
C	+	o	+	+	+	o	+	o	+	o	+	+	?	—	?	o	—	+	+	?
My	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

TABLE II.

Re-agents.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
H	6	6	34	35	33	33	37	38	4	6	28	29	25	29
M	38.5	39.5	30.5	33.5	32.5	27.5	6	6.5	33.5	35.5	25.5	29	22.5	25.5
W	32	39	55	63	61	49	67	78	28	33	52	54	63	57
Mc	20.5	11	23	16.5	3.5	27	34.5	26	15.5	11	17	12	4	21.5
Km	16.5	18.5	32.5	32.5	11	9.5	9	5	.5	1.5	14	15	7	8.5
B	59	31	71.5	54.5	31.5	36	76	61.5	55	38	63	51	26.5	25.5
McG	53.5	46.5	58.5	51	48	48.5	63	62	47	41.5	57.5	44.5	38.5	38.5
D	33	35.5	65	67	66.5	69	49.5	30.5	51	49.5	73	66	68	70
C	43	72	52.5	76	57	63.5	12.5	25.5	49	69	24	56.5	57.5	58.5
My	20	20	20	20	20	20	20	20	20	20	20	20	20	20

Re-agents	15	16	17	18	19	20	21	22	23	24	25	26	27	28
H	33	32	11	16	16	18	8	19	18	19	5	13	11	14
M	5	4.5	14.5	18.5	20.5	25	20.5	24	21.5	15	8	13.5	13.5	13.5
W	74	76	19	22.5	20	50	27	40	23	25	4	4	2	11.5
Mc	26.5	19.5	22.5	22	17	34.5	34.5	23.5	13	22.5	11	6.5	3	14.5
Km	4.5	4.5	24	30	27.5	32	32	32	25.5	28	12.5	15.5	12	17
B	70.5	56	40	26	30.5	24.5	33	24.5	34	28.5	17.5	14.5	14	6.5
McG	59	51	28	20	27.5	20.5	25.5	18.5	28	20	4.5	4	15	4.5
D	37.5	34.5	32	21	37	49.5	32.5	47.5	31	20	14	14	24.5	31.5
C	8.5	21.5	68	39.5	13.5	70	19.5	61.5	13	44	62	36	10.5	47.5
My	20	20	20	20	20	20	20	20	20	20	20	20	20	20

Re-agents.	29	30	31	32	33	34	35	36	37	38	39	40	41	Total.
H	6	11	7	12	15	23	31	14	22	26	36	40	0	819
M	10	20	14	11.5	38	25	3.5	35.5	17	4	4.5	3.5	30	820
W	5.5	12	7	10	38	57	76.5	34	40	74	47	66	43	1639
Mc	11.5	5.5	4	8	27	26	36	23.5	23.5	32	39	38	32.5	820
Km	12.5	16.5	12.5	12.5	36.5	39.5	18	36.5	39.5	18	31.5	33.5	35	820
B	13	11	21.5	12.5	57	67	75	57	63	75	13	20	55	1640
McG	5	7.5	13.5	5.5	70.5	76.5	77.5	71	73	68.5	49	51	47	1640
D	18.5	24.5	24.5	13.5	38	55	21.5	67	74	34.5	8	13.5	27.5	1640
C	19	40.5	13	41	46	38.5	3.5	43	24.5	.5	69.5	56	13.5	1640
My	20	20	20	20	20	20	20	20	20	20	20	20	20	820

1. Table I. shows that *My* was indifferent to all the lines, that all the other reagents were indifferent to one or more of them, and that all, except *My*, disliked some lines. This table shows, moreover, that the assumption so often made in books on æsthetics, that people like lines, especially curved lines, is not entirely true. Even as careful an experimenter as Dr. Stratton[1] seems to have made such an assumption in the case of curved lines in that, in experimenting upon the relation of eye move-

[1] 'Eye Movements and the Æsthetics of Visual Forms,' *Phil. Stud.*, XX.

ments to the æsthetics of visual form, he does not report having made a subjective examination of his reagents. If all his reagents resembled *My*, which of course is scarcely probable, his experiments would throw little light, it seems to me, upon the part played by the muscular movements of the eye in our enjoyment lines.

2. Tables I. and II. show that the reagents do not agree regarding the comparative pleasure giving power of lines as a class, that is, in preferring straight lines, curved lines (arcs or circles), waving lines, circles or the ellipse. The arcs of the circles seem to be least liked, but no further general agreement is noticeable. This is shown at a glance in Table IIa, in which the various classes of lines have been arranged in order of preference for each reagent — under I. the class relatively most often preferred, under II. the next often preferred, etc. The table was made by taking the whole number of judgments for the lines of a particular class and dividing it by the number of different lines of that class. For example, for reagent *H* the whole number of preferences for the straight lines, the arcs of circles, the circles, the waving lines and the ellipse were 408, 204, 131, 76 and 0 respectively. Each of the numbers divided by the whole number of lines of its class, that is, by 16, 16, 6, 2 and 1 gives 24+, 12 +, 21, 38 and 0, which shows that for this reagent the order of liking was that given in the table below in which *S* stands for the straight lines, *A* for the arcs of circles, *C* for the circles, *W* for the waving lines, and *E* for the ellipse.

TABLE IIa.

Reagent.	I.	II.	III.	IV.	V.
H	W	S	C	A	E
M	E	S	C	A	W
W	C	S	W	E	A
Mc	W	E	C	S	A
Km	E	W	C	A	S
B	C	E	S	A	W
McG	C	S	W	E	A
D	S	C	E	A	W
C	W	S	A	C	E

Table IIa. shows that it is only by selecting the results of particular individuals that the following opinions can be sup-

ported. Hogarth[1] speaks of the 'waving line'[2] as 'the line of beauty.' Spencer,[3] Allen,[4] Santayana,[5] Witmer,[6] Stratton,[7] etc., think that there is a preference for curves as against straight lines. Burke[8] says that 'though the waved line is that alone in which complete beauty is found, yet there is no particular line . . . which is beautiful in preference to all other lines,' Mach[9] says 'we prefer straight lines to curved lines.'

3. The æsthetic judgment of a straight line evidently depends upon its length. This is seen by comparing the number of preferences under lines 1–8 with those under lines 9–16. *H*, *M*, *Mc*, *W* (except in case of the oblique lines), *B*, *McG*, *C* and *Km* prefer the longer lines. The longer arcs absolutely and relatively considered (compare number of preferences under Nos. 17–24 with those under Nos. 25–32 respectively) are also much better liked. The same is true of the large circles except in case of *D*, who prefers the smaller, and *Km*, where there is no preference (compare results under Nos. 33–35 with those under Nos. 36–38). From these results one could scarcely agree with Burke that smallness enhances beauty, for here the opposite seems to be the case.

4. Æsthetically considered straight lines do not 'vary only in length' as Hogarth[10] says. They vary also in width and our estimate of them is frequently dependent upon their width. *H*, *W*, *Mc*, *B* and *McG* prefer the broader, *Km*, *D* and *C* (except in shorter lines) the medium, and *M* the narrower straight lines. The arcs used were all of the same width but three different widths were employed for the larger and three for the smaller circles. *C* prefers the narrower lines in circles but all the reagents preferred the same widths as in case of the straight lines, except *McG* in case of small circles.

[1] *Analysis of Beauty.*

[2] Lines 40 and 39 are enlarged copies of this line as it appears in a copy of the *Analysis of Beauty* published in 1753 and 1838 respectively.

[3] *An Essay on Gracefulness.*

[4] *Physiological Æsthetics.*

[5] *The Sense of Beauty.*

[6] *Analytical Psychology.*

[7] *Eye-movements and the Æsthetics of Visual Forms.*

[8] *An Essay on the Sublime and the Beautiful.*

[9] *Popular Scientific Lecture*, 'On Symmetry,' 98.

[10] *Analysis of Beauty*, ch. VII.

5. The direction of the line is evidently of some importance for the judgment. As regards horizontal and vertical lines, *M*, *W* and *C* prefer the first, *Mc*, *B* and *McG* the second, but *H*, *Km* and *D* show little, if any, preference. A comparison of the preferences as regards vertical and horizontal with oblique lines as a class seems to show, as Mach says, that 'vertical and horizontal straight lines' are preferred to oblique. As regards the right and left oblique *W* prefers the left, *Mc*, *McG*, *D* and *C* the right, but no conclusion can be drawn regarding the preferences of the other reagents. These two lines have also been shown to a large number of other right-handed persons but there was no very marked preference shown for either line.

6. While the results show that the direction or position of a curve is a matter of some individual, artistic interest it does not show any agreement on the part of the individuals as a whole. Such an agreement as one would expect if Witmer's[1] statement regarding the comparative pleasure giving power of a 'gradual curve upward to the right,' 'upward to the left,' etc., is true.

7. The results show that the direction in which 'the waving line' is turned is not a matter of indifference, as one might suppose from the fact that the line is reversed in some editions. All the reagents except *Mc* prefer line 40 to 39. *W* is the only one whose preference grew out of an association. She remarks that No. 39 is 'a meaningless curve' but that No. 40 'is clearly one side of a vase.' As a matter of curiosity, in this connection I showed the reagents Fig. 45 in the *Analysis of Beauty* and asked them to select the line best liked. They did not agree with Hogarth or with each other regarding 'the precise line properly to be called the line of beauty.'

8. Occasionally a reagent spoke of the pleasure a line gave him because he felt himself drawing it. This led me to examine the results with a view to finding, if possible, the part played by the imitative movements of the hand and arm in the æsthetic impression. I reasoned that if such imitative movements occurred they would be along the lines of least resistance. In short, that lines easiest to draw would be most liked. My own introspections, the fact that many persons whom I had asked to

[1] *Analytical Psychology, 85.*

draw an oblique line drew the right oblique, and certain statements made by McAllister,[1] as that the slant in a 'back hand' writing requires movements that 'are comparatively very hard to make,' led me to believe that the left oblique would be harder to draw and that, therefore, if the imitative movements just referred to played a determinative rôle, the left oblique would be less liked. This I do not find to be the fact when people are asked to compare right and left oblique lines, nor do I find in pen, pencil, crayon, etc., drawings that, when the lines used in filling in do not follow the form of the objects, they always take the direction of the right oblique, which we should expect if Hogarth's idea, expressed as follows, is correct: 'The waving line is still more ornamental and pleasing, insomuch that the hand takes a lively movement in making it with pen and pencil.' Thinking that possibly the introspective data was not reliable and that the right oblique is not so much easier to draw, as I had been led to suppose, I determined to try another line which is almost universally drawn by right-handed persons in particular direction, and that is the outline of a profile. I was assisted in this work by one of my students, Miss F. King (*K*). She asked one hundred different students to draw a profile. The results agree with those given by Professor Minot.[2] Eighty-eight drew the profile facing towards the left. Of these, eight were originally left-handed, but they had learned to use the right hand and used it in making the drawing. While we may grant here that the drawing of the profile facing left is easier and more pleasurable, we cannot say also that any imitative movements which occur in looking at such profiles play a rôle in the æsthetic judgment, for by these very persons the profile facing left is not universally better liked, although it is the one in which we would suppose the imitative movements would be most likely to occur. Fifty of those persons who drew a profile facing west were shown a transparent slide on which the profile could be faced right or left by reversing the slide. Of these twenty-five preferred it facing left, fifteen right, and ten had no

[1] 'Researches on Movements used in Writing,' *Studies from the Yale Psychological Laboratory*, VIII., 63.

[2] *Proceedings of the Amer. Society for Psychical Research*, I., 306.

choice. The absence of a very decided preference here would make us explain the fact that the profiles are so often faced left in the art of primitive peoples by supposing that on the part of the observer imitative movements, of the kind referred to, played a larger part in the earlier times, or that ease of drawing gave more pleasure to the artist than any other artistic factor. Modern artists who, one would suppose, would be more alive to all the details which would heighten both their own and others' artistic enjoyment, do not seem to show the same preference for profiles facing left as do artists among primitive peoples. Miss King examined the first fifty-three volumes of the 'Masters-in-Art Series of Illustrated Monographs' with a view to ascertaining whether modern art favored the left profile. She divided the pictures into four classes, — single portraits, pictures of the Madonna and Child, other pictures having only two figures, and pictures having many figures. She then counted the number of figures facing right and left in each class. No preponderance as regards facing figures right or left was found in any of the classes mentioned, nor did a cursory examination of the portraits in several volumes of the International Studio show any decided preference. In volume XXII., for example, there are portraits by more than thirty artists, but the number facing right and left is approximately equal. A large number of photographs were also examined, but among these no differences were observed. The direction in which a single figure is faced is influenced, of course, by various considerations, as the direction of the light in the studio where painted, the side of the model's face which is most characteristic or pleasing, the ease of presentation as regards technique, and above all the æsthetic preferences of the artist and of those for whom the picture is painted, etc. None of these considerations seem to favor especially a profile facing left. Altogether I do not believe that among us the ease of movement involved in actually drawing a line or in imitating the drawing of it plays any preponderating rôle in æsthetic appreciation.

9. In this and the following experimental series the reagents were instructed not to encourage the arising of associations in connection with the lines, but, if any arose, to report them at

once. The results show that the æsthetic impression from the lines was in general very direct and no reason for the judgment was, or could be given. Occasionally a reagent remarks that he likes or dislikes narrow lines because they seem 'graceful' or 'delicate' or 'weak' or 'look like a thread,' or in case of broad lines, that 'they have strength,' 'character,' 'look clumsy,' etc. In case of individual lines the reagents sometimes give reasons for their judgments. For example, in Series V., it was reported by several of the reagents that the eyes moved round and round in looking at the larger circles where some very large circles were used, and that this sensation was disagreeable. One or two reagents said they did not like the larger circles as well, because the lines were not as distinct, and yet they were of the same diameter and had been made by using the same ink. Again a reagent liked the smaller circles because they seemed so much nearer. One formed his judgments almost wholly on associations, and his results are not given. It was now that a certain circle looked like a figure on a certain piece of calico, again it was just the size and shape of a certain picture, circles larger and smaller arousing still other associations. The vertical line of a certain length and width to *M* (see Series IX.) looks like 'a pussy-willow branch,' the distance best liked on a certain horizontal width like 'the level top of a line of foothills,' and a right oblique line of a certain angle and width like 'a road between pine trees.' Even the judgments on short distances (the thresholds) to be discussed later occasionally grew out of associations, as the words, when the line was being gradually uncovered, 'it seems to be pushing itself forward,' or 'it is not worth looking at,' etc., show.

10. Usually the lines were considered without respect to the background or to the imagined lines, but this was not always the case. *C*, for example, occasionally in connection with an oblique line projected an imaginary horizontal line and found herself giving judgment with respect to her feeling for the inclosed space.

11. Occasionally the reagents reported that they liked or disliked the combination (figures, etc.) formed by the two different lines, and that they were sure this had affected their

judgment on each. The effect on the individual judgments on this summation influence, has not, it seems to me, been sufficiently emphasized in discussing the comparative method.

12. The results obtained in this first series or experiments have been considered in this detailed way with a view to ascertaining whether lines are capable, not only of arousing and holding æsthetic feeling, as these results and the introspections even of those who were most skeptical at the outset show, but to ascertain whether the feelings were sufficiently differentiated to make it possible to employ such material in studying particular points. From the very definite results obtained in these experiments, the great differences in the degree of liking for the different lines, and from the opinions of the reagents, several of whom subsequently expressed themselves as surprised at the definite feelings of like and dislike they had when looking at the lines, and one of whom declared she had nearly as strong a liking for her favorite lines as for her favorite pictures, I feel confident that although the æsthetic impression arising from lines is not as strong as from some other sources, they will, except in case of very exceptional reagents, be found the most satisfactory material in some æsthetic investigations.

Series II. Object: That the æsthetic threshold must be reached before the æsthetic impression arises, is so self-evident that it needs no experimental proof. The difference of opinion, however, in regard to the relation between feeling and sensation makes it of some æsthetic interest *to ascertain whether the length of the absolute æsthetic threshold coincides with that of the sensation threshold in the case of straight lines.*

Material. — A horizontal, straight, black line 89 cm. long and with a breadth of .8 mm. drawn on a sheet of Bristol-board 1.15 mm. x 32.7 cm. Red, orange, green, and gray lines of the same length and width, and a black line of like length but 3 mm. in width. A cover of the same material and having the same dimensions as the paper upon which the lines were drawn.

Method. — The sheet upon which the narrower black line was drawn was covered and laid on the table with the left end directly in front of the reagent. The experimenter, seated on the other side of the table, exposed 2 mm. of the line and

asked the reagent to give a judgment on it, employing one of the following terms: very much liked [recorded in the table as 3 alone or with a plus (3+) or minus (3—) or even a double plus (3+ +) or minus (3— —) sign, if the reagent felt he must still use this judgment category and yet wished to distinguish a given judgment from some other]; moderately liked [recorded as 2+, etc.]; slightly liked [recorded as 1, 1+, etc.]; do not know whether liked or not [?]; indifferent [0]; slightly disliked [recorded as — 1, — 1— , — 1 + , etc.]; moderately disliked [recorded as — 2, etc.]; very much disliked [recorded as —3, etc.] After becoming acquainted with the material the reagents were inclined, in the repeating of the experiments, to employ not only the terms at first used, which were the lower terms, but all the other terms as well. 'Very much liked' meant then not that the line was really very much liked when it was compared with things in general that would evoke such a judgment, but in respect to a similar line of a different length. The reagents' attention was drawn to this change of judgment and they were directed to exclude comparison as far as possible and to use terms expressing their feeling at the moment as they had done at first. This was done to obtain additional information regarding the strength of the æsthetic feelings aroused not only by differences in the length of the line but by the line itself. When the judgment had been made on 2 mm. of the line, the regeant was instructed to expose the remaining portion of the line by gradually moving the cover to the right with his right hand, keeping the exposed portion symmetrically before him, and reporting in the terms just given if he experienced any change in liking. The reagent sat squarely before the table, but no head rest was used, and he was allowed to turn his head as he pleased. The object of allowing him to remove the cover himself and to sit in a natural position in this and in the following experiments was to avoid all constraint, as previous experiences in experimenting with comic pictures suggested that it might decrease the æsthetic impression.[1]

Results. — In Table III. below, 2 indicates 2 mm., 2–4,

[1] Martin, *Psychology of Æsthetics, I.*, 'Experimental Prospecting in the Field of the Comic,' *Amer. Journ. Psychol.*, Vol. XVI., 50.

Table III.

Reagents.	2	2-4	5-10	11-80	81-160	161-230
H	0(100)	0(100)	0(80) 1(20)	1(58) 2(41)	2(84) 3(10)	3(77) 2(23)
M	—1(100)	—1(95)	—1+(90)	—1(80) 0(17)	1—(44) 1(48)	1(37) 1+(26) 1—(23)
C	0(100)	0(100)	0(95) 1(50)	1—(53) 1(33) 1+(14)	1(48) 1—(30) 1+(22)	1+(36) 1++(36) 1(17) 1—(11)
K	0(50) —1(50)	0(60) —(40)	0(35) ?(20) —1(20)	1+(24) 1(54) 2—(07) —1(07) 0(06)	1+(36) 2—(32) 1(32)	2—(33) 1+(43) 1(23)
W	—1(80) 0(20)	—1(70) 0(10) 1(15)	—1(65) 1(35)	—1(15) 1(43) 1+(36)	1(18) 1+(82)	1++(29) 1+(68) 1(3)

Reagents.	231-380	381-500	501-650	651-890 (End).	End.	No. Exp.	No. Exp. Days.
H	3(100)	3(51) 2(46)	2(33) 1(46) 0(12)	0(54) 1(32) —1(14)	0(90) —1(10)	10	10
M	1(56) 1+(34) 1++(10)	1(39) 1+(19) —1(39)	—1—(50) —1(23) 1+(12)	—1—(22) —1(78)	—1(100)	10	10
C	1+(34) 1(34) 1++(22) 1—(10)	1—(46) 1(33) 0(16)	1—(66) 0(30)	1—(56) 0(44)	0(60) 1—(40)	10	10
K	1(46) 2(10) 1+(16) —1(12)	—1(36) 1—(30) 0(20)	—1(69) 0(23)	—2(68) —1(32)	—2(80) —1(20)	10	5
W	1++(58) 1+(10) 1(20) —1(10)	—1(50) —1+(43)	—1++(83) —3(13)	—1++(20) 3(80)	—3	10	5

5–10, etc., indicate the distance between 2 and 4 mm., 5 and 10 mm., etc. Under each of these distances is found the per cent. of each kind of judgment given in connection with the exposure of this length. In the cases where the total number of judgments do not reach 100 per cent. they were scattered

and are omitted to economize space. The number of trials and the number of days over which they were distributed are given for each reagent. The number of experiments were purposely limited in these and other experimental series in order to exclude any regularity that might arise from memory, etc.

In using the red, orange, etc., lines the lengths 2, 4, 10, 45, 120, 190, 305, 440, 575, and 750 mm. were shown to the reagent and he gave a judgment. The judgments which were taken but once on these lines are found in Table IIIa. below. It will be noticed perhaps that results are reported from four reagents only. The experiments have been repeated with many others and those given may be regarded as typical not only in connection with this but the following series in which lines were used.

TABLE IIIa.

Re-agents.	Lines.	2	4	10	46	120	190	306	440	575	750
H	red	0	1	—1	—2	—2+	—2+	—3	—3	0	0
	orange	0	—1	—1	—2	—2	—2+	—3	—3	0	0
	green	0	—1+	—2	—3	—3	—3	—3+	—3+	—1	0
	gray	0 to end but indifference less as line lengthened.									
	black	0—2	2	2	3	3+	3+	2	2—	1	0
M	red	0	1	—1	1—	1	1	—1—	—1—	—1—	—1—
	orange	0	—1	—1+	—1+	—1+	—1+	—1	—1+	—1+	—1+
	green	0	0	—1	1—	1+	1+	1—	—1	—1	—1
	gray	0	0	—2	—2	—2	—3	1—	—1	—1	—1
	black	0	0	—1+	—1	—1	—1	—1—	—1	—1	—1
K	red	0	—1	—1	—1	—1+	—1	—2	—2	—3	—3
	orange	—1—	—1	—1	—1+	—1	—1	—2	—2	—3	—3+
	green	0	?	1	?	1—	1	1	—1—	—1	—1
	gray	0	0	1	1	1	1—	?	0	—1	—1
	black	0	0	1	1	1+	2	—1	—1—	?	—1—
W	red	1	1	—1	—1	—1+	—1+	—1++	—2	—2	—2
	orange	1	?	—1	—1	—1+	—1+	—1++	—2	—2	—2
	green	1	0	1	1+	1+	1++	1	—1	—1	—1
	gray	1	1	—1	—1	—1+	—1++	—2	—2	—3	—3
	black	—1+	—1	—1	1	1+	1++	2	1++	1+	1

In examining these tables one is reminded of Dessoir's [1] words 'Die Objeckte können bekanntlich so gross . . . sein, oder auch in ihrer quantität so geringfügig sein, dass ein æsthetischen

[1] Dessoir, 'Die æsthetische Bedeutung des absoluten Quantums,' *Zeit. für Psych. u. Phys. der Sinnesorgane*, Bd. 32, 60.

Genuss nicht eintritt.' One sees at a glance that the degree with which we like, resp. dislike, a line depends upon its length. There is a length which is most liked, resp. disliked. After this length has been reached in the case of a liked line the liking decreases and finally becomes zero and in some cases the feeling is transformed to dislike. In the case of a disliked line the feeling increases to a certain length. After this length is reached it may increase, remain constant, or decrease and become zero. The reagents had not been instructed to look at the line as a whole but the change of feeling after the line has reached the length on which the highest judgment was given was often due doubtless to the fact that the line was better liked when it could be seen as a whole. This was shown by the fact that they all tended to bend the head back as the line lengthened, remarking that they would like the longer lengths if they were not so near and complaining that it tired them to move the head from side to side. To prove experimentally that a line is better liked when seen as a whole is difficult, from the fact that in changing its position a new set of determinative factors enters. For example, if a reagent likes a broad line, he likes it less when farther away, for it appears narrower to him. Moreover, increased length itself is a factor to be considered. The introspections of *H* show that the zero judgments occasionally found on the line when longest do not grow out of adjustments of the eye but are due to a certain monotony which becomes very noticeable as the line grows longer.

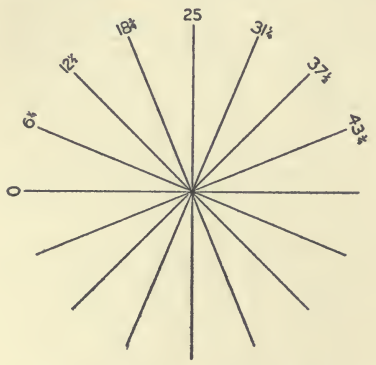
It is evident from the results of Tables III. and IIIa. that we have material which it would seem might be employed in investigating the æsthetic difference threshold by any one of the psychological methods. If we examine the judgments on the shorter lengths of line exposed, we see also that there is a length to which the reagent is indifferent or if he likes, resp. dislikes, the line which he dislikes, resp. likes. This length is longer in general than that required for the recognition of the line, that is to say, longer than the absolute sensation threshold. The introspections of the reagent throw no very satisfactory light as to why the impression from the short lengths should be different from that from the longer ones and the next experiments

were made with a view to getting some further light on this point; that is, to learn whether these short lengths ought to be considered æsthetic absolute thresholds. To avoid circumlocution these short lengths will be designated for the present as apparent æsthetic thresholds.

Series III. Object: To ascertain whether the apparent absolute æsthetic threshold is affected by the direction of the line.

A line 12.7 cm. long and .6 mm. wide was drawn upon the center of a circular sheet of drawing paper having a diameter of 67.0 cm. On the back of this sheet was a scale graduated in a hundred degrees. The sheet was placed on an easel in front of which sat the reagent in a comfortable position for seeing the line, whose center was placed on a level with the eyes. Behind the circular disk sat the experimenter and through a thread stretched on the paper across a diameter of the circular sheet it was possible to place the line in the eight positions used. The sketch below will show the position of the line. The number in connection with each line corresponds to the angles given in Table IV.

The line was placed in one of the positions and then shown to the reagent, whose eyes had been closed for rest during the placing of the line, and after he had given his judgment upon it (the judgment categories were the same as those used in Series II.), it was entirely covered by him with a piece of paper (held generally in the right hand, though for reasons previously given no instructions had been given), the edge of which was placed vertical to the line used. The upper end of the line was then gradually uncovered until a length was reached which the reagent liked. This distance could be seen through the paper by the experimenter and its length was measured in mm. and is so expressed in the table. Any introspections of the reagents given in connection with this



judgment were, of course, recorded. The line was then placed in turn in the seven other positions given and the judgment and the corresponding distances recorded. In the next round, the judgment was taken on the whole line in each case as before but the movement was reversed, the lines being gradually covered by the reagent until the required length had been reached. *M* and *W* were occasionally indifferent to the line in a certain position and they were told to give a length, if there was such a length, which they liked, and this length was then recorded. *W* occasionally disliked a line and at such times she was told to give a length, if there was such a length, which she liked.

Results. — In table IV. below, under I in case of each line for each reagent, are given the number of judgments of a given kind, and under II. the average length of the æsthetic threshold expressed in mm. and its mean variation. Under 0° (H) and 25° (V) are given the results obtained when the line was horizontal, respectively vertical, under 6¼, 12½, 18¾ those obtained with left obliques, and under 31¼, 37½ and 43¾ with right obliques. It will be observed that when the line is at 6¼° and 43¾° it is more nearly horizontal, and at 18¾° and 31¼° more nearly vertical.

As regards the judgments it is evident — (1) that the horizontal is best liked except in case of *H* who likes the vertical equally well. The horizontal is liked for its symmetrical position doubtless. Associations in connection with the body occasionally arise in connection with the lines. Muscular sensations are frequently present with *H*. She feels herself weighed down occasionally, for example, by the horizontal line. The want of stability of the vertical is an important factor with *C*. She said she would like it if it had a support. (2) *M* and *W* prefer the left obliques and *H*, *C* and *K* the right. *K* says she feels herself drawing these lines. The oblique lines most nearly horizontal are best liked and those most nearly vertical least, the reagents feeling that the last 'ought to be straightened up' or 'were intended to be vertical.' (3) Except in the case of the vertical and horizontal lines in case of reagents *H*, *K* and *W*, where the illusion of over-estimation of vertical as compared

Table IV.

Re-agents.	0° (H).		6¼°.		12½°.		18¾°.		25° (V.).		31¼°.		37½°.		43¾.		No. Exps.	No. Exp. Days.
	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.		
H	3	18.9 4.8	1+(1) 1(8) 2(1)	39 45.4 50	2(9) 2(1)	38.1 68	2(8) 1(2)	25 53	3	16.1 4.1	2(6) 1(4)	26.3 36.2	3(2) 2(7) 1(1)	10 31.8 25	3+(1) 3(6) 2(1) 1(2)	24 15.8 16 34	10	10
		18.9 4.8		45.2 8.8		37.3 8.7		30.7 10		16.1 4.1		30.3 9.8		26.8 8.4		20.3 6.7		
M	1(8) 1—(2)	66.8 67.5	1++(1) 1+(8) 2(1)	56 63.2 61	1+(6) 1(4)	62.7 67.8	1—(10)	71.1 4.3	1—(10)	67.8 3.3	1—(2) —(6) 0(1)	71.5 0 0	1(2) 1—(6) 0(2)	72 69.1	1+(8) 1(2)	58 65	10	10
		67.0 4		62.3 4.5		64.7 3.3		71.1 4.3		67.7 3.3		71.5 2.5		69.8 4.1		59.4 6		
C	1++(7) 1+(2) 1(1)	14.5 15.5 15	1+(6) 1(3) 1—(1)	14.5 17.7 21	1(9) 1——(1)	17.1 29	1+(1) 1(3) 1—(3) 0(3)	17 22 17.3 0	1+(2) 1(4) 1—(4)	18 16.7 18	1++(1) 1+(3) 1(2) 1—(4)	18 15.7 16 17.8	1+(4) 1(3) 1—(3)	14.2 13.7 20	1++(4) 1+(6)	14.5 14.8	10	10
		14.7 1.1		16.1 3.3		18.2 3.2		19.3 3		17.5 1.3		16.8 1.4		15.8 2.6		14.7 2.1		
K	2+(3) 2(10) 2—(3)	17 16.2 18.6	1+(3) 1(10) 1—(3)	17.7 16.7 18.3	1+(1) 1(13) 1—(2)	20 15.5 20.6	1+(2) 1(11) 1—(3)	16 15.1 19.3	2—(11) 1+(5)	14.6 18.2	1+(1) 1(14) 1—(1)	13 16.1 17	2+(1) 1+(6) 1(7) 1—(2)	15 14.7 17.6 19	2+(1) 1+(4) 1(9) 1—(2)	14 14.5 17.5 20.5	16	5
		16.8		17.2		16.6		16		15.7		15.9		16.5		16.2		
W	1(25) 0(1)	26.1 27	1++(13) 1+(9) 1(4)	26.1 23.9 22.3	1++(1) 1+(3) 1(9) —1(13)	20 22.7 25.1	1(2) —1(12) 1+(11) —1++(1)	22.5 24.6 22.3 26	1(1) 0(25)	29 22.8	—1++(16) —1+(5) —1(5)	23.0 24.6 25	1(10) —1(15) —1++(1)	25.1 23.7 29	1+(6) 1(18) —1(2)	22.3 24.7 23	26	12
		26.2 3.5		24.7 3.2		23.1 2.9		23.6 2.5		23.3 2.9		23.7 2.5		24.2 3		24.0 2.8		

with horizontal distances plays a role perhaps, the average apparent æsthetic threshold of the lines best liked seems to be shorter. Although the number of judgments is small, the same thing is shown when the average length of the apparent threshold given for each judgment category in case of a single line is examined. When all the judgments have been taken and the threshold has been computed for each judgment category, as has been done in Table IVa., the fact that the shorter apparent æsthetic threshold occurs in connection with the higher positive judgment (judgment where the line is liked) as regards the line, and conversely, is demonstrated.

TABLE IVa.

Re-agents.	3+	3	3—	2+	2	2—	1++	1+	1	1—	1— —	0	—1	—1+	—1++
H	24	16.5			30.9			39	42.5						
M					61(1)		56	61.2	67.4	69.3		71	0		
C							14.7	15.4	17.0	18.4	29	0			
K				16	16.2	15.5		16.2	17.0	19.1					
W							21.0	23.1	25.2			33.2	25.5	22.8	23.5

Subsequent experiments, however, would seem to show that the length of the apparent æsthetic threshold here is not dependent upon the kind of the judgment given upon the whole line but upon the fact that a shorter length happens to be more agreeable in itself when in a certain position than a longer length, and this position happens to be that in which the line as a whole is best liked. The lengths liked which were given for the apparent æsthetic threshold in connection with the negative judgments (judgments where line was disliked) show no particular trend in the case of the reagent (*W*) who gave such a length.

Series IV. — To ascertain whether the length of the apparent æsthetic threshold is affected by the width and color of the line.

Material. — Sixteen horizontal lines drawn with colored inks on separate sheets of cardboard 25.4 × 20.3 cm. Uniform backgrounds were used so that if differences occurred they could not be attributed to the fact that these differed in form, color, size or texture. Each of the lines was 203 mm. in length.

Five of them (given in Table V. as Nos. 1, 2, 3, 4 and 5) were black with the widths .5, 1, 1.5, 2 and 3 mm. respectively. As broader lines of the same color appear darker, an effort was made to make these black lines and the gray lines (Nos. 8, 9, 10 and 11) subjectively of the same brightness by mixing white and black inks in different proportions in making the lines of different widths. The attempt was completely successful with some reagents but not with others. Of the six gray lines No. 6 was made very light in color. No. 7 was made darker in shade than 6 but not as dark as Nos. 8, 9, 10 and 11. The widths of the gray lines Nos. 6, 7, 8, 9, 10 and 11 were .2, .5, 1, 1.5, 2 and 2.8 mm. respectively. Nos. 12, 13, 14, 15 and 16 were .5 mm. in width and red, green, violet, orange and brown in color respectively. Before taking up the above sixteen lines, in which much greater variety occurs as regards width and color, experiments had been previously made with five black lines 127 mm. in length and .1, .3, .5, .7 and 1, in width, which were drawn on cards of the same material and size as those above. The results obtained for *C* in these experiments have been placed under Nos. 1, 2, 3, 4 and 5. The results obtained in using the first five lines are recorded for *C* because no usable results were obtained from her in using the sixteen lines from the fact that, as she became more acquainted with lines, she found herself unable to give a satisfactory judgment, in that the color and width gave rise to two distinct judgments, something which in no case was reported by the other reagents.

Method. — On beginning the experiment with the five lines just mentioned, both to acquaint the reagent with the material and to encourage him carefully to observe differences, these lines were laid in pairs in turn before him until each of them had been compared with all the others at least once and he had reported which he liked the better. After these preliminary experiments, in case of the set of five lines and of the sixteen lines, a line selected by chance from the others was laid directly in front of the reagent, his eyes during the placing of the card having been closed or turned away for rest, and when the 'ready' signal was given he looked at the line and gave his judgment upon it in the terms given in the previous series. The judgment

having been recorded, the line was entirely covered and then gradually uncovered. If the line had been reported 'liked' in the judgment just made, the reagent was instructed to report as soon as he began to like it; if it had been reported 'disliked,' he was to say as soon as it was disliked. If he was 'indifferent' to it, he was to report if he liked, resp. disliked, any length of the line. This distance was noted and the procedure repeated with each of the remaining lines. In the next round of experiments the same thing was done except that in alternate rounds the line was entirely covered, resp. entirely uncovered, and gradually uncovered, resp. covered, until the threshold was found. In Table V. below under 1 I, 2 I, 3 I, etc., are given the number of times each class of judgments occurred on a given line in case of the sixteen lines, and under 1 II, 2 II, etc., the average length in mm. of the corresponding apparent threshold and its mean variation. As the results, in case of the ten experiments upon each of the five lines first used, agreed with those obtained by using the sixteen lines they are omitted to economize space. It should be said that the reagents report that the lengths given for the apparent threshold are accompanied by very definite feelings. *W*, for example, says that she feels as certain of the length as if there were 'a dot at the point' and the other reagents use equally definite expressions as regards certainty of judgment.

The results show (1) that the liking for the line depends upon its color. This is seen by comparing the judgments for the various reagents on the lines 1, 7 and 12–16, which agree in width but differ in color. (2) The liking also depends upon the width. A comparison of the judgments on the set of black lines and of gray lines shows that *M* and *K* like the narrowest lines, and *H* and *W* that next to broadest, and *C* the line of medium width. (3) An examination of the results in case of lines of like width but differing in color show everywhere that the length of the apparent æsthetic threshold is not a function of the degree of liking for the whole line, for lines equally liked have different apparent thresholds and those not liked in the same degree have the same thresholds. In lines of like width the color is evidently that which determines the length of the apparent

Table V.

Re-agents.	1		2		3		4		5		6		7		8		No. exps.	No. exp days.
	I.	II.	I.	II.	I.	II.	I.	II.	I.	II	I	II.	I.	II.	I.	II.		
	3(4)	14	3(20)	16	3+(4)	13	3+(4)	2	3(88)	3					1+(8)	80		
	2+(40)	31.1	3—(32)	24.7	3(32)	16.9	3(92)	14.6	3—(4)	17					1(92)	54.7		
H	2(20)	36	2+(44)	16	3—(56)	22.1	3—(4)	17	2(8)	28.5								
	2—(32)	37.4	2(4)	31	2+(8)	29											25	6
	1+(4)	45																
		33.9		25.0		20.7		14.2		3.0		0		0		56.8		
	1++(12)	48.3	1+(12)	55.3	1— —(8)	47.5	1—(4)	61	—1(98)	12.0	1—(4)	54	1+(32	50.9	1+(12)	54		
	1+(88	51.4	1(56)	56.9	1—(40)	59.3	—1—(4)	10	—1++(4)	2	—1—(4)	8	1(44)	53.6	1(76)	56.4		
			1—(32)	59.9	—1—(20)	9.8	—1(72)	12.2			—1(24)	18.1	1—(24)	54.7	1—(8)	63.5		
M					—1(32)	9.1	—1+(20)	8.9			—1+(64)	24			0(4)	19	25	7
											—1++(4)	24						
		51.0		53.3		32.0		13.9		11.6		23.1		52.9		55.5		
	3(32)		2+(8)		2+(4)		3(4)		1(4)		2+(4)		3—(4)		2—(8)			
	3—(4)		2(16)		2—(16)		1+(8)		1—(20)		2(20)		2(32)		1+(28)			
	2+(32)		2—(60)		1+(52)		1(52)		—1—(48)		2—(16)		2—(4)		1(12)			
	2(24)		1+(12)		1(20)		1—(28)		—1(12)		1+(4)		1+(12)		1—(20)			
K	2—(8)		1—(4)		1—(8)		—1+(4)		—1+(16)		1(20)		1(16)		—1—(24)			
							—3(4)				1—(20)		1—(24)		—1(8)		25	7
											—1—(8)		—1—(4)					
											—1(8)		—2—(4)					
		4.8		7.8		10.1		11.2		11.2		6.5		7.1		8.6		
		1.5		2.0		2.6		3.0		3.3		2.0		2.1		1.9		
	1(4)		1+(8)		1++(92)		3(84)		3(8)		—1++(100)		—1+(24)		1+(12)			
	0(12)		1(92)		1+(4)		1++(16)		2(92)				—1(72)		1(88)			
W	—1(84)				1(4)								0(4)					
																	25	5
		11.5		13.3		21.7		35.6		48.8		8.5		11.0		14.9		
		7		.9		4.3		7.0		6.9		.7		8		2.1		
	1++(2)		1++(5)		1++(10)		1++(3)		1—(5)									
C	1(8)		1+(5)				1+(7)		0(5)									
		9.4		10.7		13.4		16.8		31.4							10	10
		1.5		1.1		2.2		2.8		3.9								

TABLE V.—*Continued.*

Re-agents.	9		10		11		12		13		14		15		16		No. exps.	No. exp days.
	I	II.	I	II.	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.		
	2(12)	39.7	2(100)	43.8	2+(4)	28	—1(100)	43.9	—3(100)	14.8	1(88)	43.4	—1(100)	46.3	1(92)	50		
	2—(72)	36.4			2(58)	37.3					1—(12)	49			1—(8)	95		
H	1+(16)	67.5			2—(28)	42.7											25	6
		42.5		43.8		38.4		43.9		14.8		44.1		46.3		53.6		
	1(60)	58.5	1(4)	71	1— —(4)	75	1(64)	54.1	1(28)	52.4	1++(8)	38.5	1+(4)	44	1+(12)	51		
	1—(36)	61.2	1—(20)	59.6	0(64)	16.5	1—(32)	54	1—(48)	53.9	1+(92)	50.6	1—(32)	52.5	1(68)	55		
M	—1(4)	5	0(60)	14.0	—1—(24)	13.1	—1—(4)	52	1— —(4)	60			—1—(12)	12	1—(20)	53.6	25	7
			—1—(16)	8.2	—1(8)	5			—1— —(4)	5			—1(24)	1.7				
									—1—(16)	4.5			—1+(28)	1.6				
		57.3		24.5		17.1		54.8		46.1		49.6		20.9		54.6		
	1+(12)		1(8)		1(16)		—1(4)		—1—(4)		1—(4)		—1(4)		1(28)			
	1(32)		1—(32)		1—(16)		—1+(4)		—1+(16)		—1—(20)		—1+(12)		1—(36)			
	1—(12)		—1—(20)		—1—(8)		—2—(20)		—2—(44)		—1(52)		—2—(32)		—1—(24)			
	—1—(24)		—1(24)		—1(40)		—2(60)		—2(28)		—2—(8)		—2(36)		—1(8)			
K	—1+(16)		—1+(12)		—1+(4)		—2+(12)		—2+(8)		—2(8)		—2+(16)		—1+(4)		25	7
	—1(4)		—2(4)		—2—(4)						—2+(8)							
					—2(4)													
					—2+(8)													
		9.4		9.5		9.7		1.6		2.1		9.8		2.0		7.2		
		2.7		3.4		3.2		.8		.3		2.1		.8		2.8		
	1+(24)		1+(8)		1(24)		1(12)		1(84)		1+(64)		—1+(76)		1(100)			
	1(76)		1(92)		1—(68)		—1(88)		—1(16)		1(32)		—1(24)					
W					—1—(4)						—1(4)						25	5
					—1(4)													
		20.9		29.4		36.1		12.0		12.3		12.8		11.8		12.4		
				5.4		5.5		.7		1.0		1.1		1.2		.9		
C																	10	10

threshold except in case of *W* where it does not seem to play any great rôle. In general, orange, red, and green lines, that is, the brighter lines, give the shorter apparent threshold. Except, perhaps, in case of *K*— who gives extremely short thresholds on the colored lines and on one occasion spoke, in shortening the line, of the red, which she did not like, as having faded to a light pink which she liked, and remarked that the threshold for the violet line was 'where it ceased to look blue'— the apparent æsthetic threshold is longer than is required for the recognition of the color, that is, the apparent æsthetic threshold is not coextensive with the sensation threshold but is longer than it. (4) *M* gave on several occasions two thresholds. The shorter was one given in uncovering the line and was doubtless the color threshold; the longer one was given in covering the line in finding the threshold and was doubtless determined by the feeling for the rectangular form. If we examine the judgments given on lines differing only in width we do not find that the length of the apparent threshold is a function of the degree with which the line is liked but of the width of the line. In case of *C*, *W* and *H*, the length of the apparent threshold does not vary with changes in liking but with changes in width. *K's* and *M's* results as regards the apparent threshold seem to show some connection between the degree of liking and the length of the apparent threshold, but they can be as well explained as can those of *W*, *C* and *H* by supposing that the width of the line determines the length of the apparent threshold, and thus a common explanation can be given for the variations found in its length in case of lines of like color but differing in width. As regards the effect of the width on the apparent threshold, we may say in case of *K*, *W*, *C* and *M* that where a line is liked its length increases with the width of the line. That is, it takes a longer length to give a pleasing rectangle in case of wider lines. On the other hand, in case of *H* the apparent threshold shortens as the lines increases in width, doubtless because the reagent likes the approach to a square form better as the line increases in width. She remarked several times, on getting the apparent threshold for line No. 4, 'the square is too small to be liked.' In experimenting with

lines wider than those here used this comes out clearly. In lines wider than a certain width of line the square is invariably given for the apparent threshold. This makes the threshold, in case of this reagent, as the line increases in width seem to grow shorter and then longer. It is probable, from the results of *M*, which are the only results we have to base our opinion upon, that, where the lines are of the same color but differ in width, the distances given for the apparent threshold do depend upon whether the lines are liked or disliked. In case of disliked lines the thresholds are very much shorter and the wider the line the shorter the apparent threshold — just the reverse of what was found in the case of this reagent when the lines were liked.

TABLE Va.

Re-agent.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	20	19	18.8	15.8	11.3	23.7	22.2	19.4	20	19.2	19.1	20.4	19.5	19.7	3.2 20.9	20

Table Va. above shows that there is in her case, a disliked length on each of the sixteen lines which is less as regards length than that given for the thresholds in case of the liked lines. When the reagent has looked at a line and found she disliked it she selects the shortest length that she dislikes in case of this line; how long it will be depends upon the width of the line (compare threshold lengths on lines 4 and 5 given in table V. with the disliked lengths given in Table Va.) and gives it for the threshold. In case of liked lines, she selects the shortest length that she likes. Its length here also will depend upon the width of the line, but in general it is longer than the length selected for the threshold of a disliked line. The following introspection, given to protocol, confirms this opinion — "There is, in case of liked lines, a short indifferent space, then a disliked space, then an indifferent space, and from there on the line is liked. With disliked lines there is an indifferent space and from there on the line is disliked." (5) The length of the threshold sometimes grows out of personal idiosyncrasies. *M*, for example, has an illusion when line 6 is shown. She always

sees a woman in gray, superimposed upon this line and puts the threshold where her chin is uncovered or covered by the cover, as she is indifferent until this point is reached. Experiments similar to those outlined have been made with many other persons with such similar results that those given above may be regarded as typical. It is evident, from what has been said, that if a line is a liked line the reagent looks for the shortest length, the shape or form of which he likes, and gives it as the point where he begins to like the line — as the æsthetic threshold, in short. With a disliked line he does the opposite. In case he is indifferent to the line as a whole and is thus left free to seek for a liked or disliked length, he selects the length which comes first or which gives the stronger impression. We would expect from this both a threshold of like and of dislike on every line, and in case of *M* we actually find these. In fact the change of form and color which occurs in lengthening the line determines the *length* of the apparent threshold. Introspections show, except in case of *W*, who likes or dislikes the line from the very first, that a line must have a certain length before the reagent has any feeling for it. The use of the magnifying and reducing glass in connection with the lines confirmed these opinions.

It is evident from the above results that straight lines are not suitable material for finding whether 'Ein quantum als solches für das Eintreten des æsthetischens Genusses erforderlich ist,'[1] as changes in their length produce not only changes in quantity but also in quality and the reagents' changes of judgment have been seen to be largely due to the latter. Whatever visual stimulus is selected it must be of such a character that variations in quantity are not accompanied by variations in quality. A series of graduated circles would seem to be the material needed and they were used in the next experiments. A surface is evidently needed which can be varied in size without any change in form having also been made. It would seem that by employing a set of graduated circles one could get the desired knowledge, and these were used in the next series.

[1] Dessoir, 'Die æsthetische Bedeutung des absoluten Quantums,' *Zeit. für Psych. u. Phys. d. Sinnesorgane*, Bd. 32, 51.

Series V. — To ascertain whether the absolute æsthetic threshold coincides with the absolute sensation threshold in a series of graduated circles.

Material. — Twenty-six circles 1, 2, 3, etc., having diameters of 1, 2, 3, 4, 5, 6, 7, 10, 12, 16, 24, 36, 40, 50, 60, 80, 100, 125, 175, 225, 275, 310, 350, 400, 450 and 500 mm. respectively, were drawn on sheets of Bristol board. The surface on which the 18 smallest were drawn was 15.2 × 20.2 cm., the next three 35.4 × 43.1 cm., and the last five 56.8 × 67.8 cm. The size of the background was varied to avoid the feeling of dislike which preliminary trials had shown to grow out of the fact that it was out of proportion to what was upon it. The lines of the circles were .3 mm. in width. The cards were put on an easel before which the reagent sat, and were then exposed in turn. Under 1, 2, 3, etc., in Table VI. are given the judgments of the reagent for one exposure.

TABLE VI.

Reagents.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
H	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2
M	0	0	0	0	0	0	0	1— —	1—	1—	1—	1	1	1	1
C	0	0	0	0	0	1—	1+	1+	1+	1+	1+	1+	1+	1+	1+
K	0	1	1	1	1	1+	1+	1+	1+	1+	1+	2—	2—	2—	2—
W	0	—1	—1	—1	?	0	0	0	1	1	1	1+	1+	1+	1++
B	0	0	0	0	1	1	1	1	1+	1+	1+	1++	1++	1++	1++
G	0	1	1	1	1	1	1	1	1	1	1	1	1+	1+	1+

Reagents.	16	17	18	19	20	21	22	23	24	25	26
H	2	2	2	3	3	3	3	3	2	2	1
M	1	1+	1+	1+	1+	1+	1++	1++	1++	—1—	—1—
C	1+	1+	1+	1+	1+	1+	1+	1	1	1—	1—
K	2—	2	2	2	2—	1	1	1+	1	1—	—1
W	1++	2	2	2	2+	2+	2+	2+	2++	1++	1+
B	1++	1++	2	2	2+	2	2	2	2+	2	2
G	1+	1+	1+	2	2	1	1	1	1	1	—1

It will be seen from the table that these reagents, and the same is true of many others with whom similar experiments have been made, are indifferent to the smallest circles. Up to a certain size the liking for the circles increases with their size and beyond this size the liking decreases, the largest circles being much less liked than the moderate sized ones and in some cases actually disliked. In describing the curve representing

the course of feeling in the change of sensation strength, Wundt[1] says: "So beginnt die Gefühlscurve bei der Reizschwelle *a* mit unendlich kleinen Lustgrössen und steigt dann zu einen Maximum an, welches bei einer mässigen Empfindungsstarke *c* erricht wird. Von da sinkt sie allmälich wieder und kommt bei *e* zum Nullpunkt, worauf mit weiterer zunahme der Reize der Uebergang auf die negative Seite allmählich wachsende Unlustgrössen andeutet." Külpe[2] says, 'the ordinary course of the affective reaction, as depicted in the psychologies, is as follows:— a very weak, but sensible, stimulus has no noticeable effect upon feeling; as its intensity increases, the limen of pleasantness is reached and passed, and maximal pleasure attained; from this point the intensity of feeling decreases up to a stage of indifference; and this in turn gives way to a liminal unpleasantness, increasing by degrees to maximal unpleasantness.' The two authorities just quoted evidently consider the absolute æsthetic threshold higher than the sensation, and the above results would seem to confirm this view. With a method which is finer as regards the detection of slight differences of feeling — a method in which a direct comparison of feeling is possible — the difference between the sensation and feeling threshold is not so apparent. This was learned from giving the above reagents two circles, chosen at various points between the sensation and apparent æsthetic thresholds, to compare. All the reagents except *K* liked the larger circle when the comparison of any two such circles was made. That is to say, of two circles to which the reagent had previously said he was indifferent, one was better liked than the other. In other words, where the comparative method was employed the sensation and æsthetic threshold were approximately, if not quite, coincident, It is evident from this that the length of the threshold depends, at least in case of some reagents, upon the method used. For my own part, however, the æsthetic impression does not seem to have the customary glow until I have passed the absolute æsthetic threshold obtained by the serial method, although if two small circles, to which I have said I was indifferent, are given

[1] *Grundzüge der physiologische Physiologie*, 5 Aufl., Bd. II., 312.
[2] *Outlines of Psychology*, 249.

me to compare, I prefer the larger, but it seems to be a purely intellectual judgment, and my experience is that of many other reagents. The use of a comparative method in studying the æsthetic threshold shows that, in speaking of the feeling curve beginning with 'unendlich kleinen Intergrössen,' Wundt probably expresses the facts better than do those psychologists who say that 'a very weak but sensible stimulus has no effect upon feeling.'

II. — Experimental Study of the Principles of Persistence, Summation, Practice, Etc.

(*V. d. A.*, II., 240–254.)

Series VI. — To ascertain the æsthetic effect of repeatedly seeing a picture.

Material. — 100 pictures taken from the Masters-in-Art Series of Illustrated Monographs, and mounted on pieces of cardboard 32.8 × 25.4 cm. of a light cream tint.

Judgment Terms. — Preliminary tests were made with different pictures and reagents in which the terms beautiful resp. ugly, pleasing resp. displeasing, agreeable resp. disagreeable, and liked resp. disliked were employed in giving the judgments, with a view to the selection of the most generally applicable and satisfactory judgment terms for the reagents to employ in expressing their feelings regarding the works of art used. When the terms were given the reagents were also asked to give any other terms they found more satisfactory in any special case. The tests showed that the above terms are in no respect synonyms as regards these reagents. For example, pleasing was declared to be too insignificant a word to be applied to certain pictures liked, and certain pictures declared beautiful were not liked or did not 'arouse any emotional response,' as one reagent says, and *vice versa*. Individual theories of art seemed to be embodied more in the term beautiful than in the other terms. The terms liked, disliked, etc., given on p. 26, were finally selected because they were the only terms that were found applicable by all the reagents to all the pictures. In testing æsthetic principles from results obtained through using such terms, it is, of course, assumed that liking and disliking are

crucial or determinate in deciding on the æsthetic value of an impression.[1]

Method. — The reagent was seated at a table, the fifty pictures were laid before her and were uncovered in turn, and remained exposed until the judgment was given. The time taken for the judgment was noted on a stop watch, the introspections recorded, and the next picture was then shown. This was repeated for five days and results are given in Table VII. under I.–V. for each of the five reagents. On the sixth and following days (an hour was given each day to a sitting) each of these pictures was exposed to the reagents for five minutes and they were asked to observe and report (using the terms above given) the course of the æsthetic impression during that period. Under VIa. and VIb. is given the report at the beginning, resp. at the end, of the five minute exposures. Under VII., VIII. and IX. are given reports (taken as were those made on the first five days) for one day, approximately for one month, and for three months later respectively. Except in case of *F* the experiments were then repeated, fifty new pictures being used. The reports are given for each judgment category in per cents. in Table VII. for the five reagents. To economize space the results in the two sets have not been separated since they show the same trend.

Results — Practice. — Comparison of the results in Table VII. for the first (under I.) and second (under II.) exposures, shows a marked change on the part of all the reagents in the distribution of the judgments. This was due doubtless to the nicer distinctions which were possible when all the material to be judged had once been examined. If the results of the second exposure (II.) are compared with those of the fifth (V.) it will be seen that the pictures as a whole are better liked by *M* and *Ma*, thus confirming Fechner's statements that 'without previous practice many fine and high æsthetic impressions escape one' and that 'there are cases where a more frequent repetition of the stimulus is needed in order to bring the (æsthetic) impression to

[1] Compare Külpe's discussion in his Review of Groos, *Der ästhetische Genuss*, published in *Göttingische gelehrte Anzeigen*, 164 Jahrgang, No. XI., 898.

TABLE VII.

No Times Judged.	*H*								*M*								*K*							
	3	2	1	?	0	−1	−2	−3	3	2	1	?	0	−1	−2	−3	3	2	1	?	0	−1	−2	−3
I.	43(5)	25	26			2	3	1	19	17	22	10	14	11	2	5	8(1)	16(4)	45(12)	4	0	23	3	1
II.	49(5)	22	20			3	3	3	26	18	22	1	15	11	2	5	6	22(5)	39(6)	12	1	17	2	1
III.	48(5)	24	21			4	0	3	28	18	18	4	13	11	5	3	5	17(6)	43(6)	7	2	19	6	1
IV.	48(9)	26	16			5	0	5	26(1)	18	17	5	11	16	2	5	3(1)	13(3)	44(3)	10	3	21	3	3
V.	47(8)	23	18			5	2	5(1)	31	15	21	2	9	15	3	4	3(3)	23(4)	38(8)	12	2	15	6	1
VI. (a)	44(7)	24(1)	21			6	2	3	28	16	20	3	9	16	5	3	2	16(1)	36(5)	6	5	31	2	2
VI. (b)	54(41)	20(3)	11(1)		1	5	6	3(2)	30(11)	15(5)	16(1)	0	17	15	4	3(1)	12(3)	23(8)	35(11)	2	5	16	3	4
VII.	54(39)	25(3)	15(4)			2	1	3(1)	31(3)	17(3)	20	1	9	15	3	4	7(5)	36(13)	36(12)		1	16	2	2
VIII.	59(30)	22(6)	12(2)			2	4	1	34	14	21	4	3	16	5	3	6(1)	32(5)	45(18)	1	5	6	4	1
IX.	50(21)	34(4)	9			5	1	1	32	23(8)	15(5)		4	16(1)	4	6	16(3)	14(1)	37(9)	—	12	12	6	3(1)

No. Times Judged.	*Ma*								*F*							
	3	2	1	?	0	−1	−2	−3	3	2	1	?	0	−1	−2	−3
I.	13	25(1)	20	4	8	13	11	6(1)	32	38	20	2	2	6	0	0
II.	11(1)	27	20	9	15	8	5	5	18(4)	54(8)	22	0	2	2	2	0
III.	16	25(2)	22	2	5	16	8	6(1)	22(4)	42(14)	22(2)	0	6	2	4	2
IV.	23(4)	19(2)	19	3	7	12	9	8(2)	24(8)	44(8)	22(2)	0	2	4	2	2
V.	28(1)	17(2)	20	2	8	10	7	8	20(2)	48(6)	22(6)	0	2	4	4	0
VI. (a)	23(2)	26(2)	15	11	6	2	11	6	22(2)	40(10)	20(10)	8	2	4	4	0
VI. (b)	35(13)	31(14)	7(1)	6	2	9	6	4(2)	22(2)	32(6)	32(6)	0	0	8	2	4
VII.	33(5)	28(8)	14	7	4	3	8	3(1)	18(2)	44(12)	24(12)	0	2	4	6	2
VIII.	26(4)	20(4)	17	6	2	13	12	4								

full strength' (*V. d. A.*, II. 241). The other reagents, with the possible exception of *K*, had approximately the same feeling regarding the pictures on both days. The results of the sixth exposure (VIb.) show that this was not due to the fact that the æsthetic stimuli had produced their full effect. It was doubtless because the stimuli had not been sufficiently examined and the following experiments were subsequently made to test the matter.

Summation. — An examination of the results in Table VII. under VIa., where the judgments were given as on the previous five days, with those in VIb., where the judgments were given after the picture had been exposed for five minutes, except in case of *F*, fully confirm Fechner's opinion that 'there are cases where a longer continuation of the stimulus is necessary in order to bring the impression to full strength . . . it is especially the finer and higher impressions which neither when first met nor in the first moment of their activity effect us most strongly' (*V. d. A.*, II., 241). This is particularly striking if one compares in the two cases the plus (+)-judgments which are enclosed in a parenthesis after the number of judgments of a given class (the minus (—)-judgments occurred so rarely that they were not segregated.) A comparison of the judgments of the fifth exposure (V.) with those of the sixth (VIa.), before the five-minute exposure, show that the pictures as a whole were less liked by all the reagents except *F* in the second case. The reagents knew the pictures were to be exposed five minutes and as they had all previously given to protocol that the impression changed from moment to moment one can readily suppose that in this case they gave, as far as possible, their very first impression which one would have expected, in the light of what was afterwards shown, to be lower. It should be said here perhaps that the general uniformity of *F's* results may be explained by the fact that she is not naturally introspective and since she has had no training along this line the finer shades of difference in feeling escaped her notice. The much larger number of high judgments 'liked' recorded in VII. as compared with the number in V., where the judgment time is approximately the same, shows that the effect of the long exposure recorded in VIb. was transferred to VII. where the time exposure was not one fiftieth as great, in

fact, that 'if the activity of the stimulus is interrupted during the period of ascension, that is, before reaching the full strength of the impression, and later begun anew, an after affect is transferred over therefrom to the second effect and thereby shortens the period of increase in case the two effects are not too far apart or the after effect of the first effect not destroyed through intervening effects' (*V. d. A.*, II., 240). The above is shown below also in Table VIII. where the total judgment time expressed in seconds for the second exposure is compared with that of the fifth on the first fifty pictures, for the reagents *H*, *M* and *K*, where the judgments are only very slightly different on the fifth exposure.

TABLE VIII.

Total Judgment Time for	J. H.	E. M.	F. K.
Second exposure.....	155	245	229
Fifth exposure.....	68	193	214

The results of the three exposures (VII., VIII., IX.) after the long exposure, when compared with those before, seem to point to the best method of increasing artistic appreciation.

Series VII. — To ascertain the æsthetic effect of looking at a picture continuously. After the experiments recorded under VII., Table VII., were completed, seven pictures of the set were selected and each of these (one picture daily) was exposed to three of the reagents *H*, *M* and *K* for forty-five minutes to observe and report on the course of the æsthetic impression. I myself also took part in these experiments, but as I knew Fechner's statements and as I found it difficult to free myself from a certain Befangenheit, I have omitted my results. I should say, perhaps, that in general they agree with those obtained from the other reagents, especially *H* and *M*. The taking part in these experiments has shown me still more clearly that such observations are extremely difficult and only reliable where they are made by very conscientious and thoughtful observers. After the first round of exposures was completed a second was made. The results for the first and second exposure rounds are given below in Table IX. under I. and II. The indices found in connection with the judgment terms 3, 2, etc.,

Table IX.

Reagents.	Time in Seconds.	Picture, Lanseer's 'High Life.'			Picture, Ruben's 'Descent from the Cross.'			Picture, Burne-Jones' 'Mirror of Venus.'			Picture, Holbein's 'Meyer Madonna.'		
		Previous Judgment = 3.			Previous Judgment = 2 +.			Previous Judgment = 2.			Previous Judgment = 1.		
		I.	II.	III.	I.	II.	III.	I	II.	III.	I.	II.	III [1]
	0– 5	0 3^4 3^5	3^3 3^4	3^5 3^6 3^7	2 3	0 2	3— 3 2	0 2 3	0 2 2+	0 13 3	0 2	0 2 3	0 3— 3+
	5–10	3^6	3^5 3^6		3^1+ 3	3— 3+		3+	2 3 3+		3	3+ 3^1+	
	10–15	3^7	3^7		3—	2 3		3^2 3^1	3— 2		2	3 3 —	
	15–20	3^3 3	3^8		3	2 1		2 1	3— 1		1 0	2 2 +	
I. H.	20–25	0 1	3^5 3		3^1+	2		2 0	1+ 0			3 2 1	
	25–30	0	2 2—		0^3	2+ 2			0 —1			—1 —2	
	30–35		1 0		1 0	1 0			—2 1		—1	? 0	
	35–40		2						0		—2		
	40–45		0								0		
		Previous Judgment = 1.			Previous Judgment = — 3.			Previous Judgment = 3.			Previous Judgment = 0.		
	0– 5	0 1+	0 1 2	0 2+	0 —3+	0—3—3^1	? 1	0 3 +3^1+	3 3^1	0 3^1 3^2	0 —1	0 1— 1	
	5–10	1+ 2— 2+	1		—3^2+			3^2+	3^2		—1—2 1	2	
	10–15		2		—3^3+	—2					1		
	15–20		3 2					3^1+	3—1 3		0 1	1 2	
E.M.	20–25	2— 2+				1—3 1		3 +	—1 2		0	1	
	25–30	2 2—	1— 1		—3 +	—3 1		3^1+3^2+3^1+			0 —1	0 1	
	30–35	1+ 2— 1+	0		—1+ —1—	0 1 0		3+ 3 —3 +			0 1 0	—1 1	0
	35–40	1— 0	10 10					3— 2 +3 —	0 1			1	
	40–45		—1					2+ 2 2 +	2			0	
		Previous Judgment = 2 +.			Previous Judgment = — 2.			Previous Judgment = 3 +.			Previous Judgment = — 1.		
	0– 5	1+ 2	? 1 ?	2 2 1+	—3	—2 —3		3 2 +2	1 1+2—	? 1+2+3	? 0 1—	? 1	1 1+? 1—
	5–10	2+	1— 0?		—3^1	—3 ?		2— 2	2 2+	3+	? 1—	1+? 1+	1+
	10–15	2	0 ? 1—		—3	0 —3		2+ 2	3+ 3+		1	? 0	
	15–20	2— 1+	?—1 —1		—3^1	—3		2 +	3		0	0	
F.K.	20–25	1 1—1	0		—3 0			3 —	3+		? 0	? —1	
	25–30	1+ 2 2+3—	? 1—			? 0		2 +	? 0			? 1—	
	30–35	2 2—	? 1—		—3 0			2	?			1—	
	35–40	2 2—			—3	—3		2 +	3 3+3+		? 1—?	1	
	40–45	1+ 2			0			3 3 +			0	1 1—	

TABLE IX.—*Continued.*

Reagents.	Time in Seconds.	Picture, Watteau's 'The Fountain'									Picture, Perugino 'Madonna, Saints and Angels.'									Picture, Durer—'Four Apostles—St Mark and St. Paul.'								
		Previous Judgment = —1.									Previous Judgment = —2.									Previous Judgment = 3.								
		I.			II.			III.			I.			II.			III.			I.			II.			III.		
J.H.	0– 5	—1		—2	—2		—3	0	—2	3	0		—3	0	—2	—3	—3^5			—2		—3	0	—2	—3	0	—3	+—2
	5–10			—3	—3+		—3^2	—2		—1	—2			—3^1		—3^1+					—3^1	—3^1		—3^2			
	10–15	—3^1			—3		—3+				—1		—3	—3	—2	—3^4				—2		—1	—3		—2			
	15–20	—1+		1	—3		—2				—3^1			—3^5		—3^6				—3			—3^2					
	20–25	—2			—1		?				—3^2		—3^3	?	0	—3^1				—2				—3^3				
	25–30	—1			0		—1				0			—3^3		0				0			—3^2		?			
	30–35	0	—1	0	0							—3		0	—3^4	0				—2	0	—3	0					
	35–40				?		0				0									0				—3				
	40–45				—1		0																0					
		Previous Judgment = —1.									Previous Judgment = 3.									Previous Judgment = —2.								
E.M.	0– 5	0	—1	—1+	0	—1	—2	0		—2	0	2	3	0	2	3	3			—2+			0	—2	0	0		—1
	5–10										3	2	3			3^1					—1		—1					
	10–15			1—			—1													—2+		—2—		0				
	15–20			0	—2		—1									3				—2+		—2		—1				
	20–25	1—			0		—1					2										—1+						
	25–30	—1—		0	0							3	2	2		3						—1+		0				
	30–35			—1—		—1	0						0	2	3	2						—1+	—1		—2			
	35–40	0		—1—			—1				1	0			1					—1—		0	—1					
	40–45				0										1									—1				
		Previous Judgment = 2.									Previous Judgment = 1+.									Previous Judgment = 1+.								
F.K.	0– 5	?	11+	1	2		2+	2		2+	?	1—	0	0	?	1—				—1			1		1+	?	11—	?1—
	5–10	1—										?		—1		1				?		1	1					
	10–15			1			2				0			1+	?	0				0	?		1	?				
	15–20	?	0	?		2+					?	1—		1—		0				—1			1—		1			
	20–25	1—		1			2							?		1					1+							
	25–30			1+			2—							1—	0	?					2		1—					
	30–35	2—		2			1+							1						?								
	35–40			1+		1								1—		0					—1		1	1—	0			
	40–45													?	1—								1	1—				

indicate the number of times the reagent raised the judgment after saying 'very much liked,' 'disliked,' etc. During the second exposure round on the day following the exposure of a given picture, it was exposed for five minutes to the reagent and the judgments during that period are given under III.

The following introspection of *M*, as well as the results in the table above, corroborate Fechner's statement that 'every, consequently an æsthetic, stimulus needs a certain continuance of activity before its effect is observable.' *M* says, "when I first look at the picture there is an interval during which, while I recognize it, it arouses no feeling. This varies perceptibly in length with different pictures, being most brief in the case of a picture strongly liked or disliked. The feeling, when it comes, is usually not at once at its full intensity, that is, there is very often a 'moderately liked' judgment given which, within a few seconds, changes to a 'very much liked' judgment." The above results also furnish abundant proof of the other statements of Fechner (*V. d. A.*, II., 240–243) as "With a continuous like remaining stimulus the impression increases up to a certain limit which can be designated as the ascending effect. . . . In many cases the period of increase may be so shortened that one thinks the first impression the strongest. . . . The æsthetic impression (higher or lower) through lengthening or repeating of the stimulus can never rise above certain limits. If the stimulus is continued in the same or a similar way or repeated after the entrance of the full strength of its effect, and if the original sensibility has not been renewed through a long interval, the impression is lessened. . . . In each interruption of the continuance of an activity the original sensibility is partially or wholly renewed." From the results of *H* it would also seem that 'strong, disagreeable stimuli through continuance or repetition are relatively less easily and quickly dulled' (*V. d. A.*, II., 242). Only occasionally is it shown above that 'by the continuous or repeated action of a pleasurable or displeasurable stimulus the weakening of the original effect can be transformed to the opposite' (*V. d. A.*, II., 242). In view of the results of this series of experiments it is evident that, 'neither too long a continuance nor too sudden nor too frequent a change in the

kind and direction of an employment (æsthetic) is pleasurable' (*V. d. A.*, II., 247). Also that 'the degree and change of degree in employment which is most satisfactory depends on individual relations of physical and psychical power.' Similar long exposures with lines also show, as Fechner says, that 'the need of a change arises the sooner, the greater the approximation to uniformity, and is stronger the longer the need is not satisfied' — and that 'too much and too little occupation in a given time gives one displeasure.' Before closing this part of the discussion it should perhaps be said that the study of the judgments on individual pictures furnishes many illustrations of Fechner's principle of habit that 'a pleasurable stimulus becomes a necessity through frequent action or repetition' and that 'a disagreeable stimulus becomes more easily endurable.' A study of the introspections given in connection with the experiments increases one's confidence in the results.

The two following are typical: *H* said, in connection with one picture, she had drawn herself up 'with a start' and said to herself 'it is beautiful.' *M* said that, during the forty-five minute exposure, she was 'distinctly conscious' of not liking to change her judgment. The following, gleaned from a study of the introspections spontaneously given, throw some light both on the origin of the above judgments and on the reasons for their momentary and more constant changes. In giving judgment *H* and *M* considered the picture *as a whole*. In examining, for example, the Sistine Madonna, *H* said that, when she was inclined to look at one detail, she felt she must look at the whole picture. As regards individual preferences, *H* liked the pictures of Ter Borch, Pieter de Hooch, the portraits of Holbein, especially those pictures where technique was an important element. *M* took especial pleasure in pictures with people, especially if the facial expressions were well brought out and she liked them. In case she did not like the expression, as in Giorgione's 'Portrait of a Young Man,' Botticelli's 'Portrait of Piero de Medici the Younger,' and Holbein's 'Portrait of Erasmus,' her judgment was not high. *K*, whose judgment as compared with the others is very low (this is partly due doubtless to a difference in the application of the terms, though she herself says often that she

feels she does not get that pleasure from pictures that many others do), gives her judgment in general on some *unimportant detail*, as the vase of lilies in Andrea Della Robbia's 'Annunciation.' *H* and *M* occasionally give judgments 'slightly liked' resp. 'disliked' where some detail strikes them particularly, and they feel they 'must give something,' when as regards the picture as a whole they are indifferent. There was one detail, however, if one can call it a detail, which was always largely determinative for *H*. It is the kind of day in which she feels 'blue and despondent,' her 'gloomy day,' as she calls it. Such a day as is presented in Carpaccio's 'Return of the Ambassadors to England,' Corot's 'A Gust of Wind,' etc. For *M* also there is a determining factor, and that is the presence of a mother and child in the picture, especially if the child is held in the mother's arms. Over and over she speaks of the delightful physical sensations arising from the sense of touch in connection with the child's flesh, which she experiences on the seeing of such a picture. Touch sensations, which very often arise in connection with the pictures for this reagent and occasionally for the others, are not always conducive to a high judgment. For example, the touch sensation arising in connection with the bare feet touching a stone pavement is 'distinctly disagreeable.' As regards *sensations* as a whole it may be said, in view of the following and similar introspections, that they certainly play a role in determining the amount a picture is liked, resp. disliked, if not whether it is liked, resp. disliked. The judgment was lowered during a long exposure of Pieter de Hooch's 'The Buttery' because *H* felt the room become 'hot and stuffy,' of Corot's 'A Road in Sunshine,' because she felt she 'was going along a road on a hot day.' Both *H* and *K* heard the noises while looking at Hogarth's 'The March of Finchley,' and *H* 'was troubled' by them. On *K's* part the hearing of noises was doubtless an illusion sometimes, for she discovered later, on one occasion, that the noise of a passing wagon had been located in the picture; the 'child became heavy' during a long exposure of Holbein's 'Madonna of the Meyer Family,' the weight of the book became 'burdensome' in looking at Dürer's 'Four Apostles — St. Mark and St. Paul.'

In long exposure of Ruben's 'Descent from the Cross,' *H* could feel the pulling on the teeth of the cloth held in the mouth of one of the men and the muscular strength he was obliged to exert. In looking at this picture all the reagents felt the physical pain in connection with the taking down of Christ's body. The feeling of sensations must contribute to giving that '*reality*' to the picture, of which all the reagents frequently speak in connection with the long exposures, which has a decided influence upon the judgment. *K*, with whom feeling of 'reality' plays an important part, says, on giving a low judgment while examining Gainsborough's 'The Blue Boy,' that the boy, whom she does not like, stands out and seems 'real' as if she were meeting him. Later, on raising her judgment, she remarked that when she looked at the background she liked it and had then said to herself she ought to think of the scene as a picture and when she had done so she liked it. *K* even locates herself in a picture. In Leonardo da Vinci's 'The Virgin of the Rocks' she feels herself standing just back of the figures. *H* says, in Pieter de Hooch's picture of 'The Buttery,' on lowering her judgment, that the picture is 'so real' that she feels the woman ought to have handed the pitcher. The same reagent says, after examining Ruben's 'Descent from the Cross' a second time, "I did not enjoy the treatment as much this time. I thought of it (the picture) as some real scene, while before I thought of it as a painting and took much pleasure in the relative handling and mastery of the subject." *Imitative and other movements* were observed occasionally in connection with the examination of the pictures, especially by *M*. She feels herself 'falling into the expression of the faces in turn in looking from one person to another' in a picture. The reagents were also conscious of certain other pleasurable movements in looking at the pictures. That, for example, of the running of the eye up and down the winding stair of Burne-Jones' 'The Golden Stairs.' The *vacillations in the judgments* not directly referable to the vacillations of the attention itself, as well as the doubtful judgments, are doubtless due to the mode of examining the picture, which is characteristic of all the reagents, that is, the eye passes from one detail to another, having an especial

tendency to return to the detail most liked. Such a mode of examination doubtless increases the pleasure[1] but it must sometimes result in conflicting feelings. My own 'doubtful' judgments, for example, on Valasquez's 'The Topers' was due to the fact that I could not decide whether I liked the group of figures at the right more than I disliked those at the left. In giving a judgment on Ruben's 'Descent from the Cross' *M* says 'the judgment is each time a compromise between a dislike of central figure and a liking for the rest of the picture.' Of Holbein's 'Madonna of the Meyer Family' the same reagent says "here it was wholly a question of which part of the picture I looked at, whether or not I liked it. The row of kneeling women and the carpet are unpleasant to me; the kneeling youth and standing child indifferent, the rest pleasing, chiefly the Madonna's face and the light on the ornaments at the back, also face of kneeling man."

In connection with the gradual lowering of the judgment on a picture and the final feeling of indifference with respect to it, all the reagents report that all *movements cease* in the picture ('dead' is frequently applied here and 'alive' to the pictures greatly liked), that it grows flat, that is, the picture ceases to be seen in perspective, and there is difficulty in holding the attention. The following introspection of *K*, in connection with the second exposure of Watteau's picture, 'The Fountain,' brings out the changes in these respects. 1, 5, etc., stands for minutes and 2, 2+, etc., under these numbers express the reagent's judgments at the end of the period.

1 5	10	15	20	25	30	35	40	45
2 2+	2+	2	2+ 2+	2	2+	1+	1 1	1

"I knew judgment at once and was surprised, for did not want to look at Watteau to begin with. Like it better than ever before. Seems darker yet more distinct than I had remembered. Perspective pronounced. Figures stand out from background. Fountain-basin deep and water falling fast from

[1] Compare Martin, *Psychology of Æsthetics, Experimental Prospecting in the Field of the Comic, loc. cit.*

fountain. Suggests two sounds — a flat one, of water falling on flat surface; and a deeper one, of falling into basin. Cannot say sounds are real. Trees seem just going to wave against sky; clouds seem moving slowly. The longer I look, the more figures stand out in detail, from background, and from each other. (10 min.) Seems to be a crosswise motion of leaves of trees on right, like a wind blowing a little. Light spot looks like toe of a boot, and spoils picture some. Trees on right rise alone — stand out from background. Want to look at individual things in picture yet like it so much as a whole I cannot stop; though remember I divided it into three parts last time. Seems as though there were a steep cliff, in the part back of the figures. Shadows on water in basin make water seem clear but deep. Like picture, but attention not quite as good. (25 min.) Attention better, but do not like picture quite so much — picture less lifelike. (35 min.) No movement unless I suggest it. Water seems a white streak unless I wonder if it will still *flow*, then it does. (Did not suggest before.) Is not so pleasing as at first, yet interested in seeing if it will not be as pleasing again. Something 'slowing up.' Find I am excited — heart beats faster, breathing uneven. Want to like picture, yet pleasure seems slipping out of my power. (40 min.) Excitement gone, and picture flat, except for drapery and fountain-basin. Still enjoy it, but not so much as at first. Do not feel tired. Have enjoyed this picture more than any other except No. 53." As regards cessation of movement in a picture as liking lessens *H* says, after looking at Pieter de Hooch's 'Cottage Interior' for a while, in lowering her judgment, 'the figure seems to have stopped work to pose'; of Frans Hals' 'The Jolly Man,' the 'man smiled at first, then the smile ceased and the mouth just seemed open'; of the mother in Raphael's 'La Belle Jardiniere,' 'seemed as if she were going to do something at first, then she did not and I was tired of watching.' *M* frequently used term 'fades out' in connection with lowering her judgment. On being asked what she meant she said 'I can scarcely explain what happens; a face which was at one moment expressive, the next is expressionless.' As the expression did not return, this can scarcely be referred to as a phenomenon peculiar to the

activity of the attention itself. As regards the *decrease of depth* (it is interesting to remember 'transparency' as a commendatory term in art and 'flat' as the opposite) or perspective which often accompany the lowering of the judgment, it was said, for example, of the dog in Lanseer's 'High Life,' "it lost in realism and it seemed then a 'flat piece of paper.'" After looking at Holbein's 'Madonna of the Meyer Family,' the expressions of all the figures began to grow set and hard to one; I then began to dislike it very rapidly, finally I felt the whole picture stiff, ugly and flat and it really gave me no feeling whatever. *M* said on one occasion "sometimes the picture 'flattens,' that is, the perspective is no longer visible to the eye. The distant mountain seems to be standing just beside the near man instead of in the background. Being only a part of a man's height, the effect is to destroy any significance in the picture." Fechner makes a good deal of the part played by *attention in æsthetic appreciation*. He says 'the attention must be first put or kept on the stretch (gespannt). All the reagents spoke of the difficulty of holding the attention in connection with the lessening of pleasure derived from the picture. Again *M* says, "I find noise or movement when I am looking at a picture tends to lessen my enjoyment of it. This is especially true of the sound of footsteps approaching the door."

Judgment-time. — The previous results show that the three seconds' exposure given in a recent investigation in æsthetics[1] would not have been sufficient for the full strength of the impression in the case of these reagents. Table X. below, in which is given the average time expressed in seconds for the various judgment categories in the case of the first fifty pictures

TABLE X.

Reagents.	Average Time Taken for Judgments.								Average Time for a Single Judgment.
	3	2	1	?	0	−1	−2	−3	
H	2	4	3			5	4		3
M	6	6	7	11	6			6	7
K	2	3	4	10		4	7		4
F	5	7	7	20	13	14			13

[1] Külpe, 'Ein Beitrag zur experimentelle Æsthetic,' *Amer. Jour. Psy.*, XIV., 215.

A Case of Pseudo-Chromaesthesia, based on reproduction of Corot's "Orpheus Greeting the Morn" (in black and white).

used, shows moreover that it would not have been sufficient for the making of the judgment in the terms here used.

The shorter time consumed in giving the higher judgment, which is observed above, must not be interpreted in any way as a measure of the continuance of the pleasurable impression, for it was particularly in connection with the corresponding picture that the reagents expressed themselves as sorry to have the particular stimulus removed. Such expressions were a proof doubtless that the point of satiety was still far away (*V. d. A.*, II., 244).

III. Experimental Study of the Principle of Association.

"*Everything with which we are surrounded is for us physically characterized through* [*being*] *a resultant of remembrances of everything which we have experienced externally and internally, heard, read, thought, and learned concerning this and even related things*" (*V. d. A.*, I., 93). Innumerable illustrations of this principle occurred in the various experiments. Two of these forms are of especial interest in that they lead one to see that this principle must be made to cover cases of pseudo-chromæsthesia and illusions or hallucinations, as they evidently play a part in æsthetic judgments.

Pseudo-chromæsthesia as an Æsthetic Factor.— An unusual form of association — semi pseudo-chromæsthesia — without doubt sometimes determined the judgment of *H* on the first examination of a picture and was in subsequent examinations sometimes the cause of a change of judgment. During the exposures of the hundred pictures of Series VI., VII., Miss Hayward (*H*), who draws and paints in both water color and oil, frequently spoke of seeing color in some of the pictures, of seeing them in a particular media, as water color, oil, etc. She remarked, for example, that Corot's 'Orpheus Greeting the Morn' appeared as a water color, and Pieter de Hooch's 'A Woman Reading,' as an oil painting. At the close of these two series of experiments I gave the pictures just mentioned to Miss Hayward and asked her to reproduce these as they appeared to her. The first was copied in water color and is reproduced in Plate IV. in the colors she saw. The second was copied in oil,

and purple and a rich brown were the predominating colors. Economical considerations have prevented the reproduction of the second picture also. Miss Hayward affirms that these colored reproductions represent just what she sees, though she knows that the pictures are in black and white. Her great surprise on hearing that I did not ever see any colors in reproductions of this kind confirms me in the opinion that she certainly sees colors in some instances where other people see only the varying shades of black and white. Later in the experiments of Series XI. I found that Miss Winslow (*M. W.*) also sees some black and white pictures in color.

Series VIII. — To ascertain the æsthetic effect of semi-pseudochromæsthesia. — In order, if possible, to get some further information regarding the origin and permanence and effect on the judgment, as regards the liking of a picture, of this peculiarity, which is evidently something in the nature of pseudochromæsthesia, I asked Miss Hayward to make a careful study along this line of each of the hundred pictures used in the previous series, recording her observations and accompanying them by sketches on which the colors seen were noted. The pictures were examined twice in this way, a month having elapsed between the examination, of each picture. Of course the records of the first examination were not consulted or compared with the second, in fact they were in my possession during the time the second examination was going on. The following is a summary of the observations recorded from day to day. Table XI. shows under I. the number of pictures in which the colors were the same on both examinations, under II. the number in which the colors were slightly different, under III. entirely different, and under IV. the number where the reagent was doubtful. It will be seen that the seeing of color is very frequent. Examination of the records further shows that purple is the color more often seen and as regards position that it is found particularly in the deep shadows.

TABLE XI.

I.	II.	III.	IV.
59	25	15	1

The forms in which the first hundred pictures were seen were oil paintings, water colors, monochrome drawings, charcoal sketches, photographs of casts, Japanese prints, and as in real life. In Table XII. below has been recorded under I., II., III., etc., the number of pictures falling in each of the classes just given in the order they were named, on the first examination (*A*), the second (*B*), and on both examinations (*C*).

TABLE XII.

	I.	II.	III.	IV.	V.	VI.	VII.
A	33	3	31	10	11	3	9
B	38	5	38	6	9	1	3
C	25	1	25	4	8	1	2

It will be observed that the impression as regards the medium was somewhat permanent, as in 66 of the 100 pictures it is the same in both examinations. The same is also shown from the fact that in the case of several pictures, which were exposed ten minutes, not only did the medium not alter, but so far as reagent could observe there was no change as regards saturation or color tone. The fact that repeated effort to change the medium in which a picture appeared through suggestion was rarely successful furnishes still further proof.

Many factors enter into determining the color and medium in which the black and white reproductions appear on the first and subsequent examinations. (1) One thing having a determinative power is the subject and mode of treatment in the originals. In the hundred pictures of series V. and VI. no pictures are reported by the reagent as appearing as if mosiacs, frescoes, or stained glass as regards medium, but later these media are frequently mentioned in connection with the examination of the pictures of the early Italian school.[1] (2) The nature of the print itself also had an influence. Whether, for example, it is so printed that one seems to 'see the canvas.' Trial showed that different kinds of black and white reproductions of a picture approximately of the same size gave different colors and media.

[1] Without doubt the mosaic work on the Stanford Memorial church and its stained glass windows have an influence as regards the seeing of some pictures in the media just mentioned.

(3) The size of the reproduction also has an influence. Many of the larger reproductions published by George P. Brown & Co. appear in decided colors, but the smaller reproductions of them which are found in the catalogue gave no color other than black and white. In general the miniature pictures of the catalogue gave no color at all. The effect of size is also seen in giving the reagent pictures, said to appear in color, to examine with reading and with reducing glasses. The first usually brings out the colors in brighter shades but the second reduces them. (4) The surroundings of the reagent play a part in determining the colors and medium in which a picture is seen. This is shown in the influence of the occupation of the preceding hour upon the judgment. For example, where the hour before the time had been spent in examining Japanese prints the first pictures of the next experiment hour appeared in this form.[1] The reagent also noticed that for several days after the examination of the same collection even the appearance of the landscape was affected. Things were literally seen from the Japanese point of view. Again some of the pictures took on the appearance of those of Brangyn when the work of this artist had been studied during the previous hour. (5) Records were made regarding the weather at the beginning of each experiment hour and the records show that the nature of the weather was a potent factor. When the day was dark and gloomy the colors were less vivid — in some cases this went so far that pictures which looked like oil paintings on sunny days came to have the appearance of wash drawings on cloudy and dull days. An example of this is found in Corot's 'Dance of the Nymphs.' As a rule the colors in the picture were those of natural objects on such a day. The reports show that if it was a bright sunshiny day she saw the reds, yellows, and light purples and blue predominating. On the other hand, if it were a very gray day, the more pictures would she see in the monochrome tones, or if as oil paintings the colors would be grayer. The influence of the

[1] From these and other studies which I have made on association I have been led to feel that in studying the train of ideas far too little attention has been paid to the influence of present environment on the results. It is for this reason that pictures on the wall, etc., should not be in sight of the reagent during these experiments.

kind of light on the colors and media in which the prints are seen came out clearly in experiments where the pictures were examined by daylight and then re-examined immediately after the room was darkened and the electric lights turned on. In this connection it is interesting to find that the colors come out more distinctly with two eyes than with one, and with the right eye, the stronger eye, than with the left. (6) Again the condition of health and the mood of the reagent at the time of the observation plays a part in the result. On days when she recorded herself as feeling joyous and happy, the colors were reported as having life and variety and the bright warm colors predominated. On the other hand, when she felt gloomy and sad she saw dull grays and gloomy purples. An example of this is shown in Corot's 'A Gust of Wind.' On January 30, reagent is in good mental and physical condition and this picture is recorded as 'brilliant in color, warm and transparent.' On February 21 the reagent records that she is 'sad and unhappy' and the colors of this picture are reported as 'gloomy, dull and lifeless.'

The question naturally arises whether this reagent shows anything resembling the usual forms of chromæsthesia or pseudo-chromæsthesia. I have questioned her on number forms, the letters of the alphabet, and colored hearing. She sees black letters of the alphabet, numbers and lines usually in dark purple. She also recalls them in this color. So far as I can find out she had nothing in the nature of what goes under the name of 'colored hearing.' In view of all this, it is evident we are dealing, as regards the appearance of these pictures to Miss Hayward, with a case of pseudo-chromæsthesia more or less permanent in character. On account of the changes which occur under varying influences we are not obliged to seek for a very complicated physiological explanation of the phenomena. It is clearly a case of psychological association — an illusion. It is interesting psychologically, because it gives absolute proof of the validity of the association explanation of similar phenomena which are so permanent in character that one is not able, as here, to trace the associative steps. From an artistic standpoint the interest lies particularly in the fact that purple is the color which occurs more frequently. One observes in Plate IV. that

purple predominates and the same is true in the reports on the other pictures. I suspect this is due to the impressionistic training which the reagent has had in painting. In her early instruction in painting she was told to see purple and in response she called up the color through an act of memory and superimposed it upon what was under examination. It was, in some sense, a form of hallucination. Gradually this, which was at first an effort, became so spontaneous that the reagent did not realize in the least that she had used her memory. It is a fact that the mere mention of a color to Miss Hayward makes her call it up with surprising vividness. It is also interesting to find that purple often comes first before her when she is asked to recall a color.

It would seem not unnatural to suppose that the medium in which a picture is seen must influence the degree with which it is liked. Unfortunately I did not ask Miss Hayward to record her judgments in examining the pictures on each of the two different occasions just referred to, and so I cannot say positively in connection with those examinations that this was actually the case. To get, if possible, something through which I could test my supposition, I gave the mean judgment given to each picture judged in Series VI. and then counted the number of judgments to each class for the different kinds of media, and they are given in Table XIII. below for those pictures which were placed in the same class on both occasions. It will be seen at a glance that the judgment is higher in case of pictures seen as oil paintings.

TABLE XIII.

Judgment Category.	3+	3	3—	2+	2—	2	1+	1	1—	0	?	—1—	—1	—1+	—2—	—2	—2+	—3—	—3	—3+	No. of Pictures.
Oil painting.....	9	15				1															25
Water color.....								1													1
Monochrome.....		2				9	1	5	1				4			3					25
Charcoal		1				2		1													4
Photograph of cast.....		2				4		1											1		8
Real life		1						1													2
Doubtful.....																	1				1
																					66

To learn whether *H's* variations in judgment could be traced to changes as regards medium and color in which these pictures were seen I showed her, in a room flooded with sunlight, when she was feeling physically well, 91 pictures which she had seen a month previous as charcoal sketches, monochromes, or as sepias, that is, in white and black or shades of brown, and asked her to give a judgment upon each and to state the medium in which it was seen. These judgments I compared with the judgments given the month before when she was below normal in health and the room in which she was seated was well lighted by diffuse light, that is, where no direct sunlight entered it. Thirty-two of these pictures were now seen in colors other than those mentioned above (as to medium they appeared now as oil paintings, water colors, or as in 'real life'), 19 of them were judged higher, 2 lower, and 11 as on the first examination. Of the 59 pictures, which were seen as regards color as at first, 21 were judged higher, 7 lower, and 31 as on the first examination. Evidently the improved physical condition and bright sunlight had increased the seeing of color. They had also increased the liking for the pictures, but the increase is much more marked in the case of the pictures which now showed color. There is evidently some connection between the liking and the seeing of the color. It seems more natural to suppose the seeing of color in a picture increased her liking for it, but these experiments suggest that the change of feeling may possibly bring about the change in color through association. That is, that the pictures which are most liked are those in which the colors are most marked.

Illusions and Hallucinations.— These played an important role in the experiments with Miss Merrilies (*M*). In the preliminary experiments recorded in Series II. she said, in studying the different impressions from lines of different lengths, when 23 mm. of the line had been uncovered, that she had been indifferent to the line up to that point but now disliked it because she saw a woman lying on the line and when she reached her chin the face was unpleasant; at 200 mm. she remarked that the figure had begun to draw out below the waist; at 230 mm. that it was hideous; and at 480 mm. that the woman had suddenly disappeared and the line had become a line.

In connection with the experiments with lines, only a few such associations or hallucinations were reported by *M*, but in the examination of the pictures they were quite frequently spoken of. For example, she says after looking at Burne-Jones' 'Love among the Ruins,' "Here I see, back of the two figures actually in the picture, a shadowy passage winding from left to right and in it, close to the left wall, the crouched form of a man. He is partly hidden by the shadows, his face screened. His direction of movement is towards the two figures in the garden." Again on looking at 'Apollo Sanroctonus' of Praxiteles, she says, "I see here below the pedestal the slender marble column on which it rests. It stretches down to a base, set among broken rocks.' This form of illusion was frequent.

Series IX. — To ascertain the æsthetic effect of illusions and hallucinations.

At the close of the experiments recorded in Series VII., *M* made, at my suggestion, a study of these illusions, working fifty minutes or more daily during several months. In this time she twice examined a set of 585 pictures, taken from the Masters-in-Art Series of Illustrated Monographs. The mode of examination was to uncover a picture, look at it sufficiently long for recognition, and then to turn it over and record the impression made before looking at the next picture in the set. The following account of the work, which I have compared and find to agree with the original records, is taken from the written summary handed to me at the close of the work.

Number of Illusions. — Out of 1170 exposures, there were found to be 374 which returned illusions, that is, 31.961 per cent. of all the pictures examined presented an illusion or hallucination of some kind.

Classes of Illusions. — The pictures containing illusion were divisible into three general classes as regards recurrence; (1) those pictures in which the same illusion occurred upon both exposures (this class includes 9.26 per cent. of the entire number of pictures examined (1170)); (2) those pictures which presented an illusion of one kind upon the occasion of one exposure and a different illusion upon a second exposure (2.05 per cent.

of the pictures examined); (3) those pictures which presented an illusion upon one examination and no illusion upon the other (20.68 per cent. of the pictures examined).

Nature of Constant Illusions. — There were thus 54 pictures — 108 exposures — which returned a constant result. In these 54 cases the illusion took the form of (1) in 25 cases, completion of or addition to the landscape which formed the background of the picture; other elements appeared, but the completion of a partly shown background was the important thing. This is illustrated by Rosa Bonheur's 'Sheep in a Meadow,' where a gently sloping plain and hill, both dotted by sheep, was seen. Under this head are counted those pictures which presented the appearance of great space. It is to be noted that most of the landscapes thus seen were of rolling hill country, very often with mountains in the background — scenes with which *M* had been long familiar. Only in one case was a flat, marshy background seen into a picture and in this case the setting was distinctly Dutch. (2) In seven cases — five to the right and two to the left — there was permanently the sense of some unseen presence in the background of the picture. (3) In five cases there was reduplication of a face or figure already present. (4) In four cases there was completion of a figure partly seen. (5) In fifteen there was the addition of some new element not directly traceable to the content of the picture. It must be borne in mind, however, that these divisions are not absolute. A picture containing completion of background may also have reduplication and is classed according to the illusion which seems of greater importance.

Illusions from Without. — Previous occupation has a marked influence upon the occurrence of an illusion. Not only does one picture in a series influence the next, but one picture will, perhaps, cast its influence over a number of those succeeding it. Sometimes also the previous thought or occupation of the reagent will influence the entire series during the day. In five out of the twelve cases in which a distinctly different illusion is presented upon one examination from that found on the other, the difference can be accounted for on the ground of previous occupation. Sometimes a face or figure is transferred entire from

one picture to another;[1] thus in Pieter de Hooch's 'Dutch Interior' it is noted, 'As soon as I saw her (woman holding wine glass), I saw the face of that other woman sipping wine in another picture.' The picture referred to had been seen in another set, but the similarity of action caused it to reproduce itself upon the eye, so that it was more strongly present than the real picture. This direct and recognizable transference is, however, rare. It may be added that illusions are not confined to pictures nor their reproduction to superimposition upon other pictures. In nearly every case in which occurred a vivid case of illusion and in many cases of pictures in which there was no illusion, the scene was reproduced upon the wall as soon as the eyes were raised from the picture. Frequently one scene would come back each time the eyes were raised during the hour's work. At first their return would be a source of pleasure, but weariness and a sense of inability to escape from the return would transform it into discomfort. Then to avoid it the reagent would consciously summon some other scene and place it on the wall, for illusions, though they cannot always be dismissed at will, can be summoned at will when this reagent is normal. If the eyes are fixed upon a picture or blank space and the mind is freed from the control of the will, pictures will usually come and go in succession. There is no sense of weariness until one picture begins to come back frequently and cannot be kept away. Blank surfaces, more than any picture, are conducive to illusion. A surface cut by a line is also likely to cause illusion. Thus a thin, vertical black line brings before the eyes a budding willow branch. This is probably because such a line was the base line of a willow drawing made a number of times by *M* as a child. Miss Merrilies thinks that, as a child, the power of imposing mental images upon external things was greater than it now is, and the ability to distinguish between the real and the imaginary less complete, but can give no very satisfactory proof of it. It should be noted that when the mind is directed toward some particular end, illusion is unlikely to appear. If work is

[1] In recalling one of a series of pictures I have found that I have transferred some detail of some other picture to it and it seems not improbable to me that people may often have illusions of this kind which may effect their estimate of a picture.

begun with the determination that mental pictures shall not be externally placed, they usually are not so placed; if, however, the placing has begun a determination that it is to cease is likely to prove ineffective. The pictures containing illusions are the ones which recur more readily to the mind after seeing. Three months after the completion of her work with the pictures, the reagent was asked to make a list of the 30 pictures which first came into her mind from the set examined. From the list of 30 it was found that 28 were pictures containing illusions, although the number of pictures containing illusion at the time of the examinaton was but 31.96 per cent. of the whole number examined.

Placing of Illusions. — After the completion of the original examination, some pictures containing illusion were again examined to find whether the illusion was placed oftener upon one side of a picture than upon the other. It was found that the illusion was invariably placed toward the more heavily shadowed side, whether this were to the right or left. In transferring an illusion to the wall, when the light came from the left, the illusion was placed to the right; when the light came from the right, it was placed to the left.

Characteristics of Pictures Having Illusions.— Among the pictures presenting illusions, either persistent or variable, the following characteristics were usually present, although often only one, not all, of them occurred in a single picture. (1) Pictures presenting illusion have frequently very dark backgrounds or backgrounds filled with shadowy and indistinct lines. The background is usually uncrowded. (2) Often the pose or expression of some of the central figures suggests the completion made; this includes those pictures in which a partly shown figure is completed or in which a background was enlarged. (3) Explanation of the pose or expression of a figure is also frequent. For example, in Reynold's 'Age of Innocence' one sees at what the child is looking because one sees the child. Suggestiveness, then, and space for the placing of an illusion are the prime characteristics of those pictures in which they appear.

Effect of Different Conditions upon Illusion. — That many pictures fulfilling the above conditions were, nevertheless, with-

out illusion may be explained by the different conditions, external and mental, under which they were seen. (1) Sometimes in two pictures closely resembling each other an illusion will be seen in one but not in the other. In Plate I. of Part 33 is shown a mutilated statue against an intensely black background; the figure was completed by illusion. The next following picture has also an intensely black background, has also a partly completed figure, yet the eye saw in it only what was represented by the artist. The difference in effect in the two cases lies probably in the sequence of the pictures. In the entire 1,170 pictures examined there are but 27 cases in which two illusions occur in immediate succession. That an illusion has appeared in one picture seems, therefore, to be prejudicial to its appearance in the picture immediately following. This is true in feeling as well as in fact. (2) The place of a picture in the series for the day also affects its illusions. I find that illusions, in the experiments made, appear fourteen times in the first picture of the daily series, twelve times in the third, thirteen times in the tenth, fourteen times in the thirteenth, six times in the sixteenth and five times in the last. Between the first and sixteenth pictures seems to be the most favorable position. At or about the sixteenth there is a marked decrease in the number of illusions and this remains true to the end of the series. (3) External surroundings influence the effect of pictures upon a reagent. Three cloudy days, chosen at random, give but 17.77 per cent. of the pictures in which illusions are found. Three sunshiny days present 19.56 per cent. In several cases a day comparatively barren of results is explained by a note calling attention to the fact that the building was unusually noisy during the hour of work. Hearing people walking in the passage outside the door was very distracting. (4) Abnormal physical condition had a variable effect according to its kind. Two days marked 'tired' present but 10.3 per cent. of its pictures in which any illusion is found. In two days marked 'below normal,' on the other hand, 25 per cent. of the pictures return illusions. (5) Abnormal mental condition is fairly certain in its results according to its kind. Excitement has a tendency to increase the vividness and complexity of illusion. Preoccupation and

depression decrease illusion. The more vivid the illusions, the sooner they cause weariness and the consequent disappearance of illusion later in the hour's work. This last is true as a general rule, but a few exceptions to it may be noted. For example, in 'The Age of Innocence,' the illusion is both vivid and restful. Two pictures — Watt's 'Love and Life' and 'Love and Death' — were the most tiring of the series though the representations were no more vivid than in the former case. Thus it is evident that both vividness and subject matter influence the effect of illusion upon the reagent.

Variable Illusions. — In 22.73 per cent. of the whole number of pictures examined, either an illusion was present upon one examination and was not found again, or the illusion found on one examination differed from that found on the other. These variable illusions were ordinarily slight in nature — the completion of a figure partly shown, the reduplication of some object, or the extension of a landscape. Different position in the series of pictures, and different external and mental and physical conditions serve to account for them.

Pictures Presenting no Illusions. — There were, from the 1,170 pictures examined 796 (68.03 per cent. of the whole) which returned no illusion upon either examination. Part of these were afterward reëxamined by themselves. Some of them, on this third examination, returned an illusion. Of those which persistently failed to do so, it was found that they had either (1) backgrounds crowded with figures or objects so that no considerable vacant space was left therein, or (2) very light backgrounds, or (3) the representation of a complete scene of some uninteresting nature as, in Plate I., Part 20, the picture of a lady washing her hands, where the figures fill the foreground and catch attention without exciting interest. (4) The point at which the eyes first strike the picture has an effect. The intention was to look first at the central point. If this were filled by some indifferent or disliked figure, illusion was unlikely to result even if the rest of the picture were suitable for illusion.

Definition of Terms. — The term 'illusion' has for convenience been applied, throughout this paper, to all mental appearances placed externally. Strictly speaking, these appearances

fall into two classes: (1) Illusion, which is an appearance based upon misinterpretation of something actually within the picture. Veronese's 'Christ at Emmaus' is a case of illusion. Here in the background are white clouds in a black sky above a very small city. The eye, seeing the black and white in conjunction, transforms it into an ice-filled river and sees it so, even after discovering the city below. (2) Hallucination is found when the mind places something within a picture without obvious external suggestion. Giorgione's 'Concert' is an example. Here are shown three faces. The eyes of the central face are fixed on the distance. Seeing the expression of the eyes, the reagent placed the scene toward which they were looking, though this was in no way suggested in the picture, by anything actually placed therein. It is not possible to distinguish very sharply between cases of illusion and those of hallucination because frequently both are present in the same picture. Nearly always it is possible to assign some reason for the seeing of a given appearance, but this reason is thought out afterward — the appearance is instantaneous. Real and imaginary are seen together without distinction, so that the picture forms a whole. It is practically always possible to tell what is real and what is imaginary — there occurred only two cases in which doubt was felt — but how the difference is marked cannot be defined. The two seem alike to the eye; the mind knows which is which.

Results Obtained with Enlarging and Reducing Glasses. — In using these glasses the illusion increased and decreased in size as did the picture. Moreover, the enlarging glass often made plain the exact nature of objects in the background so that they no longer served as a basis for an illusion. The use of one eye had no effect on the illusion except in so far as the attention was focused on the part of the picture opposite the eye used.

Effect of Illusion upon the Judgment. — (1) In the *constant illusions* the relation between liking and illusion was very marked. In the two constant classes of pictures in which illusion always appeared and pictures in which it did not appear at all, the judgments were as follows — Class I. representing the pictures in which illusion was always present and Class II. those in which it was never present:

TABLE XIV.

Terms of judgment	3	2	1	0	−1	−2	−3	±	?	Total number of pictures.
Class I.	30	11	1	0	0	3	0	8	1	54
Class II.	31	88	62	80	77	37	6	11	1	393

Thus in Class I., 55.55 per cent. of the pictures were very much liked; in Class II., only 7.88 per cent. In Class I., the element of indifference was entirely absent; in Class II., 20.35 per cent. were judged indifferent. Considering the whole table, it is evident that low judgments, both of liking and of disliking are more often present in pictures which present no illusion; in pictures presenting an illusion, the elements of indifference and of slight dislike are absent. (2) *Variable illusions.* The relation between liking and illusion is still more plainly shown by a comparison of the judgments given on those pictures in which an illusion was seen upon the occasion of one examination, but not upon the other. Taking those pictures which present an illusion on the first examination but not on the second, we find the judgment to be higher on the first occasion than on the second in 50.9 per cent. of the pictures examined, equal in 45.45 per cent. and lower in only 3.63 per cent. While then it is very evident that there is some connection between the liking for a picture and the occurrence of an illusion in examining it, it seems impossible to say which is the cause and which the effect.

Conclusions Drawn from the Experiments.— The mind has the ability to locate mental images externally, so that they shall not differ in appearance from real images. The exercise of this ability is conditioned by the mental and physical state of the reagent, and by his external surroundings. The content of these mental images is affected by the former experience and occupation of the reagent, and also by the kind of surface presented for reproduction. In general, a decided liking for a picture and illusions in connection with it go hand in hand.

Series X. — To ascertain the effect of the title of the picture upon the æsthetic judgment.

Before concluding the discussion of the law of association, mention should perhaps be made of some experiments in which

Fechner's supposition (*V. d. A.*, I., 136), that the legend may or may not enhance the pleasure derived from a picture, was tested. Neither the title of a picture nor the name of the artist who painted it was shown to the reagent when the pictures used in Series VI. were first shown. After experiments recorded in Table VII were completed, the pictures were shown in turn to each of the reagents and each was asked to give a judgment upon them and to tell whether she knew the title of the picture or the name of the artist who painted it. Immediately afterwards, the pictures the reagents did not know were again shown to them and they were told the name of the author who painted each and its title and they were asked whether they wished to change their judgment. Table XV. below gives the results. In I. are given the number of pictures unknown as regards artist and title, in II. and III. respectively the number of pictures judged higher, resp. lower, after acquiring this knowledge. Evidently knowledge regarding the artist and the title does have some influence upon the judgment.

TABLE XV.

Reagents.	I.	II.	III.
M	66	6	4
H	29	6	1
K	35	5	0

IV. DATA DRAWN FROM THE PRECEDING EXPERIMENTS WHICH THROW LIGHT ON OTHER ÆSTHETIC PRINCIPLES OF FECHNER.

Proofs of the *principle of the æsthetic mean* ("when an object undergoes chance changes in size or form the mean appears under like conditions to be preferred." — *V. d. A.*, II., 260) are given in the preference for a moderate length and size in case of straight lines and circles. The introspections in connection with the examination of pictures also furnishes many confirmations of this principle — a man 'is too stout,' the eyes of a certain woman are 'too large and dark,' Burne-Jones' women are 'too long,' a given picture is 'too dark,' etc.

Of the *principle of æsthetic help* ('*from the non-contradic-*

tory gathering together of pleasurable conditions, which in themselves are of themselves of little effect, arises a greater, often much greater, pleasurable result than corresponds to the pleasure value of the single factors in themselves, a greater than can be explained as the sum of the single effects' — *V. d. A.*, 51) innumerable proofs could be given. In determining the size of background to be employed, the lines were drawn on sheets of paper of the same shape but of different sizes, and it was found that the æsthetic impression varied with the size of the background. For example, the larger circles were redrawn on larger sheets of paper, as the reagents disliked them when on small sheets just because they seemed out of proportion to the size of the paper. In order to have the backgrounds of uniform size the very small circles were first drawn on large sheets, but here also the reagents found the comparative size of the paper and the circles so unpleasant that they were redrawn on smaller sheets. Trial also showed that the shape and color of the background were of decided influence. In the experiments here recorded the cards on which the lines were drawn were placed on a table placed in a horizontal position, but after the work was finished it was discovered that it would have been better to have put them on an easel, that is, in a vertical position before the reagent, as trial showed that, in case of nearly all the lines, the æsthetic impression was stronger when they were placed in the last position. Again, the distance at which the lines were examined was an important matter. Not one or two trials were made in determining these matters, but all the sixteen lines were used, and careful quantitative experiments were made. To economize space, it has been thought best to omit the tables of results and the details of these experiments, but that distance has an influence there is no doubt. This is partly due to the change thus made in the color and width of the line but also to the fact, doubtless, that what is near calls forth a stronger personal feeling. Personal peculiarities may, however, make the distant observation more pleasurable. *M* liked the lines far away in that they were less distinct and the illusions to which she is susceptible and in which she takes much pleasure more frequently arose when the lines were in this position. One would not be

overestimating the importance of the principle of æsthetic help were one to say that much of what relates to methodology in experimental æsthetics could be considered under it.

A comparison of the judgments on the same pictures taken on days when the reagent felt well and in a good humor with those when she did not, furnish proof of the truth of the *principle of secondary pleasure and displeasure* ('there can grow secondary pleasures and displeasure out of one's own or foreign ideas of past or future pleasure or displeasure' — *V. d. A.*, II., 256). The effect of the reagent's physical and mental condition was particularly marked on one occasion in the case of *C.* She reported at the beginning of the experiment hour that she had a 'cold' and felt 'out of sorts.' When the sixteen lines were shown to her she gave the judgment 'indifferent' in nearly every case. Naturally I postponed the experiment until she had recovered, when the lines again gave her pleasure. In fact I tried to set the experiments at a favorable time for all the reagents. When, for example, *M* reported that lines gave her much greater pleasure earlier in the day, I planned for the experiments at that time.

The introspections show that the extent to which the principles of the *unified connection of the manifold* ('in order to find pleasure in contemplating an object one must find offered there a unified connected manifoldness' *V. d. A.*, I., 54), of the *economical applicatian of the means or of the smallest amount of power* (*V. d. A.*, II., 263), and of *non-contradiction, agreement and truth* ('when introducing one and the same thing, diverging motives occur, there is a sense of pleasure if we observe that they really result in a harmonious conception, but a sense of displeasure if we find that they result in one that is inharmonious' *V. d. A.*, I., 82), especially the first two, are complied with in the execution of the work, greatly influence the judgments of the reagents.

V. Experimental Study of Æsthetic Contrast, of Æsthetic Sequence and Compensation.

1. *The Principle of Æsthetic Contrast.* ("*One can say in general that that which gives pleasure gives the more pleasure,*

the more it enters into contrast with that which gives displeasure or is less pleasure giving and there is a corresponding principle for the displeasurable" (*V. d. A.*, II., 232).

Where 'rest,' 'peace,' 'calmness,' 'absorption,' 'inner imitation,' 'sympathy,' 'buoyancy,' 'sense of freedom,' etc., play the determining rôle in æsthetic pleasure one would scarcely expect the above principle to stand the test of experiment. To ascertain whether the condition of repose and absorption also characterizes the æsthetic impression of persons who not only had no æsthetic theories of their own, but were ignorant of the theories that had been proposed by others, the sixty-three students attending lectures on the 'Psychology of the Emotions' were each asked to select three Brown reprints which they very much liked and to write down as accurately as they could what they experienced in looking at them. Some few gave a report having an objective character, that is, they spoke of the 'graceful figures' of a picture 'the play of light and shade,' 'the silky texture of the garments,' of 'the white masses against a dark ground,' etc., but the majority making the reports dwelt upon the sense of peace and absorption that they experienced in looking at the picture selected. The following introspections are typical: 'I found that the sense of quiet and peace which they caused was the principal feeling, 'a forgetting of myself and surroundings momentarily and a resulting rest,' 'I noticed my mind seemed to lighten as if a weight had been lifted from it,' 'I found that the dominating sensation was one of content and restfulness,' 'I felt quiet and rested inside, and my heart seemed to beat softer and my breathing to be quieter,' 'as I looked I found myself in a position of easy relaxation, breathing deeply and with a feeling of happiness and ease,' 'there is a quietness, a strange restfulness which steals over me as I look at the picture,' "on looking at a picture I like my heart begins to beat faster and I say to myself, 'I like that picture.' Then for a few moments I feel myself perfectly lost in peace and contentment with life My brain is in a passive state and I don't seem to be thinking or to be very conscious of anything. Then all at once I waken from my semi-conscious state to wonder why I liked the picture."

In view of the above and similar introspections, one is not

surprised to find that in general Fechner's law of contrast which is not calculated as are his other æsthetic laws to secure mental and physical repose, does not stand the test of experiment.

Series XI. — Object: To ascertain the effect of simultaneous æsthetic contrast. In these experiments the pictures were shown in pairs. Each picture of a pair was first shown alone to the reagent and he gave his jndgment upon it. The pair was then laid on the table before him and he again gave his judgment upon each of the pictures comprising it. After reversing the position of the two pictures in the pair, the reagent again gave a judgment upon each. To eliminate the effect of æsthetic fatigue and summation, the pictures used (this set of pictures was partly made up of Brown reprints, varying as to subject and degrees of beauty, and partly of pictures very much disliked by the experimenter which had been gleaned from various sources) were examined a second time when they were reversed as to order of presentation to the reagent, that is, a pair was first shown for the reagent's judgment upon each of the pictures composing it, and immediately after the individual pictures composing it were presented alone for judgment. In Table XVI. are given the results where one picture of a pair was liked and the other disliked, when both pictures were liked but one was liked more than the other, where both pictures were disliked but one was more disliked than the other, where both were equally liked, and when both were equally disliked. Under these divisions, the numbers under *H* signify the number of pictures in this class which were better liked in case of liked pictures and more disliked in case of disliked pictures when the pictures were examined together than when alone. *L* signifies less liked in case of liked pictures and less disliked in case of disliked pictures when the pictures were examined together than when alone. The judgments are classes under = when they were the same whether the pictures were examined together or alone. Sometimes the judgment on a picture of a pair was altered when the pictures comprising it were reversed as regards their position to each other. In such cases the judgments were classed under ?. If in both positions both the judgments on a picture were higher or lower than the judgment when it was alone, they were

TABLE XVI.

Reagents.	One Picture Liked and Other Disliked.												One Picture Liked More Than Other.												No. Judgments.	No. Pictures.
	Picture Liked						Picture Disliked.						Picture Better Liked.						Picture Less Liked.							
	H	L	=	?			H	L	=	?			H	L	=	?			H	L	=	?				
				H	L	=				H	L	=				H	L	=				H	L	=		
H		32	1		2	12	20	5	15	1		6	3	19	2	1	20	5	2	26	13		2	7	322	161
R	18	9	20			5	28	5	16			3	15	25	10	1	8	1	12	29	12		1	6	304	152
M.W.	1	23	2		1	11	5	6	21			6	4	35	10	1	7	17	9	14	18	1	6	26	274	137
S	1	3				5	3	1	3			2		3	9		4	7		3	12		2	6	100	50
P	3	8		2	6	6	4	4	4	3	2	8	2	13		2	10	15	4	8	1	8	4	17	200	100
M	4	12	16		2	23	15	6	19	2		15	5	9	10	2	2	20	4	10	23	3	1	7	300	150

Reagents.	One Picture Disliked More Than Other Disliked.												Pictures Equally Liked.						Pictures Equally Disliked.						No. Judgments	No. Pictures.
	Picture More Disliked.						Picture Less Disliked.																			
	H	L	=	?			H	L	=	?			H	L	=	?			H	L	=	?				
				H	L	=				H	L	=				H	L	=				H	L	=		
H	4		2				5		1				9	26	6	1	10	10	48			2	2	2	322	161
R	12		2	1		2	11	2	1		1	2	9	10	5		1	5	13	21	1	1			304	152
M.W.	3	2	9			2	8	1	6			1		5	7	2	1	5							274	137
S													2	4	20	1		9							100	50
P	3	4	2	5	4	1	3	2	2	3	3	6	1	4			5	2	1			4		11	200	100
M	3	6	23	1		3	5	7	11		1	12	1	1	2				1	6	4			3	300	150

counted as one and classed under ? *H* or ? *L*, but if one judgment was higher and the other lower, or one was equal and the other higher or lower than when the picture was alone, the two were counted as one and put under ? = .

If Fechner's principle of æsthetic contrast is true, we should expect to find in the above results: (1) That where a liked is compared with a disliked picture the liked picture would be better liked and the disliked more disliked than when alone; (2) that where a liked picture is compared with one less liked the better liked picture would be still better liked and the less liked still less liked; (3) that where one picture is more disliked than the other the more disliked picture would be still more disliked and the one less disliked still less disliked, and (4) by inference, that where pictures were equally liked respectively equally disliked there would be no change as regards liking. On examining the table above we do not find this to be the case. We find much more frequently that when a liked picture is examined with a picture disliked or with one less liked, better liked or equally liked, it is less liked than when alone; (5) that when a disliked picture is examined with a liked picture or with one less, more disliked or equally disliked, it is more disliked than when alone. In short, in general that a liked picture put with another picture is less liked and a disliked put with another picture is more disliked. The results given above for the six reagents may be considered as typical in that they have been confirmed by tests made with many other persons.

If we take into account the part played by attention as well as by contrast, we are able to satisfactorily explain the above data. Occasionally, doubtless, contrast acts as a restorative from æsthetic fatigue, but when the æsthetic sentiment is acting normally, it brings in mental and physical discordant elements which more or less interferes with that peace and calmness which characterizes æsthetic pleasure. The introspects of the reagents ('Can't get the impression from two,' 'this trying to see two is very irritating,' 'don't see either as well,' 'don't feel as much in either picture,' 'when I get away from one picture I like the other better,' 'can't put other aside and it's disagreeable,' 'seems dull and dead when my attention is not centered upon it,' etc.)

show as we should expect, that the distraction of the attention which arises from putting two different pictures together for examination also decreases æsthetic pleasure by interfering with state of absorption which also marks it. On the other hand, for the reasons just given, contrast favors æsthetic displeasure. But the distraction of the attention arising from having to examine two pictures simultaneously must act against displeasure in that the mind would be less concentrated on the disagreeable features giving rise to this impression. The fact that the difference between the higher and lower judgments in case of the disliked pictures is much less than in the case of the liked pictures confirms this opinion.

In discussing the above principle Fechner says: "Every work gains when we compare it with a less complete work of art of the same kind or class and loses when we compare it with a more complete" (*V. d. A.*, II., 232). If by gains and losses Fechner means that certain features in each work are brought out more prominently by putting the two pictures together, his statement is probably correct. The reagent says, for example, that he notices the shape of each picture more, the great brightness of the one as compared with the other, the difference in tone, the dullness of one, the delicacy of the one, the strong character in one, the emptiness of the face in the one, and the character in that of the other, the finer drawing and the more excellent design in the one, etc. Whatever may be the ultimate effect on the judgment, of such perception of difference, in favor of one picture, it is not at once, except in exceptional cases, as possibly in case of *R* in these experiments when liked and disliked pictures were compared, translated into æsthetic pleasure. One can readily conceive however that persons whose judgments rest on matters of technique, who are interested in the way the effects are produced, might immediately give a higher judgment upon a picture when it was put with a picture which served to draw attention to its good features. Indeed, in case of these very reagents, especially *R*, I am sure from the introspections that the judgments were sometimes given on the fact that through the presence of another picture the reagent was made aware that certain lines, etc., of a picture were especially fine, and

gave the higher judgment in accordance with this new knowledge, but not because she really derived increased pleasure from the picture. Judgments of this kind have an objective character, they do not grow out of that constellation of ideas and feelings of which we are all more or less conscious on looking at the pictures which give us the greatest enjoyment and which we say we 'like very much.'

In discussing the principle, Fechner says: 'The two factors must not be merely uncomparable, rather arises the contrast effect more strongly in degree when the factors, aside from the contrasting elements, are alike in so far as herewith a stronger or more undisturbed psychical relation is produced between them.' I doubt whether the increased æsthetical pleasure which sometimes arises under the above conditions, except in exceptional cases, should be explained by contrast. It should rather be explained as a case of positive summation æsthetic effect, an effect which has given rise to the law of repetition which has been laid down in works on æsthetics by Soret[1] and others.

The increased likeness between elements which are liked gives for various reasons mentioned below, or because less strain is made upon the attention, a heightened æsthetic effect. If the common elements are disagreeable, or such as do not permit of the heightening of effect through repetition, it would seem that the æsthetic pleasure would be positively decreased by likenesses in the two works. The results of the following experiments show that the positive and negative effects just mentioned do enter into æsthetic contemplation and doubtless accounts for judgments which are not in harmony with what one would expect from the action of contrast and the varying degrees of the concentration of attention.

Series XII. — Object: To ascertain whether there is a summation æsthetic effect in the simultaneous examination of pictures. In these experiments a picture was laid on the table before the reagent for judgment. Immediately after the judgment had been made, two pictures exactly like it were laid symmetrically before him and he was asked to say whether the two pictures gave him more or less pleasure than one of the pictures

[1] Soret, *Des conditiones physiques de la perception du beau.*

alone. Under I. in Table XVII. are given for the several reagents the number of liked (+), disliked (−), and indifferent (o) pictures better liked when alone, under II. the number of such pictures better liked when the two liked pictures were shown together, and under ? the number of such pictures where the reagent could not decide whether he liked the picture better alone or when with a like picture.

TABLE XVII.

Reagents.	+			−			o		
	I.	II.	?	I.	II.	?	I.	II.	?
H	7	72	1	19					1
R	45	28	1	19	7				
M. W.	46	32	2	7			10	3	
S	36	10	6	11	6	1	23	7	
P	36	32	3	5	5	1	6	11	1
M	39	24	6	6	17	4	1	2	1

The æsthetic significance of repetition is proven in the above table. The introspections show that the more important changes of impression which arise from seeing two pictures together, changes which may lead to a higher and a lower judgment than when one picture was seen alone are the following: (1) The more massive effect[1] — 'the picture seems larger,' 'more sea-like,' 'more meadow-like,' 'wider sweep to whole,' 'more like the woods,' 'the two pictures blend into one, it seems one big picture,' 'the wrinkles seem more pronounced and the face seems to have more expression with two pictures,' 'the two pictures form one and the figure in each seems like two different people.' Naturally the subject, the mode of treatment, the shape of the pictures, and the width of the margin separating them, effect the forming of these unified combinations which result in this more massive effect. One reagent said at the close of the experiment that she had noticed that where there were strong contrasts in the picture the putting of the two like pictures together greatly increased the effect of brilliancy even when the pictures did not fuse into one, another said that oval pictures did not form one picture as did rectangular pictures, the

[1] Compare Dessoir, *Die æsthetische Bedeutung des absoluten Quantums*, 23.

reagents also frequently said that if the margin was not there the two pictures would make but one. (2) The increase in apparent movement. This arises doubtless from the fact that the eyes move over a larger field in examining the two pictures — 'scene seems more animated,' 'dramatic effect greater.' This increase of apparent movement lowers the judgment occasionally, but in general it raises it. It gives me, for example, a greater impression of being buoyed up, carried along, and the strength of this buoyant feeling is the criteria I employ in deciding on my judgment as regards the degree of liking. (3) The different attitude with respect to the pictures — 'with two pictures I feel a part of the picture but with one outside of it — a looker-on, a critic,' 'two makes the scene more real,' 'two make me feel really in the open air,' 'I feel in the building with two pictures, then it seems a real building, not the picture of a building,' 'the picture seems nearer with two.' (4) Where there are two like pictures the whole composition, matters of light and shade, tone, etc., are more closely observed than are the details. Whether, then, we prefer one or the two pictures depends of course upon which of these give us the greater pleasure. One reagent, for example, preferred at first glance two pictures but afterwards one, saying the details were more prominent with one. Deficiencies of print were more often observed with one picture. This difference in the seeing of wholes and particulars doubtlessly explains why one may prefer two pictures in the case of very much disliked pictures. (5) The consciousness of the repetition is often agreeable, especially if the person thinks of the two pictures as forming a frieze 'when repetition is rhythmic is especially pleasing.' (6) There are slight changes growing out of the arising of illusions produced by putting the two pictures together, which effects the liking. The putting together, for example, of two like pictures representing the 'Basilica of St. Paul beyond the walls of Rome' makes the two interiors seem to radiate from a common point and the reagent feels himself standing at their point of intersection and looking down two long corridors. On account of this illusion *S* feels drawn in two ways on looking at these two pictures and so gives a higher judgment when he sees the picture

alone. On the other hand, *M. W.* enjoys looking down the two corridors and so gives a higher judgment when the two like pictures are seen side by side. (7) The shape of the picture sometimes seems to be altered in putting two pictures together. If the picture is so narrow as to hold the eyes to too narrow a field, the increased width gained by putting the two pictures together results in raising the judgment, while, on the other hand, the putting together of two wide pictures results in lowering the judgment. (8) The picture gains in depth by having two pictures side by side. This is due, possibly, to a tendency to stereoscopic vision even when pictures are entirely alike.

The previous results have shown that one picture does not give the intensity of expression that may be obtained often by putting two pictures together. This increased impression often arises from the fact that the two pictures fuse into one and give the impression of an enlarged picture. In case different pictures are put together, this possibility would without doubt often be much greater when the pictures had a given position with respect to each other than when they were reversed as regards position. This explains, doubtless, the reason for some of the judgments which fall under (?) in Table XVI. There is another factor to be considered, which, without doubt, gives rise to some of the judgments classed under this head. That is, that a picture may be in the most favorable position to give pleasure as regards its position to another picture, but yet may not be in the most favorable position as regards the reagent's right and left. The following experiments prove what one would expect from seeing people take up pictures and try them alternately right and left of the median plane before selecting a permanent position in which to examine them, that is, that there is a 'space error,' a 'space difference' which ought to be compensated if possible in making experiments in æsthetics.[1]

Series XIII. Object: To ascertain the æsthetic effect of the position of a picture as regards the reagent's right and left. Two like pictures were laid before the reagent, and he was asked if he liked them equally. If not, he was told to point

[1] Martin, *Psychology of Æsthetics*, I., 'Experimental Prospecting in the Field of the Comic,' *loc. cit.* 54.

out the picture better liked. The pictures were then reversed and afterwards tried in different lights in order to exclude differences growing out of unlikenesses in the prints themselves or in their illumination. If the picture at the right resp. at the left was invariably preferred under the different conditions just mentioned it was counted in Table XVIII. and the *R* and *L* where the sum of the whole number of pictures preferred at right and left are given, in case of liked (+), disliked (—) and indifferent (?) pictures. If a picture was preferred at the right under one set of conditions, that is, when reversed in position or seen with the light falling from a different direction, and at the left under another it was counted under (=).

TABLE XVIII.

Reagents.	+			—			o		
	R	L	=	R	L	=	R	L	=
H	1	71	8	17		2			1
R	34	1	39	9		17			
M. W.	9	2	69			7			13
S	31	4	17	6	2	10	7	2	21
P	29	15	27	4	4	3	3	4	11
M	22	9	38	2	6	19			4

The above table shows that in general *H* prefers the pictures at the left, and many tests show that I also prefer them in this position, that *M. W.* is indifferent, and that the other reagents prefer them at the right.

Dr. W. F. Snow, of Stanford University, has kindly made an examination of the eyes of the above reagents. A mydriatic was not used but in every instance a thorough subjective examination checked by the ophthalmoscope, ophthalmometer and various rod and prism tests were made. The results do not show any striking resemblances in the structure or activity of the eyes of the students who have the similar general preferences just mentioned. One can conceive that these general preferences may be traced indirectly to physiological causes in that, for example, the lesser distinctness and differentiation of a picture on one side of a reagent, growing out of the differences in his eyes, may be more agreeable to him while another reagent

under exactly the same physiological conditions might prefer the more distinct and differentiated picture. The following introspections are given because they show some of the psychological factors that determined the preferences of the reagents: 'the part of the picture I like best is more in sight in the right picture' (nearer the centre of vision), 'like picture at right because figure is looking at me' or 'coming toward me,' 'figure in left picture seems moving away,' 'the cow is nearly out of sight in the left picture,' 'picture at right seems subordinate,' 'picture at left seems nearer,' 'picture at right stands out more in a relief, other is flat and receding,' 'picture at the right not as distinct,' 'face in left picture looks sullen,' 'more gracious,' 'feel less sympathy with other picture,' 'have more tender feeling towards figure in right picture,' 'the lines go off at different angles in the two pictures,' 'the curve of the face is rounder in the profile of the right picture,' 'I (*S*) see more of the right picture than of the left,' 'the picture at the right does not seem as nearly in front of me (*H*).

2. "*The Principle of Æsthetic Sequence: — If greater pleasure precedes, and smaller pleasure or even displeasure follows after, then a decrease of the second pleasure or a strengthening of the displeasure will occur through the contrast with the first greater pleasure; if the sequence is reversed then the first smaller pleasure or the first displeasure will occur unstrengthened, the second greater pleasure is however strengthened through the contrast*" (*V. d. A.*, 235).

This principle, as we should expect in view of the results of the previous experiments, does not hold good when tested except partially in case of *R*. When the better liked picture comes last *P* says he does not like it as well, *H* says there is a moment after the removal of the less liked picture when the better liked picture is less liked; *M* says she feels relieved and glad when less liked picture is gone but the better liked picture itself is not better liked, *M. W.* says that when a very much disliked picture is seen before one very much liked she cannot forget the ugly picture, it seems to spread itself over the good, to be superimposed upon it.

Fechner also makes another statement in discussing this

principle which I am inclined to question. It is that 'in successive impressions the contrast effect can express itself merely in connection with the second.' I have noticed from the remarks of the reagents, particularly in case of ugly pictures, that when the ugly picture is seen first its ugliness does not seem the same when it is recalled. It seems often very much uglier than it seemed at first.

In the discussion of the principles Fechner says: "In the direction of advance from smaller to greater pleasure or from greater to less displeasure (positive) the sum total of the pleasure is greater or of displeasure is less than in the opposite direction" (*V. d. A.*, II., 234). All the tests corroborate this statement, one has but to apply the laws of memory to explain the fact, no principle contrast is needed. The last picture seen is the one that dominates the impression. If that picture gives pleasure resp. displeasure there is a tendency to find the whole impression pleasurable resp. displeasurable.

(3) *Principle of Æsthetic Compensation:* "*The collective cases where a cause of displeasure is compensated or overcome as regards æsthetic effect through a following or imagined as following, at the same time contrasting, cause of pleasure, we designate, in order to have a short general expression, under the expression æsthetic compensation*" (*V. d. A.*, II., 238). *One of the most effective æsthetic aids is to so arrange the sources of displeasure in relation to the sources of pleasure that the principle of æsthetic compensation enters into play and makes the collective result of the impression pleasurable* (*V. d. A.*, II., 238).

V. The Principle of the Expression of Pleasure and Displeasure.

'*In general man is so constituted that the mood of his environment is transmitted to him*' (*V. d. A.*, II., 254).

Fechner does not employ the term suggestion in connection with this principle but in the light of our present knowledge it is a statement, although a very incomplete one, of the æsthetic significance of this influence. The preliminary experiments made with a view to testing this law have opened up so many

different lines of work that it has seemed best to reserve the results until a more special study has been made of this subject. The possibility and the desirability of increasing æsthetic appreciation through the use of suggestion give experiments along the line of this law a practical importance that they do not have along the lines of Fechner's other laws.

ANNOUNCEMENT.

We have been informed that the common cover of our various issues causes some confusion and difficulty in shelving and using them. We have accordingly adopted a scheme of different colors for the covers of our publications. Hereafter the *Index* will appear in dark brown, the *Monograph Supplements* in light gray-brown, and the *Bulletin* as heretofore in white. The REVIEW proper will retain the blue imported carbon cover which has always given its appearance a certain distinction. — ED.

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The Psychological Review.

THE PSYCHOLOGY OF INTEREST (I).

BY FELIX ARNOLD,
New York.

In psychology interest seems to be, in certain respects, like charity, and in pedagogy, too, 'it never faileth.' What makes it useless, however, in many discussions, is the loose and varied manner in which the subject is treated. Whether the discussion is dealing with instincts, impulses, feelings, attention, will, the term interest seems broad enough to cover them all. In pedagogy we have the most beautiful examples of argument in a circle due to similar misconceptions of the situation which has in it interest. "Get attention by making things interesting." So at least we are told. And what is interest? Why, attention; and the formula now resolves itself into the tautology, 'Get attention by making the children attentive.' Or we are told to get the interest in children and a little later this apparently simple process is brought about by making things interesting. Similarly the directions to rouse interest by appealing to the child's curiosity, and the like, mean little more than synonymic substitutions. Rather than throw about these various interpretations in scholastic fashion, which would lead to little more than a development of concepts, or academic definition, I have thought it better to attack the subject *de novo*, examining the leading theories on the subject, and then giving in schematic form the facts in the case as they exist in foundation situations. For this purpose I shall treat interest in its connection with feeling and attention, and then shall consider interest itself in its conative and cognitive aspects.

I.

In treating of the different contributions made by the various writers to the psychology of interest, it seems proper to begin with Herbart. But at this point a difficulty at once arises. Do we not all know Herbart's theory of interest? Is it not a commonplace among young pedagogical students and is it not shouted from the housetops of learning, as it were? I venture, however, to assert that many who shout loudest for or against Herbart do not fully understand his theory in this connection. Some critics of his system simply pull down a straw man which either they themselves have made, or have found ready-made for that purpose. Herbart's theory, we may say, *schwebt oben in der Luft*, but in the *schweben* its real outlines have become rather indistinct. It seems to me not too much to say that many of the present articles and discussions dealing with Herbart are based on the theories of so-called Herbartian writers, or upon the general opinion of the writers themselves as to what Herbart meant.

Before presenting Herbart's theory of interest as he himself has given it, it may be well to show some of the false conceptions which are prevalent. James tells us that 'the Herbartian doctrine of interest ought not . . . in principle to be reproached with making pedagogy soft.'[1] Dewey's[2] Monograph on Interest is mentioned by De Garmo[3] as 'reconciling interest and effort.' We are also informed 'that the current theory inherited from Herbart, and by him from Rousseau, that everything should be made to depend upon interest, that there should be no *must* in education, seems to the author (J. P. Gordy) thoroughly pernicious.'[4] These are samples of the common opinion. Others are satisfied to stalk about and loudly to proclaim themselves 'Herbartians' because they believe in interest, and this 'interest' is usually a cheap kind of sensationalism or feeling, which, of course, must be reconciled with effort, which gives rise to 'soft pedagogy,' and which, perhaps, may have

[1] *Talks to Teachers*, 1899, p. 111.
[2] *Second Supplement to the Herbart Yearbook*, 1895, revised, 1903.
[3] *Outlines of Educational Doctrine*, 1901, p. 46.
[4] *A Broader Elementary Education*, 1903, preface.

been inherited from Rousseau; but which, none the less, is *not* Herbart.

What then is Herbart's theory? The best explanation of the Herbartian psychology, according to Stout, is to be found in Herbart's own *Psychologie;* and the best exposition of his educational tenets is to be found in his educational writings, and not in the writings of those who explain Herbart according to their own views. Strange to say, Herbart's treatises on psychology deal almost entirely with apperception, without any corresponding treatment of interest. Neither in his *Psychologie als Wissenschaft* nor in his *Lehrbuch* do we find any account. In the latter book we meet with the statement,[1] "Observation and expectation, as the two stages of interest, also belong to the basic concepts of universal pedagogy." This is followed by a statement in parenthesis referring the reader to the *Pädagogik* for a fuller exposition. This reference, by the way, is omitted by Miss Smith in her translation of the *Lehrbuch.* In the *Science of Education,*[1] which contains the fuller discussion of interest referred to, we find interest thus defined: "Interest, which in common with desire, will, and the æsthetic judgment, stands opposed to indifference, is distinguished from these three, in that it neither controls nor disposed of its object, but depends upon it. It is true that we are inwardly active because we are interested, but externally we are passive till the interest passes into desire or volition. It occupies the mean between observation and attainment."[3] Interest is thus, according to Herbart, a feeling which passes or which may pass into desire. Herbart, after this explanation of the term, then skips rapidly on to his seemingly more congenial discussion of the apperceptive systems which give rise to interest, the so-called many-sided interests, *viz.*: (1) empirical, speculative, æsthetic; (2) sympathetic, social, religious.

It is at this point that misinterpretation creeps in. The interests are not these systems of ideas, nor are the systems of

[1] *Works*, V., Hartenstein's edition, 1886, p. 148.

[2] Translation by H. M. and E. Felkin. This translation is the one to which I shall refer.

[3] *Science of Education*, p. 129.

ideas necessarily the result of interest. Rather, interest results from the risings and sinkings of the ideas and systems of ideas. "Interest depends upon concepts, on their opposition and interconnection, on their mode of comprehending various aspects, without being confused with these. . . . Interest attaches itself to the thing, to relationships, not to number or mass."[2] This would make interest, for example, in speculation, result from an interaction of the ideas in the 'speculative' group on some others, and similarly with the rest. According to the Herbartian view, the six-groups, wrongly called 'interests,' are rather apperceptive systems, interest-producing groups. I venture to state that Herbart himself, engrossed in his theory of apperception, introduced interest merely as a pedagogical commonplace, and did not see fully its relation to the apperceptive systems. This is a rather strong statement, but I do not find anything either in his *Psychologie* or in his *Lehrbuch*, or even in his pedagogical writings, to justify any other opinion. Herbart is considered the champion of interest in education because of the so-called six interests. Robbed of all apperceptive terminology, Herbart's interest is simply an Herbartian 'feeling'; and whether the ideas giving rise to the interest are grouped into six classes or not, makes no difference. The interest remains a feeling. It is curious to note that Wundt, who like Herbart, has, in his three bulky volumes, developed the subject of apperception, has also, like Herbart, neglected interest as a psychological topic. Remembering Herbart's real exposition (what there is of it) of interest, one can easily see that there is no contradiction between Herbart's psychology and his pedagogy. The Herbartian interest is not a bit of sensationalism to rouse an apperceptive mass. Sensation or pleasure-pain feeling, as we understand it, would be a *Vorstellung* in the Herbartian sense. Interest is the result of the interaction of a number of ideas or systems of ideas, which persist and remain. To rouse and to develop such ideas and systems of ideas, we do not of necessity need interest. Strength of impression, freshness of susceptibility, degree of opposition present, economy of receptivity, etc., are necessary to rouse and develop the systems

[2] *Science of Education*, p. 134.

of ideas, and not interest.[3] In teaching, therefore, we must work from within outwards, and not from without inwards, if we are to rouse interest. We present things which will excite the apperceiving masses to get interest, and vivid impressions, etc., to develop the apperceiving groups. In the interaction of the various ideas on one another, interest arises; the interest does not first cause the apperceiving groups to act. Interest as feeling in the usual sense will give rise to a contradiction of Herbart's system; but not feeling in the Herbartian sense.

Another point to be emphasized is that Herbart does not say we must depend upon interest in instruction at all times. The groups guaranteeing the interest, and resulting in further interests, may be built up by other means, but when they are there, we are sure of interest. The formation of such interest-producing groups is the be-all and end-all of education. And in this process we need not sugar-coat everything, as the usual interpretation of Herbart would have us believe. We need go but to Herbart himself to show this. I think it advisable, therefore, to give a number of quotations enforcing the view that we should not necessarily pursue soft methods in instruction, and showing that the Herbartian methods are 'soft' only in the minds of those who think so. As regards the government and discipline of children we have the following: "At first, instead of a true will, which renders the child capable of determination, there is only a wild impetuosity, impelling it hither and thither, a principle of disorder, disturbing the plans of the adults, and placing the future personality of the child itself in manifold dangers. This impetuosity must be *subdued*, or the disorderly character will be put down as the fault of the child'l guardians." "The first measure that all government has to take is the threat of punishment, and in its use all government runs the danger of striking on one of two rocks: on the one side there are strong natures who despise all threats; . . . on the other there are natures . . . who are too weak to be impressed by threats. . . . This twofold uncertainty of the result cannot be avoided." Finally: "Threats, in case of need en-

[3] *Lehrbuch*, p. 148, and *Outlines of Educational Doctrine*, Ch. IV. (trans. by de Garmo).

forced by compulsion, supervision by persons who are generally cognizant of the dangers to which children are liable — authority and love combined — these powers will pretty easily obtain a certain degree of ascendancy over children." This is hardly as wishy-washy as usually represented. Finally, for the Rousseau heresy, we have: "What most distinctively raises him (Herr Niemeyer) above foreigners and entitles us to think with pride of our nationality, is in my eyes the definite moral tendency of his principles, whereas in the principles of Locke and Rousseau crude impulse holds sway, and, barely mitigated by a highly unstable moral feeling, leads to a superficial sensuous life."[1]

I shall now touch briefly on Volkmann's treatment of interest, and then shall take up Dewey's discussion. In Volkmann we find one or two significant statements and this is all that it is necessary to give. "Since we are accustomed to consider interest as the relation of an idea to the predominant ideation masses of the self (only that interests me by which I can say I am present), so we may consider this expression in the following tautological formulation — We are attentive to everything which interests us." "Where interest is lacking, attention, too, is lacking; where the former is weak, the latter also is weak." As a modern object of instruction, "Instruct in such a manner that an interest is roused which will continue for life."[2]

Volkmann may be considered the last of the orthodox Herbartians, and he adds nothing of importance to the Herbartian doctrine of interest. It is of interest to note that Wundt, who still shows traces of Herbartian influence, has caught the real significance of Herbart's theory. He neglects interest entirely, and develops along more modern lines the theory of apperception. So too, in England, Stout, who shows the influence of Herbart along certain lines, gives a full treatment of apperception and apperceptive systems, but omits entirely in the chapter concerned any mention of interest. His own theory of interest is an entirely separate development, and shows rather the influence of Mill and Stumpf.

[1] *Science of Education*, pp. 95, 97, 102, 251.
[2] *Lehrbuch der Psychologie*, II., 1895, pp. 206, 207.

Dewey's account has usually been supposed to expound further, in some manner, Herbart's doctrine of interest, to reconcile the latter theory of interest with the modern theory of effort, and so on. But it may safely be said that the only sense in which Dewey's theory of interest, as such, is Herbartian, is in that of being published in a *Supplement to the Herbart Yearbook*. Dewey is too original a man tamely to follow the usual treatment and end with the excellent though well-worn division of the various interests into empirical, speculative, æsthetic, sympathetic, social and religious. His entire theory is founded on his own principle of activity which forms the basis of most of his psychological and philosophical discussions. Only in the definition of interest as 'consciousness of worth' have we a slight tinge of Herbartian influence. The sections in Dewey's paper dealing with Kant and Herbart, with interest and education, etc., are outside the theory of interest proper which forms the second section of his monograph, *Interest as Related to Will*. Since the monograph is connected with Herbart in current discussion, I add it to the views of Herbart above presented.

"Interest is first active, projective, or repulsive. We take interest. To be interested in any matter is to be actually concerned with it. The mere feeling regarding a subject may be static or inert, but interest is dynamic. Second it is objective. We say a man has many interests to care for or look after. We talk about the range of a man's interests, his business interests, local interests, etc. We identify interests with concerns or affairs. Interest does not end simply in itself, as bare feelings may, but always has some object, end, or aim to which it attaches itself. Third, interest is subjective; it signifies an internal realization or feeling of worth. It has its emotional as well as its active and objective sides. Wherever there is interest, there is response in the way of feeling."[1] Interest may be mediate or immediate. In the latter case the activity exists as an end in itself and constitutes the interest, *e. g.*, play. Where, however, we have a transference of the interest in an end to some means leading to the end, the interest in the means is a mediate one. The closer the connection between the means

[1] *Second Supplement to the Herbart Yearbook*, 1895, revised 1903, p. 13.

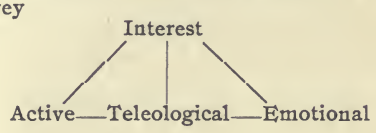
and the end, the nearer is the mediate to the immediate interest. Where the means and end are disparate we have effort and drudgery. "Genuine interest . . . is the accompaniment of the identification, through action, of the self with some object or idea, because of the necessity of that object or idea for the maintenance of self-expression. Effort in the sense in which it may be opposed to interest, implies a separation between the self and the fact to be mastered or task to be performed, and sets up an habitual division of activities. Externally, we have mechanical habits with no psychical end or value. Internally, we have random energy or mind-wandering, a sequence of ideas with no end at all, because not brought to a focus in action. Interest in the sense in which it is opposed to effort, means simply an excitation of the sense organ to give pleasure, resulting in strain on one side, and listlessness on the other."[1]

We may summarize the above views in the following schematic form:

Herbart

Interest = Feeling (Herbartian)

Dewey



II.

I shall now examine the more recent discussions on the subject, some of which have been storm centers in the literature of psychology. Prominent among those who have forced their theories to the front stands Stumpf with his identification of interest, attention and feeling. Due to his influence, the question of the concomitance of interest with attention has been more closely examined, while some psychologists seem to have been led astray by their interpretation of Stumpf's 'feeling.' We must examine the theory of Stumpf to some extent to see exactly what he means and not rest satisfied with placing all our faith in his much-quoted sentence, "Attention is identical with interest, and interest is a feeling. That is all there is to it."[2] Alone,

[1] *Second Supplement to the Herbart Yearbook*, p. 12.

[2] *Tonpsychologie*, 1883, p. 68.

this sentence gives a learned flavor to a discussion on interest, and interpreted in the usual English manner, leads one to believe Stumpf held a theory which he by no means favored. Pursuing the subject further in his *Tonpsychologie*, we find that this interest or attention may be roused by intense or agreeable impressions, or by an impression exciting an image which was of interest on a previous occasion. The strongest stimulus to attention or interest, however, is that which forms the basis of a volition. In such a case the will is not directed upon the attention, but upon some cognitive process, which is based upon an ideational content, and which in turn may become the foundation of a volition. To use Stumpf's words, "The will, therefore, does not produce attention, but it is attention."[3] This makes interest, not only a feeling, but also will. If this is so, then Stumpf s 'feeling' must likewise be a form of will. This gives us some suggestion of his further treatment of interest.

As Stumpf explains in the second volume of his *Tonpsychologie*, his identification of interest with attention caused some criticism, and to meet this he modified his former statements somewhat and gave a more explicit treatment of the subject. As he explains, interest as a term cannot always be substituted for attention when the subject of attention or interest is taken up. But, after making such changes as the language, the context, and the signification of the terms in their contexts demand, we may substitute one term for the other. Thus interest is not 'identical' in the logical sense, but rather 'synonymous' with the expression 'attention-exciting.' In addition, Stumpf further expounds his theory, and we get such a treatment of 'interest as attention and as feeling' as throws sufficient light on the subject to clear any doubts possibly caused by the first seemingly contradictory statements. To examine the characteristics of attention, Stumpf considers it necessary to see what are the characteristics of feeling in general, and then to determine what kind of a 'feeling' attention or interest is. Every feeling, according to Stumpf, is one either of '*Lust*' or of '*Unlust*,' of pleasure or of pain, of appetition or aversion, *i. e.*, it is either positive or negative. Attention or interest belongs to the positive

[3] *Tonpsychologie*, I., p. 69.

class. It is an interest, a participation-in, a turning-towards something. But the content itself, towards which we are attracted may be agreeable or disagreeable; it matters not which it is. The appetition is not determined by the content as pleasure-pain. "It is rather nothing more than the desire to notice as such, which naturally does not exclude those cases in which an impression, associated with some desire, also excites a desire to observe, discriminate, compare."[1] So, too, interest, 'when it is used as synonymous with attention,'[2] ('identical' now becomes 'synonymous') means not the desire for the agreeable content, *per se*, but rather the desire to know of such content. For example, a critic may be neither attracted nor repelled by an article and still be interested in it. "The article may not have been pleasing to him; but as a matter of fact he may have been pleased to know of it."[3] To this Kohn rather aptly remarks "The critic hates the article, by no means does he desire 'to know of it,' perhaps prefers to take a sleep. The noticing in and of itself is a burden to him. That there is no desire for it therefore, as such, goes without saying."[4] This, however, is by the way.

According to Stumpf, interest is a '*Lust am Bemerken*. More fully, finally, to define the character of this '*Lust*,' it is necessary to turn to Stumpf's discussion of voluntary attention.

[1] *Tonpsychologie*, 1890, II., pp. 279–280.

[2] I translate '*Lust am Bemerken*' as the 'desire to observe or to notice,' and not as a 'feeling of pleasure in observing.' We must take Stumpf in his entire discussion, and not in isolation, before we can determine what he means. In addition to the above, which gives some idea of his meaning, the following may help to throw some light on his meaning of '*Lust*.' He says, "*Die Aufmerksamkeit gehört zweifellos zu den positiven.* SIE IST EINE TEILNAHME, EIN INTERESSE, EINE HINWENDUNG ZU ETWAS. *Aber der Inhalt selbst, auf den wir merken, kann ein schmerzlicher, hässlicher, verabschauungswürdiger sein. Also ist Aufmerksamkeit nicht ein Lustgefühl, das der Eindruck, auf den wir merken, als solcher mit sich führt. Sie ist vielmehr, wie mir scheint, nichts anderes als die Lust am Bemerken selbst.*" *Tonpsychologie*, II., pp. 279–280. Stumpf's analysis is one of the keenest, but his terminology in this connection seems rather loose. Does he acknowledge this in his expression, "*In terminis libertas, in notionibus unitas.* But still better of course, *In terminis unitas*, also"? II., p. 286. (Small caps are mine.)

[3] *Tonpsychologie*, II., p. 281.

[4] 'Zur Theorie der Aufmerksamkeit.' *Abhandlungen zur Philosophie und ihrer Geschichte*, 1895, p. 32.

Here we are told that "it is nothing other than the will, in so far as it is directed towards an observing. Every feeling of desire which is directed towards an object can pass into a volition as soon as the object seems probable or attainable."[1] Completing now our Stumpfian equation, we have,

Interest = Attention = Feeling = Desire = Will,

that is, interest is a feeling of desire which may become an act of volition. It seems, therefore, safe to say that Stumpf in no way identifies interest with feeling as it is usually understood.

A very similar treatment of interest to that of Stumpf is given by Mill and his co-workers in psychology.[2] James has said that the association school has overlooked the problem of attention because it might interfere with the 'smoothness of the tale.' Locke, however, is the first English writer to define attention,[3] and in Mill's *Analysis* we find the first account of attention in which interest and attention are identified. In the *Analysis*, to quote rather fully, we find the following — "A pleasurable or painful sensation is said to fix the attention of the mind. . . . Having a pleasurable or painful sensation, and attending to it, seem not to be two things, but one and the same thing. The feeling a pain is attending to it; and the attending to it is feeling it. The feeling is not one thing, the attention another; the feeling and the attention are the same thing."[1] Where we have a number of ideas or feelings, the stronger may swallow up the weaker. "That the feebler sensation merges itself in the stronger, and is lost in it is matter of common and obvious experience."[1] Attention to a so-called indifferent object is present when this indifferent object is a means to something more pleasurable. The pleasurable idea is associated with it. "The state of consciousness is not an indifferent sensation merely; it is a sensation and an idea in union."[1] Further characterizing attention, J. S. Mill adds in a note, "The essence of attention is that the sensation or thought is, as it were, magnified or strengthened; it becomes more intense as a whole, and at the same time more distinct and

[1] *Tonpsychologie*, II., p. 283.
[2] *Principles of Psychology*, I., p. 402.
[3] *Essay*, 1690, Bk. II., ch. XIX., § I., Vol. I., p. 299, Fraser's edition (1894).

definite in its various parts like a visible object when a stronger light is thrown upon it." Objecting to his father's statement that attention is simply the highly pleasurable or painful quality of the sensation, either directly or by association, he adds that in addition such sensation tends, first, to exclude all other sensations from consciousness, and second, to persist in consciousness.[1]

Another name of this pleasurable or painful quality of the sensation or idea is, according to Mill, its interest. Mill is constantly using 'pleasurable' and 'interesting' indifferently. Thus in defining an end which is desired he says: "The end is thus a pleasurable, that is, an interesting idea."[2] And such interest is the same as attention, which again makes interest a feeling. "As the having an interesting sensation, and the attending to it are but two names for the same thing; the having a sensation rendered interesting by association and the attending to it cannot be regarded as two different things. In the first case attention is merely a sensation of a particular kind: in the second it is merely an association of a particular kind."[2] Again — "When the young man in love has the idea of the woman who is the object of his affections, is not attention merely another word for the peculiar nature of the idea? In like manner, in the mind of the man who is to be executed tomorrow, the idea of the terrible event before him is an idea in the very essence of which attention is involved. Attention is but another name for the interesting character of the idea. . . . It remains to expound the case in which an indifferent idea becomes interesting by association. It cannot do so in any other way than those in which it appeared that an indifferent sensation becomes interesting. It may be considered as the cause or the sign of some interesting state of consciousness. When that which is interesting becomes associated with that which is uninteresting so as to form one compound state of consciousness the whole is interesting. An idea, in itself indifferent, associated with interesting ideas, becomes part of a new compound which, as a whole, is interesting; and an interesting idea

[1] *Analysis of the Phenomena of the Human Mind*, 1869, II., pp. 363, 364, and notes 75, I., p. 230, and 66, II., p. 272.

existing and an interesting idea attended to are only two names for the same thing."[1] It might be well here to remark that the account of interest given by James[2] in his *Talks* could have been taken bodily from Mill, so similar are the two theories.

Mill does not give any special treatment of attention and interest, but touches on them in his discussions of feeling, motive, will and the like. From the whole we may summarize his views as follows:

Pleasure-pain quality of the sensation or idea

Attention (direct or by association) = interest (direct or by association)

Similar in some respects to the theory of Stumpf, but more closely in accordance with the facts, is the account of interest given by Baldwin in his *Feeling and Will*.[3] "Objects are interesting," according to his view, "only as they affect us or are associated with objects that affect us. And by the phrase 'affect us,' we mean — work some change in the sensibility, which tends, by the law of motor reaction, to realize itself in activity. . . . Now, such affective modifications may come in two ways. The two great stimuli to activity are pleasure and pain on the one hand, and suggestion on the other. Suggestion is passing, shifting, temporary; the interest it arouses is intellectual, temporary interest. . . . The common element, further, is an impulsive element — a tendency element — realizing its object through attention, which is the vehicle of apperception. Accordingly . . . we may define interest as the *impulse to attend*." Applying his two great laws of habit and accommodation Baldwin finds as the intellectual conditions of interest, first, that 'intellectual repetition diminishes interest,' second, that new relations involving higher integrations, rouse the interest of curiosity, of exploration and discrimination. And on the emotional and active side we have as determinants of interest, first, reference to the self in the form of pleasure-pain, the interest being something over and above the feeling of pleasure-pain. "It arises in connection with the apprehending of the tone and its causes. We would hardly say that an oyster is in-

[1] *Analysis*, II., pp. 361, 367, 368, 369.

[2] *Talks to Teachers*, Ch. X.

[3] Chap. VII., on 'Interest, Reality and Belief.'

terested when a sharp instrument is thrust painfully between his shells. The intrusion affects him, and it is in his interest to avoid it; but it is truer to say that it hurts than that it interests him."[1] Second, the effort expended on a thing gives it additional worth and so conditions our interest in it. In general, interest is the feeling of an impulse to attend to an object; it has a future or prospective reference and is renewed by new impulses, new apperceptive activity. This will give us schematically,

Interest = Ideal feeling = Impulse to attend

Of other writers, Sully touches upon the question of interest, but he adds little to what is given in Mill. In fact, both Mill and Stumpf seem to run through the account given by Sully. He tells us, "When it is said that we attend to what interests us it is meant that we attend when our feelings are touched; that is, to objects or ideas which directly or indirectly excite feeling. We may thus be said to be interested when we experience a sense feeling, and our attention is determined to the object, or to the action that excites this."[2] He also emphasizes the necessity of investigating the relation of interest to attention, quoting Stumpf to this effect: "Stumpf goes so far as to write, 'attention is identical with interest and interest is a feeling.'"[2] Sully hints at what interest might be, but he does not definitely tell us what it is. We are interested when our feelings are touched, but what is interest? Is it a feeling, or is it caused by such feeling? At any rate I shall hazard this equation as based on his account:

Interest = Feeling (?)
\ /
Attention.

More explicitly, Stout has given his views on the subject, and in his rather long discussion we again see attention and interest treated together. Stout considers it undeniable "that attention and interest, disagreeable or agreeable, are coincident. We cannot be feeling an interest in an object without attending

[1] *Handbook of Psychology, Feeling and Will*, 1891, pp. 139–146, and Ch. VII.

[2] *The Human Mind*, 1892, I., p. 163, and Note 1, p. 163.

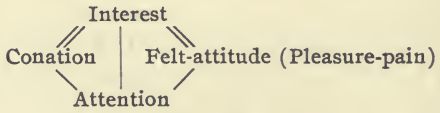
to it, and we cannot be attending to it without feeling some interest in it. Where the interest is very slight and transient, attention is also slight and transient and *vice versa*. But the two always go together. There is, however, a fallacy in the ordinary doctrine of their connection. The assumption that attention *depends* on pleasure-pain seems to have no sufficient basis. The relation is not one of cause and effect. The coincidence is simply due to the fact that interest as felt at any moment is nothing but attention itself, considered in its hedonic aspect. . . . Stumpf, indeed, goes too far when he says 'attention is identical with interest'; but the distinction between them is simply that the word *interest* carries with it a reference to something else as well as to attention as a mode of mental activity; this something else is the pleasure-pain tone of the attention process."[1]

As with Stumpf, so with Stout, we must be careful in interpreting what he means by attention and its hedonic aspect. It seems that in his rather violent effort to break away from the passive pleasure-pain theory of Mill, he has turned completely round and denied it altogether. Everything with Stout is conation and activity in this connection, and one needs but to skip through his book to verify this. For example he says: "There can be no such thing as purely passive consciousness. This means (1) that a total psychosis or state of mind can never be a state of complete inaction; (2) that no special content of consciousness entering into the composition of a total psychosis can exist apart from its relation to mental activity."[2] To make doubly sure that he is not misunderstood, Stout further says: "The process of consciousness is, as such, a felt process";[2] *i. e.*, we know that consciousness is active not only through reflection, but we also feel its activity during its existing moments. Attention is therefore mental activity, a conative tendency, a striving towards an end, and felt as active, while the concomitant feeling of pleasure-pain is due to the furthering or thwarting of our practical aims. "The pleasant or painful feelings involved, as springing out of the furtherance or thwarting of our

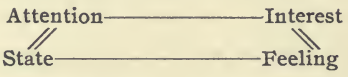
[1] *Analytic Psychology*, 1896, I., pp. 224–225, and also Ch. III. of Bk. II.

practical aims, is coincident with the apprehension of the object and its significance for us."[1]

In his *Manual* Stout gives a similar theory of interest. Conative continuity and continuity of interest are considered as the same. "It is clear, then," he writes, "that continuity of interest is more or less independent of direct proximity in time. This kind of continuity is essentially connected with mental activity in the strict sense, with the striving, conative, appetitive side of our nature. Its general condition is that the successive phases of a conscious process shall constitute a movement towards an end-state or terminus."[2] In almost every mention of 'conation,' Stout uses the term of 'interest' as synonymous. His idea of the matter may be represented as follows, portion of the diagram being taken from his *Groundwork:*[2]



The concomitance of interest with attention is also emphasized by Titchener who says, "When we say an 'interesting' thing catches the attention we are really speaking tautologically. A thing is 'interesting' when it is 'a thing to be attended to.' It is not that the pleasantness or unpleasantness comes first, and that we then attend to the impression; the two parts of our experience, the affective and the attentive, are simultaneous. In popular parlance, we attend because the thing is interesting; in psychological language the interest and the attention are two sides of the same experience.[3] According to Titchener, therefore, we have the following:



Among the other psychologists we do not find so full an account of interest given, though the subject is more or less fully touched upon. James tells us that consciousness "is always

[1] *Analytic Psychology*, I., pp. 166, 168, 225.

[2] *Manual of Psychology*, second edition, 1901, p. 81, and *Groundwork of Psychology*, 1903, p. 19.

[3] *Outline of Psychology*, 1901, p. 143.

interested more in one part of its object than in another";[1] that "interest alone gives shade, background and foreground — intelligible perspective, in a word,"[1] and that "the things to which we attend are said to interest us. Our interest in them is supposed to be the cause of our attending."[1] James also refers to interest as a selecting principle.[1] In his *Talks* he again takes up the subject. The native interests of children lie altogether in the sphere of sensation."[2] "*Any object not interesting in itself may become interesting through becoming associated with an object in which an interest already exists. The two associated objects grow, as it were, together; the interesting portion sheds its quality over the whole; and thus things not interesting in their own right borrow an interest which becomes as real and as strong as that of any natively interesting thing.*"[2] This statement would fit much better in Mill's Analysis than in anything that James has written; which implies, of course, not that James is bad, but that Mill is good.

We shall end our historical survey by rapidly giving what the other psychologists treating of interest have given. Ladd considers interest a feeling. As he says, "the question of gaining attention, is, in general a question of exciting some kind of feeling. In fact, the power which different objects of sense or ideas have to get attention in that 'struggle for existence' which takes place in the stream of mental human life is all summed up in that one word indicative of feeling, 'interest.' It is acknowledged by all that different minds have very different interests. But with all this great diversity of particular interests it is also the acknowledged universal rule that men attend with ease and effectiveness to what interests them, but only with difficulty and reluctance, or not at all, to what does not interest them." "This, however, is far from warranting us in saying, as Stumpf does, 'Attention is identical with interest, and interest is a feeling.'"[3] Finally Miss Calkins, assuming (1) Stumpf's dictum, '*Aufmerksamkeit ist identisch mit Interesse, u. s. w.*,'

[1] *Principles of Psychology*, 1890, I., pp. 284, 402, 416, 515, 572, 594; II., p. 344.

[2] *Talks to Teachers*, 1899, pp. 92, 94.

[3] *Psychology, Descriptive and Explanatory*, 1894, p. 79.

and (2) combining it with the formula of attention given by Titchener and by James, attention as a state of clearness, gets as a description of attention and therefore of interest which she identifies with attention, the following: Attention or interest is the 'feeling of clearness' which is present in such moments.[1] It is evident that these two will hardly mix if we take Stumpf's *Gefühl* in its actual signification.

(*To be concluded.*)

[1] *Introduction to Psychology*, 1901, pp. 137, 140, 488.

ARE THERE HYPNOTIC HALLUCINATIONS ?[1]

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When we first formed our acquaintance with hypnotic phenomena, we had many reports of the wonderful feats possible in the hypnotic state. Among the many marvels hypnotic and post-hypnotic hallucinations induced by suggestion occupied a prominent place. A good many of such hypnotic studies have been the result of amusement and at best of wonder. If it be true as Plato and Aristotle tell us that the origin of science is in wonder, all that is well and good as a beginning. When however we find that the beginning persists, when we find that the apparently precocious baby does not reach its adolescence and manhood, we begin to wonder what the trouble may possibly be, and whether it is not a case of mental defectiveness. When we find that as the literature of the subject grows the same state of blank wonder still persists; when we find that hallucinations induced by suggestion are described in all their minutiæ without the least critical psychological analysis of the phenomena, it is time to ask whether the preliminary stage of hypnotic marvels and mysteries has not lasted too long. It is well to pause and ask the question: "Are there any hallucinations hypnotically suggested? Does the subject really experience the hallucinations?" We rarely find in the whole literature of the subject that any of the writers should even as much as refer to the question of the validity of the hypnotic hallucinations. The hypnotic subject accepts the experimenter's suggestion and the experimenter takes the subject's honest word on faith. The trust is mutual. He however who has devoted time and reflection to the matter realizes that the introspective account of the hypnotic subject must be taken *cum grano salis*. First, because one rarely finds a subject who is able and trustworthy to give an introspec-

[1] Read before the American Psychological Association, December, 1905.

tive account; and second, one must always remember the training and extreme suggestibility of the subject, a suggestibility which makes the subject insist on what the experimenter suggests to him, no matter whether he really experiences it or not. This is the dangerous pitfall of hypnosis, into which many an investigator in this field has fallen. We cannot possibly base our scientific generalizations on the insight and 'psychologizing' of one hypnotic case, nor can we accept universally the statements of the subject on the ground that the latter is of an exemplary conscientious character. One must be constantly on his guard, have many cases and keep on constantly sifting his material and that with a good deal of scepticism. One must watch his subjects or patients very closely, always have his suspicions, compare their statements with one another and especially with those of the same patient in various states.

In my experience of many years with hypnotic subjects, some of whom went into a deep somnambulistic state, a doubt gradually began to arise in my mind as to the validity of the hypnotic hallucination. When I came to devote my time to studies of cases afflicted with hallucinations, the doubt grew stronger and almost became a certainty. I could not help reaching the conclusion that the hallucinations hypnotically suggested are not genuine. In other words, facts lead me to think that there is no hypnotic hallucination in the strict sense of that word.

Before we proceed with our discussion it may be well to give an analysis, however brief, of the percept of hallucination, and then compare the latter with experiments and observations of hypnotic and post-hypnotic hallucinations.

We may begin with the percept and its elements. In looking at the vase before me I see its beautiful tints, its rounded shape, its heavy pedestal with its rough curves, its solidity, weight, brittleness and other experiences which go to make up the perception of the vase. Now, the visual elements are given directly by the visual perceptive experience; but whence come the seemingly direct experiences of weight, heaviness, roughness, smoothness, and others of the like kind? They are evidently derived from other senses. The whole perceptive experience is of a visual character. We take in the whole with

our eye. In the organic structure of the percept then, besides the experiences directly given by the stimulated sense-organ, there are other experiences, sensory in character, indirectly given, and coming from other sense organs which are not directly stimulated.

The percept is a complicated dynamic product, and its elementary processes are never derived from one isolated domain of sensory experience. The activity of all the sensory domains coöperates in the total result of an apparently simple percept. Along with sensory processes directly stimulated, a mass of other sensory processes become organized and help to contribute to the total result. The direct sensory elements are termed by me *primary sensory elements;* the indirectly given experiences are termed *secondary sensory elements.* The secondary sensory elements may be figuratively said to cluster round the primary sensory elements as their nucleus.

The whole perceptual experience is tinged by the character of the primary elements which constitute the guiding nucleus, so to say. Thus, where the primary sensory elements are visual, the whole mass, no matter from what domain the sensory experiences are derived, appears under the form of the visual sense, and the percept is a visual percept. While the primary sensory elements form, so to say, the dynamic center of the total perceptual experience, the secondary sensory elements mainly constitute its content. Both primary and secondary elements are sensory and are induced peripherally; the primary directly, the secondary indirectly. The percept then is sensory and is constituted by primary sensory elements, or primary sensations, and by secondary sensory elements, or secondary sensations.

The character of the secondary sensory elements stands out clear and independent in the phenomena of synæsthesia, of secondary sensations. In synæsthesia we have a sensation of one sense organ followed, without an intermediary direct stimulation, by a sensation coming from another sense organ. Thus, when a sensation of light instead of giving rise to a subsequent idea gives rise to a sensation of sound for instance, we have the phenomenon of secondary sensation. Here the secondary sen-

sations stand out free and distinct, but they are really always present in our ordinary perceptive experiences as bound up secondary sensory elements, as secondary sensations grouped around primary sensations.

When the phenomena of synæsthesia were first brought to the notice of the scientific world, they were regarded as abnormal and exceptional, and only present in special pathological cases. Soon however their field became widened, and they were found not only in the insane and degenerate, but in many persons otherwise perfectly normal. We find now that we must further widen the field of secondary sensory elements and, instead of regarding them as a freak of nature existing under highly artificial conditions, we must put them at the very foundation of the process of perception.

Secondary sensations are at the basis of perception. We have become so accustomed to them that we simply disregard them. When, however, the conditions change, when the secondary sensations stand out by themselves, isolated from the primary nuclear elements with which they are usually organically synthetized into a whole, into a percept, when they become dissociated, it is only then that we become conscious of them directly and declare them as abnormal. Secondary sensations are always present in every act of perception; in fact they form the main content of our perceptual activity, only we are not conscious of them and it requires a special analysis to reveal them. Secondary sensations *per se* are not something abnormal — just as hydrogen present in the water we drink or the oxygen present in the air we breathe are not newly created elements, — it only requires an analysis to discover them. If there be any abnormality about secondary sensations, it is not in the elements themselves, but rather in the fact of their dissociation from the primary nuclear elements.

Now when the secondary sensory elements come to the foreground and stand out clearly in consciousness, a full-fledged hallucination arises. In the phenomena of synæsthesia we have hallucinations in the simplest form, inasmuch as only isolated secondary sensory elements dissociated from their active primary central elements stand out in the foreground of consciousness.

This very simplification however of hallucinations reveals their inner character. The most complex hallucinations are only complex compounds, so to say, of secondary sensory elements. Hallucinations are not anything mysterious, different from what we find in the normal ordinary processes of perception; they are of the same character and have the same elements in their constitution as those of perception. Both hallucinations and percepts have the same secondary as well as primary elements. The difference between hallucinations and percepts is only one of relationship, of rearrangement of elements, primary and secondary. When *secondary sensory elements become under conditions of dissociation dynamically active in the focus of consciousness we have hallucinations.*[1]

From this standpoint we can well understand why a hallucination, like a percept has all the attributes of external reality. A hallucination is not any more mysterious and wonderful than a percept is. We do not recognize the humdrum percept, when it appears in the guise of a hullucination, and we regard it as some strange visitant coming from a central, from some supersensory universe. Hallucinations, like percepts, are constituted of primary and especially of secondary sensory elements, and like percepts, hallucinations too are induced peripherally.

Now how is it with suggested[2] or hypnotic hallucinations? Do we find in hypnotic or suggested hallucinations, as in the case of hallucinations in general, the requisite primary and secondary sensory elements directly and indirectly induced? Binet makes an attempt to establish a peripheral stimulus in the case of hypnotic hallucinations, claiming that there is a *point de repère*, a kind of a peg, on which the hypnotic hallucination is hung. It is questionable whether Binet himself still maintains this position. However the case may be, this position is hardly

[1] For a full account see my paper '*An Inquiry into the Nature of Hallucinations*,' THE PSYCHOLOGICAL REVIEW for January and March, 1904; also the excellent paper on '*Hallucinations*' published by my friend and former associate, Dr. Wm. A. White, superintendent of the Government Hospital for the Insane, Washington, D. C., in *The Journal of Nervous and Mental Diseases* for November, 1904.

[2] Throughout this paper I use the term 'suggested hallucination' to indicate the character and origin of the latter. The term seems to me convenient and may prove acceptable.

tenable when confronted with facts. Hypnotic hallucinations may develop without any peg and prop. Furthermore, granted even that now and then such a peg could be discovered, and that the alleged hypnotic hallucination develops more easily when such a peg is furnished, still the fact remains that even in such cases the peg is altogether insignificant, that it is altogether out of proportion and relation to the suggested hallucination, and that on the same peg all kinds of hallucinations can be hung, and that finally it can be fully dispensed with. All this would go to show that the peg, as such, is of no consequence, and is really more of the nature of an emphatic suggestion for the development of the alleged hypnotic or post-hypnotic hallucinations.

The arbitrariness of the hypnotic hallucinations, showing that the whole thing is simply a matter of representations, or of what the patient happens to think at that particular moment, is well brought out in the following experiments: Mr. F. is put into a hypnotic state and a post-hypnotic suggestion is given to him that he shall see a watch. On awakening he claims he sees a watch. The eyeball is then displaced, the watch is also displaced; now when the eyeball returns to its normal condition we should expect that the hallucinatory watch would return to its former place; but no, the watch is not perceived in its previous place, — it appears in a displaced position. The hallucinatory watch could thus be displaced any distance from its original position. The patient evidently did not see anything, but simply supplied from his stock of knowledge as to how a seen watch would appear under such conditions, and he omitted to notice the fact that with the normal position of the eye the watch should once more return to its former position. Such inconsistencies are often found in hypnosis. More intelligent and better informed patients would reason out the matter differently and would give different results. If the subject knows of contrast colors and if a color is suggested to him he will without fail see such contrast colors. If his eyes have been fixed on some hallucinatory color, such as red, for instance, he will even give you a detailed account of the green he sees, but if he does not know anything of the

effects of contrast colors no amount of fixation on hallucinatory colors will bring out the least contrast effects. The reason is the patient does not know anything about it and cannot think of it. We tried to mix by suggestion different hallucinatary colors, and as long as he knew nothing of the real results his replies were uniformly wrong; no sooner did he find out what the right mixture *should* be than he gave correct results. The hypnotic subject really does not perceive anything; he simply tells to the best of his abilities what he believes he ought to see under the given conditions.

It is extremely interesting to make one experiment which gives an insight into the alleged suggested hallucination and shows its fictitious character. The experiment succeeds best when the subject is unprepared and is taken off his guard. I have tried it in various cases and have had uniform results. A suggestion is given to the subject to see a watch, say, on awakening. When he awakens, the watch of course is claimed to be seen in a kind of perfunctory manner. If now another watch is put near the hallucinatory watch, the real watch is not taken notice of; it is absolutely ignored as if it did not exist. If his attention is drawn to the real watch the subject still continues to treat the real watch as unreal, and the suggested hallucinatory watch as the *only real one*. It is evident that in his honest zeal to carry out the suggestion he overdoes the matter and thus clearly reveals the fictitious character of his alleged hallucination, which he in fact does not experience. If now we give him the benefit of the doubt and tell the subject, when in the hypnotic condition, that when he wakes he will see two watches, thus calling his attention by suggestion equally to both watches, one as much as the other, on awakening he still ignores the real watch and his whole attention is occupied with the hallucinatory watch. The subject simply *overacts*. He is so anxious to carry out your suggestion and oblige you. If we now try to test the matter by choice and ask him which of the two watches he prefers to have, he unhesitatingly points to the hallucinatory watch. When asked the reason, he replies almost anything that may at that moment occur to him; such for instance as that the hallucinatory watch is newer or bigger,

or any old thing he may happen to think of, no matter how absurd the reason is. In his eagerness to carry out the suggestion and to show the reality of the hallucinatory watch he will choose the hallucinatory in preference to the real watch. The subject in short does everything in his power to convince us of the reality of his alleged hallucination, and in his eagerness he overdoes things, thus clearly revealing the fact that he really does not perceive the hallucinatory object. The so-called hypnotic or post-hypnotic hallucination is really not a hallucination and should not be taken as such; the *suggested hallucination is more of the character of a delusion.*

To take a couple more of my experiments with cases of hypnotic subjects: H. R. goes into a deep somnambulistic state. I carried out on H. R. a series of experiments in color hallucinations. The results were far from being uniform. To take an example: He was given a suggestion to see red; he saw it, of course. He was then told to look at it and tell me what he saw. At first he answered at random; he saw the chair, the table, the books, and so on. When he found out that color was wanted he obliged me with that. All kinds of contrast colors, white, blue, yellow, orange and brown were given. No sooner did he find out the approved color than he saw it and stuck to it afterwards. Similar results I had in the case of mixture of hallucinatory colors. Red and green, for instance, gave all kinds of results but the right one. No sooner was the right color hit and felt by the subject that the experimenter approved of the guess, than he kept on 'seeing' it without any further modification.

All through these experiments a good deal of fishing was done by the subject, and this fishing was probably the most instructive part of the experiment. On the whole, I must say that the statements of the hypnotic subject should be treated with extreme circumspection. I often wondered which of the two is the greater dupe, the subject or the hypnotizer.

On one occasion I suggested to H. R. to see a hallucinatory pencil; he saw it, of course. He was given the suggestion to insert the pencil in water; he did so. 'What happened to the pencil?' I asked. 'It turned red,' he replied. When, however,

he found out that the experimenter had in mind the refraction of the pencil, then his pencil behaved accordingly. The subject, especially the good one, the one who is capable of good training, is eagerly on the lookout for the slightest wish and caprice of his manager, and is always fishing for the best way of doing it, of carrying out those wishes to the delight of the hypnotizer.

In cases of primary dementia or dementia præcox and katatonia under my observation and experimentation, now being carried on and soon to be published, I found hallucinatory states strikingly like those of hypnosis. Thus in one of my cases of katatonia, Q. M., the patient could readily be made to see all kinds of hallucinations, no matter how incongruent. The patient could see a 'four-horned chicken with toes on its tail'; 'a cat with two legs and wings'; 'a tree with feet, eyes and wings,' and other visions of like kind. To demonstrate their reality the patient actually drew these visions. (Similar experiments were carried out by me on hypnotic subjects.) The patient could be made to see lions, wolves, elephants and tigers, and was no more afraid of them than the hypnotic subjects are in similar conditions. The fact is that neither the demented nor the hypnotic subjects actually experi ence the suggested hallucinations.

Experiments, therefore, point to the fact that suggested hallucinations, hypnotic and post-hypnotic, are purely ideational and closely conform to the course of associative, ideational or representative activity. In other words, the subject does not really perceive the suggested hallucinatory object. He simply thinks of it. The subject to whom I gave the suggestion of seeing the watch no more saw the hallucinatory watch than I saw it. He *thought* of the watch, and he *claimed* he saw it and acted as if he did see it. Furthermore, he was anxious to carry out fully my suggestion to the best of his abilities, and persuade me that he really did see an actual watch *more real than a real* watch. The alleged hypnotic or post-hypnotic hallucination is not at all of the nature of a hallucination, it is a *delusion*. All we do by such a suggestion is to act on the subject's belief. The subject believes that he perceives, and he, in his turn, as

one under a delusion, tries to convince us of the reality of his belief; and I must say that he is quite successful in imparting this delusional belief to the experimenter himself thus unconsciously, but ironically none the less, repaying his deluder in the same coin.

One of the special characteristics of hallucinations, as of percepts in general, is that of *reality* or of *externality*. The hallucination, like the percept, during the time it is experienced, is clothed in the full garb of external reality. The hallucination is regarded by the percipient as an external object of perception. Hence he who suffers from hallucinations experiences them as he does any normal sensory percept, and, unless he learns in other ways the hallucinatory character of his perception, he reacts to it as he would to any of his normal percepts of external reality. Now if we closely watch the subject possessed by the alleged hypnotic or post-hypnotic hallucination, we find that the inmost character of externality is sadly lacking. The sensory-motor reaction is by no means the one produced by the corresponding sensory percept. After all, the best criterion of an experienced percept, especially if it be that of another organic living being, is the total motor reaction. The proof of the pudding is in the eating. The subject does not react to the 'suggested' pudding as if it were worth the eating. The reaction is by no means the one called out by the perception of an external object regarded for the time being by the percipient as actually present, no matter whether that presence be right or wrong, whether it be hallucinatory or not. The suggested hallucination calls forth a reaction, if there is any at all, of a very weak character and disproportionate to the supposed stimulating presence of the hallucinatory object. The motor reaction is such a one as is called out by a representation, by a thought of the object, but not by an actual perceptive experience of an external object, as it is in the case of an actual hallucination. In hallucinations of ghosts or of tigers, for instance, the patient actually perceives, sees the ghosts, the tigers, the serpents; but in suggested hallucinations the subject sees the suggested objects no more than we do when we talk about ghosts, tigers and serpents, or when we suggest them to the subject.

The subject thinks of the suggested hallucinations and acts as if he perceived them. In fact, the most we can do is to create in him a belief in the supposed presence of the suggested hallucinatory object. *The subject is not in the psychic condition characteristic of hallucination, but he is in the mental state characteristic of delusion.*

The most we can say of hypnotic, post-hypnotic, or suggested hallucinations is that they are saturated, so to say, with the belief in the supposed presence or existence of the object suggested, somewhat in the same way as the child believes in Santa Claus, or as the school boy believes in Washington, or as we believe in the existence of Julius Cæsar. The belief, however, is not of the vital over-bubbling stimulating effect given by a direct perception of an external object, true or hallucinatory, but is one essentially representative in character. And that is all that we can claim for the potency of the hypnotic state and efficacy of suggestion.

Hypnosis with its allied states can modify, undermine, create belief, and important modifications can be induced in the total mass of representative life activity. Associations and dissociations can be brought about in the dynamic processes of representations or ideas, but we cannot create objective sensory miracles. If faith and ideas move the world, as they most certainly do, we have in our hands a powerful instrument, which if intelligently used may prove of the greatest benefit to civilization and humanity. We should not, however, delude ourselves and ascribe to it mysterious magic virtues. The hypnotic state with its abnormally increased suggestibility can give rise to belief, to new associations and dissociations of ideas, but by no legerdemain can it produce, without the intermediacy of peripheral physiological processes, the faintest sensory element. Faith may move mountains, but it cannot create the minutest particle of dust, nor can suggestion create the most insignificant sensation.

We should not delude ourselves as to the power of suggestion, even if it be in the hypnotic state. A suggestion even in a hypnotic state, however deep, can do no more than a very vivid persistent idea can do in the waking state. An ideational proc-

ess can give rise to motor and possibly to some glandular changes but no mental magic will ever make of it an external stimulus capable of giving rise to peripheral physiological processes resulting in a sensation with the cumulative effects ending in perception. Suggestion cannot cause an amputated leg to grow, nor is suggestion a reliable antitoxin in infectious diseases, nor is it regarded as an efficacious antiseptic; it can hardly be credited with the power of destruction of the minutest bacterium, nor is suggestion regarded as possessing the medicinal virtues of regenerating a single destroyed neuron. Why then should we be so credulous as to endow suggestion with the wonderful and mysterious qualities of producing sensations and percepts without their adequate complex peripheral physiological processes?

As far as our present knowledge of facts goes we are only justified in saying that the efficacy of the hypnotic state with its greatly increased suggestibility is limited entirely to ideational processes, to their integration and disintegration and that it can do no more than can be effected by a very vivid idea under the most favorable conditions. But are we justified in claiming that ideas however vivid can become sensations and perceptions? No more than our ideas of vapor can become the power of steam. We may as well claim that our idea, say of red, provided it is 'strong' enough, may give rise not only to the peripheral, physiological, sensory processes, but also to the requisite physical processes, to ether vibrations of color red, and thus influence by a backward 'reverse current,' so to say, the sense organs and mind of other persons.

We may arrive at that 'scientific' speculation of telepathic power possessed by our minds to impress the 'Universal Ether, and imprint on it our thoughts and wishes and sensations and it simply remains for other men or 'sensitive mediums' to breathe in or take in the impressions that flood the ethereal universe.

There is not a particle of evidence that ideas, however vivid, may become 'centrally' transformed into sensations. The idea of musk does not smell; the idea of white does not shine, and the idea of sound does not ring. The suggested hypnotic and post-hypnotic hallucinations, along with the alleged central hal-

lucinations and other notions of like kind belong to the general category of psychological and psychopathological fallacies. It savors somewhat of the mediæval alchemists' belief that gold could be refined out of any old rubbish. Suggestion reminds one of the magic powers of the philosopher's stone,— its touch can convert the base metal of fictitious ideas into the pure gold of sensory experience. The wonder is that the world is not one large asylum for ideas to play gambols in, and raise havoc with all our sensory experience, and make us suffer from all kinds and forms of hallucinations, inasmuch as a high-pitched ideational activity would give rise to the same sensory elements and consequent perceptions as do peripheral stimuli and physiological processes. Our ideas would be regarded as realities and our great expectations as actualities. It is agreed on all hands that no sensation can be transformed into another even if they both belong to the same domain — the sensation of yellow cannot become orange much less that of sound, for instance, because they are qualitatively different. How then can we maintain the untenable position that ideas, no matter how intense and vivid, can ever become sensations, percepts, can ever form sensory and perceptive experiences, even if they be hallucinatory in character.

The validity of hypnotic hallucinations has passed unchallenged, because of the dubious assumption of the central origin of hallucinations, an assumption still current among psychlogists and especially among psychiatrists who still pin their faith to 'images and idols' and accept uncritically the introspective lucubrations of insane and dements. Although the introspective account of the hypnotic subject is far more trustworthy and valid than that of the insane and dements, it should be taken with the utmost caution and should not be too credulously accepted on its face value.

If we eliminate then the psychopathological fallacy of central transformation of ideas into sensations and percepts, we clearly realize the flimsiness, the spurious character of suggested, or hypnotic hallucinations. *We have first of all to prove that the subject actually experiences the suggested hallucinations.* We should not be blinded by a too devout worship of 'central images,' but should pay more attention to facts, to the actual mental

condition of the hypnotic subject. The fact that the introspective account given by the subject confirms most emphatically the presence of an actual hallucination does not count in this case. The introspective account is just the one that is the *least reliable* in such cases because of the untrustworthy suggestible nature of the whole state, and as such should if possible be avoided, especially in cases of long standing in which suggestibility has been trained to its utmost. We must always keep in mind the highly suggestible character of the hypnotic subject, and that from the very nature of his state of suggestibility he will stick to the apparently objective description of a purely ideational experience. We must remember that the suggested hallucination is given in terms of objective perceptual experience and that the more effective the suggestion is, the more suggestible the patient is, the more will he insist in his introspective account on objective description of his experience given to him in the suggestion by the experimenter. The so-called *hypnotic hallucination is an artifact elaborated by both parties in the experiment*,— it is a kind of an unconscious collusion formed between the experimenter and the subject.

In order to find out the delusional nature of the suggested hallucination it is well to begin with an intelligent trustworthy subject who has no knowledge of the marvels and mysteries of the hypnotic state and no training has yet been permitted to effect by means of the cumulative effect of suggestion the highly artificial results which destroy the value of many a valuable case. Now if we take a fresh case with no mystical humbug about it we meet with results far different from those which are usually described and reported. Of the various cases under my observation and experimentation I may take the case of one patient who went into a deep hypnotic state. To quote from my notes: "Mr. N. goes into deep trance. While Mr. N. is in the hypnotic trance I suggest to him that as soon as he wakes he shall go to a jar full of water and look into it and see a series of scenes from his former life. On awakening and hearing the signal he goes to the jar, looks into it, and begins to recite the scenes or the events of his former life. I suddenly stopped him and asked him: Do you see all that in the jar? No, he replied, I see it in

my mind; I have it all in my mind." The subject did not really see it; he simply thought of it. The subject is hypnotized again; the suggestion of hallucination is enforced. On being awakened, when the signal is given he goes to the jar, looks into it, and begins once more to recite his supposed visions. Do you see them in the jar? I ask again. I do not know, he answers, whether I see them in the jar or in my mind; it is hard to tell. Evidently my succeeding suggestion has brought about some hesitation in his belief or attitude as to the pure ideational character of his supposed visions. He would not have hesitated in his statement as to the whereabouts of the alleged hallucinatory objects had he perceived the actual external objects as is the case in actual hallucinations. The hesitation is also instructive from another standpoint, namely, the training which the subject gets by the form and insistence of the suggestions given to him. The patient was just on the point of giving way to the suggestion of objectivity of pure ideational experiences; a few more experiments and suggestions and he would have given a full description of a suggested hallucination in its full perceptual objective glory, so delightful to the heart of most experimenters. The simple truth of the whole matter is that the patient had not the least perceptual experience of the objects suggested by the alleged hallucination; he did not see anything, he did not see the scenes anywhere, he only thought of them, he simply remembered them, possibly very vividly, but still they were only thoughts, memories, and not perceptions, not actual visions.

I could similarly bring from records a number of other cases under my observation, cases in which the suggested hallucinations were at first regarded as unsuccessful and only after some repetition have the hallucinations apparently become fully developed. Thus in some of the cases put into hypnosis for the first time the subjects declared on awakening that they did not see anything, but that the thought of the suggested object came to their minds. What really happened was that the subjects not as yet trained by a whole course of 'suggestive treatment' gave me a real account of what was actually taking place in their minds. Such results are usually regarded as unsuccess-

ful suggestions. As a matter of fact, it is such failures that are really successful and that give the actual state of mind, while the *successful suggested hallucinations are artifacts.*

Dr. R. D., with whom I carry on extensive series of experiments, goes into a very deep somnambulistic state. He is an excellent visualizer and takes readily visual hallucinations. Being a trained physician and psychiatrist the subject's account is all the more valuable.[1] Now R. D. describes his hallucinations as 'mental pictures,' as 'auditory memories,' which 'lack exteriority, are not located in space.' He aptly characterizes his hallucinations visual, auditory, and others, as '*fixed ideas.*'

Mr. M. goes into deep hypnosis. When in one of the deep trance-states a suggestion is given to him that on awakening he shall see a watch. When awake he claimed he saw a watch. He was asked: 'Do you really see it?' He replied 'Yes.' The interesting point here was the fact that the subject did not even look in the direction where the suggested hallucinatory watch was supposed to be placed and where he himself claimed that the watch was located. When tested by automatic writing the hand wrote: 'Yes, I see the watch.' The subconscious then was also under the influence of the suggested hallucination. This point it is well to bear in mind.

Rehypnotized, and suggested that on awakening he would see *two* watches. One was a real silver watch and the other was hallucinatory. The subject claimed he saw both, but he handled the hallucinatory one, and when asked which of the two he would prefer he pointed to the hallucinatory watch. When asked why, he replied that the suggested watch was bigger. He was really indifferent to the chosen watch and paid no further attention to it as if it did not exist for him.

He was again put into the hypnotic state and was suggested to see a flower. On awakening he claimed he saw a flower and smelled it in an indifferent, perfunctory fashion. The subconscious was then tested by automatic writing and the writing was to the effect that he saw it: 'I see a flower.' The subconscious then had also the same hallucination. A series of similar experiments was carried out with the same results. *The subcon-*

[1] The experiments will be published in full.

scious claimed in automatic writing that the suggested hallucination was real.

The subject was again put into hypnosis and was given the suggestion that he would see a watch on awakening, but here I made some modification. 'When you wake up you will be sure to see a watch,' I said, emphatically. "Look here; I want you to write what you really see and not what you do not see.' When awake he saw a watch, but he immediately wrote: 'I do not see anything.' *Here the subconscious disclaimed the suggested hallucinations which it had claimed and insisted on before.*

Rehypnotized, and was given the suggestion that on awakening he would see three watches. He was awakened and a real silver watch was put before him; the other two were hallucinatory. He claimed he saw all three. Meanwhile, in automatic writing he wrote: 'One silver watch, real, the other golden, not real; nothing there.' A series of similar experiments was made and with the same results. *The automatic writing disclaimed the hallucinations, although before, under the same conditions, it most emphatically insisted on their reality.*

The subject was put into hypnosis and a post-hypnotic suggestion was given to him that he would see his wife and child. When awake he began to smile, and when asked why he smiled he said: 'I see my wife and child'; but he wrote: 'I see nobody.' When put again in hypnosis he still continued to smile and said: 'I see my wife and child'; but he wrote (in hypnotic state): 'I do not see them really; I see nothing; I see my child, but I really see nothing.' "What do you mean," I asked, "by 'I see my child, but I really see nothing'?" To which he replied: 'I mean that I see my child in my mind only, but '*in honest*' I don't see anything.'

I then gave him a posthypnotic suggestion to see a snake. He claimed on awaking that he saw a snake. He manifested little fear. He certainly did not behave as if he really saw a snake and instead wrote "I see a snake. I see it in my mind." A great number of similar experiments were carried out by me varying the suggestions and all with the same results. I shall not burden the reader with a detailed account as they all gave identical results.

At first the automatic writing claimed emphatically the presence of the hallucinatory object and when the truth of the automatic writing was insisted on, the writing disclaimed fully the perception of the hallucinatory object. Finally we came on the real character of the suggested hallucination; 'I see my child but *honestly*, I do not see anything; I see my child in my mind only; I dont see anything.' In other words, if we take the facts plainly and do not play hide and seek with the subconscious, we come to the conclusion that in the suggested hallucinations the subject does not perceive anything as is the case in an actual hallucination but that he simply represents, vividly perhaps, what is suggested to him; in short he does not perceive but he simply *thinks* of the suggested hallucinatory object.

Another interesting point may be brought out here. The automatic writing, as is usually the case, is not taken cognizance of by the patient, and, although this same writing at first claimed the actuality and genuineness of the suggested hallucinations it gave in the second series of experiments the real insight into the whole matter: 'I see the child; I see nothing; I see it in my mind'; or 'I see the snake; I really see nothing; I see it in my mind.' When the subject was made fully conscious of his automatic writing and became fully aware that he was being entrapped he once more began to claim in automatic writing the actuality of the suggested hallucination. As long then as the automatic writing was regarded by the subject as independent for which he was not responsible and as long as the suggestion of the hallucination was not taken as directly addressed to it, the subject himself frankly acknowledged the fact that he did not see anything. The cat was thus let out of the bag. No sooner, however, was this truth of the automatic writing brought home to the subject so that he should be confronted with it directly and squarely, than he was bound by the fact of the given suggestion to claim that he actually saw the suggested hallucinatory object, although he really did not see anything at all. This is most instructive. For it shows clearly that the hypnotic consciousness, from the very nature of its heightened suggestibility, clings most anxiously to the given suggestion and insists on the reality of its fulfillment. We must, there-

fore, be on our guard and not trust the subject's introspective account, unless it is well sifted by good circumstantial evidence. It is because such precautions have not been taken in the close interrogation of the subject's actual state of mind, and because of the deep-rooted psychological fallacy as to the relation of ideational and perceptual activities that the prevalent belief in the validity of suggested hallucinations has passed unchallenged. If not for those factors, it seems to me, it would have been quite evident that *hypnotic and post-hypnotic suggested hallucinations are not genuine, but are essentially spurious; that hypnotic hallucinations, unlike actual hallucinations, are really not experienced; that hypnotically suggested hallucinations are only forms of delusions.*[1]

[1] The MS. of this article was received March 11, 1906. — ED.

STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF CHICAGO.

COMMUNICATED BY PROFESSOR JAMES R. ANGELL.

A Study of Certain Relations of Accommodation and Convergence to the Judgment of the third Dimension.

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with the coöperation of
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I. While one of the writers of this paper was investigating the problem of the third dimension, controlling the depth location of combined visual images by obtaining a reflex control over the convergent-accommodatory process, the other who was serving as subject insisted that she possessed the ability to locate the image at will, irrespective of the reflex control exercised over the convergence by the conditions of the experiment. Furthermore, it was stated that she had possessed this peculiar ability of voluntary control of depth location throughout life and had often amused herself during youth by voluntarily changing the apparent distances of objects in the visual field. For instance, a house could be made to approach or recede at will. After becoming a psychologist her interests had led her along other lines, and the phenomenon had never been studied.

The results of the following tests show that this subject possesses a direct voluntary control of lenticular accommodation independent of the convergence, and that depth is in her case a function of accommodation and is in no respect *effectively* influenced by convergent changes.

In the experiments the subject's head was held by a mouth-bit head-rest. At the opposite end of the room (290 cm. distant) was a screen. Two bright wires of identical size and appearance were fixed parallel to one another in a screw mechanism

similar to the Jastrow æsthesiometer so that their distance apart could be gradually changed. The mechanism was fastened before the subject so that the wires were vertical and but a few inches in front of the eyes. A screen was interposed so that but a couple of inches of the tops of the two wires could be seen. The subject then combined stereoscopically the foveal images of these two wires and voluntarily controlled the depth location of the combined image. Under these conditions there is a reflexive tendency to maintain this binocular unity of vision and hence the experimenter can alter the degree of convergence as desired by gradually changing the distance between the two wires.

1. The experimenter kept the subject's eyes in a fixed convergent position, while the subject voluntarily moved the combined image back and forth between her head and the distant screen. This change in the depth location of the image was not a matter of mere interpretation but was an actually perceived movement. One's judgment as to the distance of an object may vary from time to time without any apparent motion on the part of that object. The distance may appear to be three feet at one time and eight feet at another. The change would be in the interpretative processes, in the motor evaluation of the constant visual criteria of depth. In our case, however, the combined image did not simply appear to be now nearer, or now farther away, but it also appeared to *move* as well. This apparent backward and forward movement was as real, psychically speaking, as that of any material object.

The following facts prove that the convergence really remained unaltered during this volitional movement of the image: (*a*) the combined images of the wires did not become doubled. Since the distance apart of the wires and their relation to the head were constant during the test, any convergent or divergent movements of the eyes would have destroyed unitary vision. (*b*) An object placed at the intersection of the visual axes was always seen single while objects placed nearer or farther away were seen double. (*c*) No convergent movement of the eyes could be detected by observation. If an observer sights over a fixed point at the juncture of the iris and the sclerotic the least

convergent rotation is easily detected. (*d*) The retina was also observed through an ophthalmoscope. A system of parallel vertical lines stretched on a frame was attached to the instrument in such a way that the retina was viewed through this non-magnified system of lines. The instrument was so adjusted that some prominent and distinct feature of the retina, *e. g.*, the edge of the optic disc or the juncture of two distinct blood vessels was in line with one of the vertical threads. Since the instrument magnified twelve to fourteen times, the least convergent rotation could be easily detected. Save a few irregular twitchings, no convergent motion occurred. A slight vertical rotation was present, a phenomenon which will be discussed later in the paper.

The following facts demonstrate the existence of accommodatory changes running parallel with the movement of the combined image. (*a*) The combined image became larger, more blurred and confused in proportion as its distance from the subject increased, and smaller, more distinct and definite in proportion as its location was changed to the distance position of the two wires. (*b*) The double images of any object placed at the position temporarily occupied by the movable image were always clear and distinct as in the case of a normal accommodation for this point. The images of an object placed at any other position were large, blurred and confused as in the case of imperfect accommodation. (*c*) In normal distance adjustments the size of the pupil varies reflexly with the lenticular changes. The same relation obtained in these tests. The pupil could be observed to enlarge when the image was moved to far distances and to decrease when the image was brought toward the subject. This change in the size of the pupil was also detected introspectively by the subject. In fact the experimenter's attention was first directed to the phenomenon in this way. (*d*) Lenticular changes were detected directly by the use of the phakoscope. The regulation Helmholtzian arrangement cannot be used in this test because the instrument would intercept the subject's binocular vision. A Welsbach gas light was covered so that no light was emitted in the room save through two small apertures. This light was directed upon the cornea. A candle screened from

the subject illumined the distant screen and a second candle was placed back and to one side of the subject so as to illumine the two wires without casting any light on the eye to be observed. In this way the room was sufficiently lighted to allow of a control of the movable image without interfering with the experimenter's vision of the reflected lenticular images. Since the eye was stationary, the lenticular images were continuously visible to the observer from one position. In fact, this is additional proof that the subject's eyes did not rotate, for the least convergent rotation would necessitate a new position of observation. The anterior lens image behaved exactly as in normal accommodation. It moved forward toward the cornea as the subject located the movable image at near distances and moved backward when the movable image was located at the screen. In certain of the tests the subject rapidly moved the combined image back and forth between her face and the screen, calling off the direction of the movements, while the observer simultaneously noted the behavior of the lenticular image. The observer also called off the movements of the lenticular image and had the results checked by the subject. With a little practice the experimenter could easily describe the behavior of the moving image of the wires by observing the accommodatory changes.

During the previous experiments the subject's eyes were kept in the one convergent position. The same tests were now repeated for several other convergent positions, varying from that of approximate parallelism to one of near convergence. The results were uniform and decisive throughout.

2. In the following series of tests the subject was requested to hold the combined image in some one position, *e. g.*, at the distant screen, while the experimenter altered the convergence as desired by means of the screw mechanism formerly described. The experiment was successful; the combined image was kept stationary at any desired position; the accommodation remained unaltered while the convergence was varied between normal limits.

The same line of evidence as used formerly proved the existence of convergent changes. The combined image remained single unless the eyes were forced beyond their normal conver-

gent limits or unless the enforced movements were too rapid or irregular. In this case the combined image would become double, the separation at once being noticed by the subject. Objects located at the point of intersection of the visual axes were seen single, while all objects outside of the temporary horopter appeared double. The convergent movement was easily observable.

The accommodation remained unaltered, for no visual images changed in size or distinctness. Objects situated at the location of the combined image appeared clear and distinct, all others being large and confused. No pupillary changes were detected by the observer. For the phakoscopic test it is necessary to keep the eye observed stationary. This can be done by moving but one of the wires in the mechanism. No accommodatory changes were observable.

The tests were repeated for different degrees of accommodation. The combined image was located at several intervening positions between the distant screen and a point 20 cm. in front of the subject's head. Uniform results were obtained in every case; the enforced convergent changes in no way effectively influenced the depth location of the combined image.

The subject was not immediately conscious of these enforced convergent rotations. At first the subject was directed to keep the combined image continuously at the screen, but was given no knowledge as to the test to be performed. The experimenter then changed the convergence back and forth between wide limits and questioned the subject as to what had occurred. The subject had no knowledge of these eye movements and expressed surprise upon being informed as to what had been done. This ignorance was no doubt partly due to the subject's extreme concentration of attention, for thereafter she was aware of these convergent rotations, though the awareness seemed to be based upon the behavior of the images in the visual field rather than upon an immediate consciousness of the eye movements themselves, *i. e.*, upon the afferent tactual-motor sensations.

This volitional control of the depth location of visual images is not limited to the conditions of the experiment, *i. e.*, to stere-

oscopically combined images. It extends to all normal conditions of vision. In the normal perception of any object, the subject can move its image nearer or farther away at will. Again no convergent movements of the eyes occur, for the moving image of the object remains single. Neither can convergent rotations be detected by observation of the cornea nor by ophthalmoscopic observation of the retina. The same relation obtains between the moving image and the accommodation as in the experiments above. The image is always located at that position for which the eyes are accommodated. These accompanying accommodatory changes are evidenced by the same tests described above.

This volitional control of depth obtains with monocular as well as binocular vision. The monocular control is probably conditioned by the same physiological changes as already described, though the proof of the statement is somewhat difficult. For instance, the experimental procedure used with the stereoscopically combined image cannot be employed, for binocular vision is necessary to secure such an image. If one eye be closed, it is impossible to make any confident assertion as to the presence or absence of convergent rotations. Observations can be made only under normal conditions when the vision of one eye is intercepted by a screen. Even here the conditions of the test are hardly fair, since binocular unity of vision is a stimulus to the maintenance of any given convergent position. The destruction of unitary vision by the interposition of the screen allows the eye observed to rotate slightly back toward its more normal position of rest, this rotation not being necessarily due to the voluntary alterations of the accommodation. However, as far as could be observed, convergent changes played no essential rôle in the monocular control of depth. The accommodation factor was present as formerly.

In the experiment on the combined image, a slight vertical rotation of the eyes was necessary in order to move the image as desired. An upward rotation was necessary to move the image away, with a downward rotation in order to bring the image nearer. This movement was first detected by the subject by noticing a slight shift in the position of the fixation point.

The observation was confirmed by the ophthalmoscopic test. The rotation was small but was further decreased in amount by practice. The angular rotation as measured by the ophthalmoscope was but one degree. However, this vertical rotation was necessary only in the case of the combined image. It did not occur for normal conditions of voluntary control, *i. e.*, for moving the image of any object normally perceived.

It is to be noted that in the experiment the combined image was moved up to and away from the distant screen. This seems rather anomalous, for if the depth location of visual images is a function solely of accommodation it would seem that all images in the visual field — the screen as well as the combined image — should move. Hence the movement of the combined image relative to that of the screen would be impossible. All images in the field should participate in the movement to the same extent. However, it is to be noted that the conditions of the experiment demand a strong concentration of the attention upon the combined image. Now it was found that the whole visual field,— or rather that part of it subject to accurate observation,— did participate in the third dimensional movements when the attention was voluntarily dispersed as widely as possible. In other words, the movements were limited to those images well within the focus of attention. With volitional control in normal perception, on the other hand, all images in the center of the visual field participate in the movements unless the attention is voluntarily concentrated upon some particular object. In that case this object alone will move although it is hardly proper to say that the remaining images appear stationary for the subject is hardly cognizant of them in any overt way. Consequently this volitional control of depth appears to be limited to those images within the field of attention. Depth is thus a function not merely of accommodation, but of the whole psycho-physical accommodatory act in which, however, convergence plays no essential or effective part.

With fatigue this volitional control over depth is weakened, or in other words, the subject loses control over the accommodatory process. In this condition the visual field tends to recede to a great distance and is only brought back to its normal posi-

tion by a distinct effort of will. At the same time the eyes tend to converge for near distances. The same results occur in the case of rest or complete relaxation. The eyes are then lowered slightly below the primary position and are converged upon a point some three or four feet distant. All images recede toward the horizon giving the subject a far off, isolated and detached feeling. From the pupillary observations as the subject falls into this half dreamy state of relaxation it is evident that the usual relation between accommodation and depth obtains. Hence there can be no fixed natural associative relation between the processes of convergence and accommodation in the case of this subject. In fact the natural relation between these processes would seem to be one of disassociation, the two becoming united or associated only in the *act of volition*. Again, in these conditions of disassociation, depth seems to be a function of the accommodatory process.

Outside of this peculiarity the subject's eyes are perfectly normal. The subject has never worn glasses and has been entirely free from eye troubles throughout life. In fact her vision has been exceptionally good. Several oculists have stated that her eyes are free from optical defects and are models in respect to general health and soundness.

The subject gives the following introspective account of the phenomenon: "From the earliest observation of my sense performances, I noticed that during eye fatigue the visual field would retreat to a great distance,— apparently to the horizon. In this condition the eyes felt relaxed and in a resting position. When the relaxation was less complete the field of view would be less remote, but still beyond its actual distance. This relaxation was subject to voluntary control and usually the amount of attention demanded by surrounding objects determined the degree of relaxation permitted. It was possible to move the field back and forth at will, but if the attention was strongly focussed on some central object that object alone appeared to move. Under natural conditions the whole field participates in the movement. It is becoming more and more difficult to keep the visual field in its proper position during fatigue, the constant tendency being for it to retreat to the horizon. In assum-

ing the position of rest, the eyes are directed downward, the visual axes being below the primary position.

"Under the experimental conditions, a slight upward and downward movement of the eyes was found necessary in order to secure the desired control. Under ordinary perceptual conditions this never occurs. When the visual object was kept stationary by voluntary maintenance of focus while the convergence was reflexly altered, no sensation of eye movement occurred. There was present merely a feeling of strain, or of constant tension *within* the eye. When the eyes are converged and focussed upon a near object, there is always present a slight sensation of strain *within* the eyes. Upon allowing the object to retreat to a far distance, the feeling is one of relaxation,— a relief of tension within the eyes. No sensations are present in the extrinsic eye muscles."

In regard to this subject the following facts seem noteworthy:

1. No fixed nativistic connection exists between accommodation and convergence. They are related only indirectly through the process of innervation.

2. There is complete volitional control exercised over the lens independent of the convergence.

3. Depth is a function of the psycho-physical accommodatory act and is not effectively influenced by reflexly induced convergent changes.

4. The subject seems to be peculiarly non-sensitive to convergent rotations, but is extremely sensitive to accommodatory changes.

II. Afterwards a somewhat similar case was discovered. The subject, Mrs. V. H., wife of a prominent surgeon of Chicago, is astigmatic and has experienced much trouble in securing accurately fitting glasses. This has resulted from the impossibility of completely paralyzing the lenticular muscles by atropine. A well known oculist of Chicago continued the treatment until compelled to stop for fear of causing a permanent injury, yet spasmodic twitchings were present sufficiently to prevent any accurate diagnosis. The subject's eyes are extremely susceptible to fatigue and in this condition all objects

appear far off and distant, it being extremely difficult to bring them back to their proper positions. The same is true of rest or relaxation. All visual objects at once recede to distant positions, but can be pulled back by an effort of will. The subject has found it almost impossible to estimate distances accurately because the apparent distances of objects vary markedly from time to time. The resulting conflict of judgments as to the same distance first brought this peculiarity to the subject's notice. No inconvenience has resulted in familiar surroundings because the varying visual distances are ignored in favor of the actual knowledge of the particular situation as reflectively derived from past experiences. However, with relatively strange surroundings she has learned to place no reliance whatsoever upon estimations of unknown distances. For instance, the subject related that she is a golf enthusiast but has always remained an extremely poor player on account of this visual trouble. When approaching a green on unknown grounds where the strength and kind of a stroke must depend upon the actual distance of the green, often to her amazement the ball would be sent flying far beyond, or occasionally it would fall far short of its intended destination. The fault lay not in a misjudgment as to the proper stroke adapted to any given distance, but rather in a *visual* misjudgment of the distance. On familiar grounds the same trouble occurred except when certain fixed objects were present whose space relations had become known from former experiences. Even here no high degree of accuracy could be obtained. The case is somewhat similar to the distance illusions in high altitudes. A mountain appears but a mile distant, yet a five-mile tramp is found necessary to reach it. In this case, however, all distances appear shortened, but in a certain definite ratio, and consequently after a short time the novice learns to make a definite allowance for the illusion. In other words, the illusion is constant in character and a new set of motor interpretations of visual distances is acquired. With the present subject the illusion is variable. The magnification or decrease of actual distances varies from day to day and hence from a few experiences one cannot derive any fixed system of motor interpretation of apparent, or visual, distances that will apply

accurately to novel situations. Adaptive evaluations of apparent distances cannot be successfully universalized. Every specific distance between two objects must be learned mainly by itself. The situation is so novel and foreign to the ordinary experience that one finds it rather difficult even to imagine, to say nothing of finding words adequately to describe, the phenomenon.

Circumstances did not permit any detailed tests upon the accompanying physiological changes. The subject declared that the fixated object never became doubled when its image retreated or approached. Tests demonstrated that she readily detected double images when present. A close observation of her eyes convinced the writer that no convergent movements occurred during the movements of the visual field. As to accommodatory changes the size of the pupil varied as in the case of the first subject. The distinctness and clearness of the movable images also varied, thus indicating lenticular disturbances. On the basis of the similarity between the two cases, the evidence seems sufficient to warrant the conclusions that this subject also possessed a volitional control over accommodation irrespective of the convergence and that depth is a function of the psychophysical process of accommodation and is not effectively influenced by convergent changes.

In a way it is hardly proper to speak of this second case as one of voluntary control of depth; it is rather to be described as a lack of perfect control. Depth is subject to volition but the control is difficult, erratic and inaccurate.

III. These two cases have a significant bearing upon two questions: (1) the mutual relation of the two physiological processes of convergence and accommodation from the standpoint of their volitional manipulation; (2) their relative influence upon judgments of depth. Their bearing upon both questions can best be interpreted in the light of other similar results.

1. The mere fact of the disassociation of the two processes is not new. The following statements in regard to the phenomenon are probably rather generally admitted: In normal perceptual conditions a relatively strict association of the two functions obtains. The two processes *can* be disassociated to some degree, at least with most people. The degree of the disasso-

ciation and the facility of its attainment vary markedly among individuals and probably with practice. For instance Hyslop[1] and the two subjects described in this paper represent the extreme as to disassociative ability. Most people can obtain but a limited degree of disassociation, and that only with difficulty.

Now there are at least two methods of obtaining disassociation, that typified by Hyslop and that represented by the two subjects of this paper. Hyslop has written rather fully of his case which is characterized by a very unusual control of convergence. He voluntarily converges in front of or behind a double figure combining the similar images, but the lens fails to follow this convergent change and remains accommodated for the actual position of the object in question. This method is the exact opposite of the second type. In both cases the volition is directed away from the object. In the first type the convergence responds to the volitional innervation while the lens remains unaltered; in the second type it is the lens which moves in conformity to the will while it is the convergence which remains adapted to the position of the object. In normal distance adjustments the two processes would alter in consonance for both cases.

This process of disassociation may be conceived of in either of two ways: (1) there is a normal associative force or relation — whatever its nature may be — between accommodation and convergence, which is volitionally destroyed for the time being, leaving one of the processes free from any stimulating influences; (2) the process which remains unaltered during the disassociation is under the influence of two antagonistic forces, the normal associative relation and some objective stimulus from the object.

The latter conception is supported by several lines of evidence. In the first, or normal, type of dissociation, the lens at first alters in consonance with the convergence with most people and after some time gradually becomes re-accommodated for the position of the object. According to the first conception no re-accommodation should occur. With Miss Allen, the con-

[1] Hyslop, 'Experiments in Space Perception,' PSYCH. REVIEW, I., 257–273, 581–601.

vergence changes as the relation of the object — the two parallel wires — is altered in respect to the eyes. The normal connection does not exist during fatigue nor relaxation.

This tendency to respond to the object is a volitional-reflexive one. It cannot be purely reflexive, for the response is not to *any* object in the visual field, but only to that object whose image occupies the focus of attention. On the other hand, it cannot be purely voluntary, for in the experiment the distance apart of the two wires was changed and the subject was at first entirely unconscious of the induced convergent changes. Given attention to a combined or nearly combined image, the convergence is reflexly altered so as to maintain or secure respectively binocular unity of vision. Given attention to a confused image, the lens is reflexly stimulated so as to secure clear and distinct vision. The response is thus reflexive in nature, but operates under volitionally imposed conditions; it is only indirectly subject to volition.

Since this process, which remains unaltered in disassociation, is subject to two antagonistic forces, the results — the degree of disassociation and the ease and rapidity of its attainment — must depend upon the relative strength of these forces in any particular situation. Since the results vary markedly with individuals and to some extent with practice, it follows that the relative strength of the two forces is a wide variant. The responsive tendency to the objective stimulus is basically reflexive and it is of the nature of these nativistic reflexive tendencies to be racially uniform. Consequently it must be the strength of the normal associative tendency which varies among individuals and with practice. In fact, this assumption is supported by another line of evidence.

This normal associative relation between convergence and accommodation may be conceived of in either of two ways: (1) It may be nativistically functional in nature. One process may be volitionally controlled while the second process has a reflex relation to the first. That is, the actual movement due to volition is the physiological stimulus to the second process, as in the case of a chain of reflexes. This supposition would demand two totally different sets of anatomical conditions to

explain the two types of disassociation, but anatomy is hardly supposed to be subject to such marked individual variations. Again the two processes are disassociated with Miss Allen in the condition of rest or relaxation. Here the association obtains only under the conditions of innervation. The associative tendency cannot be a natural nativistic one. The two processes are related not directly but only indirectly by means of their common relation to innervation. (2) The second hypothesis conceives the two factors as connected only in the process of innervation, and in such a way that individual variations may arise during the development of volitional control. Two possibilities are again open: (*a*) The two processes were originally distinct and separate volitional acts, which in time were combined, or coördinated into one act, as is the case with many of our complicated habits. The method of development is one of synthesis. The connection is thus not nativistic, but acquired and subject to individual variation. (*b*) The second possibility differs from the first in the fact that the growth of motor control proceeds by analysis and differentiation rather than by synthesis and integration. As an illustration, a baby attempts a definite movement of its big toe, but as a result the other toes and the foot as a whole receive a definite innervation. In time this vague whole may be differentiated into separate volitional acts, or into certain coördinations wherein the parts bear certain mutual relations to each other. In other words, individual variations may arise during the development of motor control.

From the standpoint of this paper it makes no difference which of these possibilities we assume to be true in the case of accommodation. Nor have any facts been developed which definitely point to either conclusion. However, we know that in general it is those movements whose anatomical conditions of innervation are widely distinct and separate, which are synthetically combined while those members closely related anatomically, *e. g.*, the toes of one foot, are originally united in volition and become differentiated in the development of volitional control. This general principle would support the second hypothesis as to the relation of convergence and accommodation.

According to both conceptions, however, it is possible that

either convergence or accommodation might play the dominant rôle in volitionally controlling the coördination. In a coördination of two factors, '*a*' and '*b*,' it might be possible to innervate '*a*' separately, while on the other hand the innervation of '*b*' would always involve that of '*a*.' For instance, most people can move the big toe without innervating the little toe any great amount, while the movement of the latter generally involves a strong innervation of the former. Thus we could have two extreme types of volitional control in one of which convergence would possess the maximum of strength or importance, while the accommodation would play the dominant rôle in the other. In disassociation, the dominant process would be subject to volition, while the subordinate, or weakly innervated, factor would come under the influence of the antagonistic tendency to respond to the objective stimulus. The strength of the normal connection between the two processes would depend upon the relative strength of their innervation, an individual variant and subject to practice and development. Hence the theory would account for the facts of disassociation, — the two methods of obtaining it, the varying degrees of disassociative ability, and the probable effects of practice. One point to be noted in this theory is that the two types of disassociation also mean two types of voluntary control over distance adjustments; convergence has the maximum of functional importance in one case, and accommodation in the other. Moreover, the theory will allow of other degrees of relative importance intervening between these two extremes.

It is idle to speculate on all the possible causes determining the development of these types, for they are too numerous. One deserves to be mentioned, however. The afferent stimulating results of each process might differ with individuals. One person might be very sensitive to convergent changes and relatively insensitive to changes in the accommodatory mechanism. This greater afferent stimulus might react so as to emphasize the corresponding innervating factor. Whether this conception is probable or not we do not pretend to say. However, it is to be noted that most people are the more sensitive to convergent changes and belong to the type of voluntary control

represented by Hyslop. On the other hand, Miss Allen is extremely sensitive to accommodatory changes and relatively insensitive to convergent movements, while accommodation possesses the maximum of volitional importance in her case.

2. The second main question deals with the relative influence of accommodation and convergence upon depth. In Hyslop's case of disassociation the distance of the combined image depended upon the convergence, the image always being located at the point of intersection of the visual axes. This result is the exact opposite of that obtained from the two subjects of this paper. However, the results agree in one respect, — depth is a function of that process possessing the most volitional importance and is not effectively influenced by the second, or volitionally subordinate process. This statement does not necessarily mean that the less important process in no way *conditions* depth, for it is entirely possible that a process may be one of the necessary conditioning factors of a result and yet in certain situations its independent variation may cause no appreciable change in that result. Especially is this true of methods of isolation.

This general problem has been a very prominent one in experimental psychology. Knowing that depth is a function of the convergent-accommodatory act, many experimenters[1] have attempted to evaluate the relative importance of each factor by some method of isolation. It is not our purpose to discuss and criticize these papers. We merely wish to point out the fact that their results do not altogether agree.

Since the tacit assumption seems frequently to have been made that some definite and normal relationship must exist applicable to all methods of procedure and to all individuals, these diverse results have led to an almost hopeless contro-

[1] Arrer, 'Ueber die Bedeutung der Convergenz- und Accommodations-bewegungen für die Tiefenwahrnehmung,' *Phil. Studien.*, XIII., 116–161, 222–304. Baird, 'Influence of Accommodation and Convergence upon the Perception of Depth,' *Amer. Jour. Psychol.*, XIV., 150–200 (admirable résumé of important literature). Dixon, 'On the Relation of Accommodation and Convergence to our Sense of Depth,' *Mind*, N. S., IV., 195–212. Hillebrand, 'Das Verhältnis von Accomodation und Konvergenz zur Tiefenlokalisation,' *Zeitsch. für Psych.*, VII., 97–151. Also on the same subject, *ibid.*, XVI., 71–151. Wundt, 'Zur Theorie der visuellen Raumwahrnehmung,' *Phil. Stud.*, XIV., 1–118. Rivers, 'The Apparent Size of Objects,' *Mind*, N. S., V., 71–80. Discusses reactions caused by drugs affecting the accommodatory mechanism.

versy. The conflict is a result of the assumption. Now this assumption can be defended upon no *a priori* grounds. It is based merely upon our normal desire for, and habitual expectancy of, uniformity. May the truth not be, as the results indicate, that the relative efficiency of the two processes in determining depth is an individual variant and hence no uniform results are to be expected? The problem may belong to the domain of individual and not general psychology.[1] Since there are no valid reasons for not doing so, let us for the time being accept these diverse results at their face value.

3. Then we should have the following facts: With two subjects depth is a function of accommodation; in another case depth depends upon the convergence and in another set of cases, the relative efficiency of the two factors varies among individuals. There results can be summarized in the general proposition that the relative influence of accommodation and convergence upon the sense of depth is a wide individual variant, possibly representing all the intervening stages between the two extremes.

In regard to the first problem as to the relative volitional importance of each process in distance adjustments we have a similar proposition: The relative volitional importance of the two processes, or the relative strength of their innervation, varies among individuals between the two extremes.

Not only are the two propositions similar, but we find between the two series a point of connection for the extremes. In those cases depth is a function of that process possessing the greater volitional importance. If we infer that what is true for the extremes is true for the intervening cases, we have the general theory that depth is a function of each process in proportion to its volitional importance, or in proportion to the strength of its innervating impulse in any particular situation.

This position finds some support from another set of facts. In a recent article [1] one of the writers maintained the thesis that depth is a function of the innervating impulse leading to the convergent-accommodatory act. It was denied that the con-

[1] Cf. Hyslop, 'Psychic Synthesis in Vision,' *Mind*, XIII., pp. 499-526; 'Some Facts of Binocular Vision,' *Mind*, XIV., 393-401. Baird, *loc. cit.*

ception shed any light upon, or involved in any way, the problem of the mutual relative importance of the two associated processes. This reservation was explicitly made in consideration of the experimental results developed in the present paper. The point to be noted here is the general agreement of that theory developed from an entirely diverse set of facts with the present conception, *viz.*, the dependence of depth in some way upon the innervating, or volitional aspect, of distance adjustments.[2] If depth be a function of the impulse innervating the whole adaptive mechanism, it is by no means an illogical inference to suppose that the innervating elements exercise a relative functional efficiency upon depth in proportion to their relative strength, — the theory advanced in this paper.

According to this conception of the normal associative relation between the two processes, it would follow that their relative influence upon depth would vary not only among individuals but also in the same person during the development of ocular control, with practice, and possibly according to the experimental procedure. The theory not only has a basis in fact but possesses a functional importance for a further study of this intricate question from a genetic standpoint.[3]

[1] Carr, 'A Visual Illusion of Motion During Eye Closure,' PSYCH. REVIEW — MONOGRAPH SUPPLEMENT, 1906.

[2] *Cf.* for a recent statement of certain facts bearing on the motor-sensation theories of space perception, Judd, PSYCH. REVIEW, IV., 374–389.

[3] Just as the above article was going to press, the writer received a note from Professor S. S. Colvin, of the University of Illinois, regarding a case which has come under his observation. A friend of his was once afflicted with cataract in both eyes, and during this period experienced from time to time the phenomenon of objects receding to a great distance. Since the performance of an operation, this visual peculiarity has entirely disappeared. With the information given, the case is subject to various interpretations, but it is certainly suggestive from the standpoint of this article. Through the courtesy of Professor Colvin, more definite and detailed information is expected. Since the completion of the MS. several new cases have come to the writer's knowledge, presenting some new details though supporting the main contention of the article. Some facts indicate that possibly the phenomenon is of more frequent occurrence during youth and often disappears with maturity. If this be true, the subject possesses interest for further observations from the genetic standpoint.

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ILLUSIONS OF REVERSIBLE PERSPECTIVE.

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This is a sketch of a work concerning the optical inversion that is observable in geometric figures and perspective designs. The special characteristic of these figures is that they call into consciousness two or more different interpretations. Thus for instance, if one fixes the point of intersection of two straight lines of a hexahedron he perceives it with one of its surfaces either inclined downward or lifted up, by a corresponding change of the position of the axis.

The illusory phenomena observed in a great many such figures have been explained by three different kinds of theories, namely by psychological, physiological, and psycho-physical theories.

I. Psychological explanations of the phenomenon are mostly generalizing conceptions, according to which inversion is a product of will, imagination, false judgment, or attention. Weadstone,[1] for instance, in his critique of the physiological theory of Necker, maintains that inversion is an effect of intuition. Hering,[2] in his 'Physiological Optics' says that the question of what kind of inversion will appear is largely a matter of chance or volition. Helmholtz asserts the same thing. He says that the perception of perspective figures has its cause in imagination and especially in the images of memory.[3] If I imagine vividly one or the other form of the figure its apparition is imminent. Or "we can also produce intentionally a change of inversion, if we recall vividly the image of its contrary form. When its resemblance to that of the figure looked at is established, then the perspective remains stationary without effort." Helmholtz

[1] *Poggendorfs Annalen*, I., 51.
[2] Hermann, *Handbuch der Physiologie*, 580.
[3] *Physiologische Optik*, 771–777.

insists that: "Glancing at a figure we observe spontaneously one or the other form of perspective and usually the one that is associated in our memory with the greatest number of images." But Helmholtz and Hering have called our attention to many physiological details characterizing inversion. Hering for instance notes that changes of light and shade necessarily tend to produce such illusion, and he mentions the acceleration of changes by practice. Helmholtz notes the influence of passiveness of the eye in the production of inversion.

II. Two different tendencies are to be noticed in physiological theories: the first regards perspective figures as produced by changes of accommodation, the other regards them as produced strictly by movement of the eye. Necker[1] after having denied that inversion could be an effect of will or accident selected accommodation as its principal cause.

By this he understands the relation existing between different points of the observed object and the central and peripheral parts of the retina. The part of the figure that is perceived with the fovea is estimated as nearer to the eye, the point observed by the peripheral parts of the retina as more remote.

Plausible as this theory appears, it does not take into account one of the principal phenomena of inversion, the absence of this illusion in certain cases of binocular and monocular vision. Secondly, Necker's theory is not to be considered as an explanation of the phenomena of accommodation, for we know that the same relations between the observed object and the special parts of the retina exist quite apart from accommodation.

Many years afterwards Loeb explained inversion by the same theory of accommodation, but he used it in its real significance, namely as innervation of the eye. His theory touches unquestionably one of the most important conditions of inversion, but it does not explain all the associated phenomena. For instance Loeb says that we obtain the impression of concavity in a perspective figure if the innervation removes the point of fixation, or that we have the impression of convexity by bringing the eye nearer to the figure. An easy experiment shows

[1] *Annal. der Physik u. Chemie.*

[2] *Pfluegers Archiv*, 1886, 411, 274.

however that once we perceive a durable inversion we can change the accommodation successively and the image of inversion stands still. It is often necessary to open the second eye in order to escape the persistent illusion.

The most recent of physiological theories is that of W. Wundt recorded in his work on geometric-optical illusions. Inversion according to Wundt[1] is caused by determined movement, consequently by change of points and lines of fixation. Wundt says: "The image of the retina ought to have a determined position if a perspective illusion is to appear; but the form of this illusion is entirely dependent on motion and direction of vision." Wundt indicates exactly what points and what lines ought to be fixed in order to obtain a concave or a convex form of inversion. Attentive observation proves, however, that if these movements can actually facilitate inversion they are not absolutely necessary to its appearance. It escapes the attention of Wundt that we can observe different forms of inversion as well if we fix only one and the same point or the same line of the figure.

We have yet to mention the experiments of Professor Mach,[2] of Vienna, which were applied chiefly to solid objects. They constitute the largest contribution yet made to our knowledge of the sum of the phenomena of inversion. Thus he observes the inversion produced by change of intensity in light and shade, or by different inclinations of the object, and he describes the phenomena of movement which accompany inversion. But Mach having described all the sedetails does not explain the cause producing them.

III. As for the special psycho-physical theories, which make use of the known facts in the functioning of the nervous system, they are mostly connected with more or less ingenious psychological hypotheses that have contributed little to the solution of the question. Such is for instance the theory of N. Lange, which explains inversion with the help of attention and of apperception. Lange[3] has otherwise the merit of first trying to measure the rapidity with which the inversion occurs.

[1] *Die geometrisch-optischen Täuschungen.*

[2] *Beiträge zur Analyse der Empfindungen*, 86, and *Wiener Sitzungsberichte Math.-naturwiss. Classe*, 54.

[3] *Phil. Stud.*, Band IV., 405, 1887.

Because of the lack of a definite solution of the problem of inversion, a series of new experiments seemed necessary.

1. The first object of these experiments was to ascertain the degree of rapidity with which we perceive inversion in plane figures. Internal observation has already permitted us to suppose this rapidity greater than the rate of respiration, but slower than that of the pulse. Consequently the investigation was made in such a way as to observe the relation between the rapidity of inversion and the frequency of the pulse.

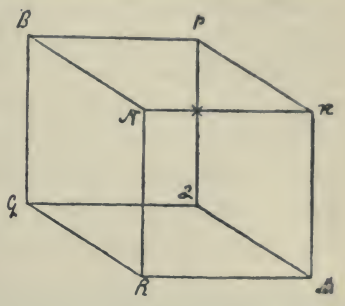

FIG. 1.

The result that was obtained by the graphic method, while the experimenter regarded intensely a plane figure (Fig. 1 made of copper wire), proved on the one hand that synchronism between

TABLE I. (Observer A).

	Pulse.	Inversion.		Pulse.	Inversion.		Pulse.	Inversion.		Pulse.	Inversion.
30/X	21	14		7	5	4/XI	10	10	12/XI	16	20
	39	27		37	23		51	52		17	21
	8	6		17	13		28	27		21	26
	17	12		29	20		31	30		36	47
	9	8	4/XI	47	46	9/XI	9	10			
	38	28		35	33		38	39			
	9	6		58	65		17	18			
	7	5		15	16		15	14			
	17	12		23	21		56	60			
	9	6		40	38		42	47			
2/XI	7	5		12	12		16	18			
	37	23		20	29		30	40			

TABLE II. (Observer B).

	Pulse.	Inversion.		Pulse.	Inversion.	Pulse.	Inversion.		Pulse.	Inversion.
30/X	7	7	10/XI	10	10	8	8		5	5
	4	4		10	10	5	5		10	10
	5	5		6	6	17	17		15	14
	7	7		4	4	8	8		4	4
	8	8		17	8	5	5		3	3
	10	10		5	3	8	8	20/XI	45	46
	9	9		18	10	4	4		28	28
	8	8		5	3	3	3		17	13
	9	9		10	7	5	5		7	7
	7	7		12	12	6	6		38	28

the two does not exist, the rapidity of inversion being often inferior or superior to the rapidity of the pulse. It confirmed, on the other hand, what was already proved by internal observation, that these two rates of rapidity are very nearly the same.

In one person 124 inversions occurred in 174 pulsations; in another 260 inversions in 265 pulsations, and 313 inversions in 362 pulsations.

2. The fact that all persons engaged in these experiments declared positively that they had the feeling of an inward movement of the eye, even during an intense fixation of the indicated point of the figure, led to a question of a different kind, namely, what sort of movement it could be. With the help of an

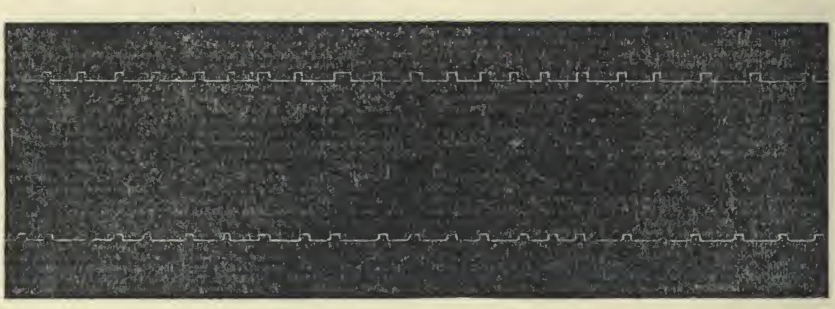

FIG. 2.

ophthalmometer the eye of a myopic person (7 dyoptrics) was observed. The observations of light images of the external lens proved that every inversion produced in a plane figure is accompanied by a change of refraction. These changes are so distinct that it was not difficult at all to mark them graphically, when the observed person marked at the same time the changes of inversion, having fixed monocularly the hexahedron made of copper wire (Fig. 2). Of 543 double reactions obtained in this way, 343 were simultaneous notations of the changes of luminous images observed by the experimenter in the ophthalmometer and the notations of inversions by the observer of the hexahedron. In 132 cases this synchronism was dubious; in 68 the reaction failed completely, a fact which is explained by a decrease of attention on the part of the experimenter, or by a disturbing movement of the strongly lighted eye of the observed

person. No series of these experiments lasted longer than a minute. These numbers proved distinctly the fact that the inversion of the plane figures can not be realized without a notable change of refraction.

3. But while the two preceding series of experiments were conducted on plane figures, it was necessary to complete them with experiments made on figures of three dimensions. To this end were prepared many figures of copper wire and many solid objects of small size.

But few trials were needed to show that the inversion appears as well in the case of solid objects as in that of plane figures. Almost any object can be used to illustrate the inversion ; for instance, a chair, a round or oval table, a lampshade, an umbrella — anything.

During these observations four main phenomena have been found to be characteristic of the inversions : (*a*) changes in the intensity of light, in tone of color, and in the form of the observed object, (*b*) the duration of the illusory image, (*c*) the illusory movement, (*d*) the inclination of the illusory image. But before we enter into the description of special phenomena of inversion a few words should be said concerning the difference of character between the inversion of plane figures and that of solid. Likewise something should be said about the difference in physiological conditions that go to produce inversions.

The difference between the plane and the solid figures consists in the fact that the first gives the sensation of two or more illusory forms, while the other presents but one. For instance : if we gaze intensely at the point of section of two lines of Necker's hexahedron, this plane figure appears immediately in three dimensions, one of its surfaces being inclined downward. This is the first illusory form. If we continue to fixate the same point of the figure, we perceive that this first illusory form has been transformed in such a way that we now see the same hexahedron lifted up. This is the second illusory form. Thus this inversion consists : (1) Of a passage of the normal sensation of a plane figure to the sensation of the first illusory form, (2) of the passage of the first to the second illusory form. But if instead of a perspective design we used a figure of three dimen-

sions (of copper wire), then, having fixed the same point, we obtain only one form of illusion. Namely, if we observe an inclined surface of the figure we perceive the illusion as lifted up. If on the contrary we observe one that is elevated we have the illusion of an inclined figure. In both cases the illusion presents to the eye the passage of a real into an illusory sensation.

In the consideration of this difference of character in the two inversions we will distinguish, in what will follow, the inversion with one illusory form from the inversion with two such forms. The inversion which consists in the passage of a normal sensation to an illusory sensation will be called real-illusory inversion; the inversion which is the passage of one to the second illusory form will be called the pure-illusory inversion. This distinction is very important, because the physiological conditions necessary to produce both are not quite the same. To obtain a real-illusory form of inversion in any object or figure, cited above, it is sufficient to fix intensively and binocularly one point of the figure and presently to cover one eye with the hand in such a way that the eye remains in the greatest possible tranquillity. The inversion will not fail to appear in these conditions, and the degree of the passivity of the eye will decide the rapidity with which the inversion occurs. This effect can still further be facilitated by inhibition of all efforts to perceive the real dimensions of the object. The case is not the same in the inversion with double illusory form in plane figures. When the gaze is fixed in the same way they show the inversion marked by transition from a real to an illusory sensation, but they do not produce the passage of one to the other purely illusory inversion, unless there is either a movement of the ocular globe (Wundt's method) or a change of accommodation (Necker and Loeb) confirmed by the ophthalmometric observations of this essay. But by following either of these methods we can easily evoke both the forms of inversion above mentioned.

We now return to the description of the four kinds of phenomena, mentioned above, that characterize inversion.

(*a*) In the first place we have to do with the changes in the intensity of light, the shade of color, and the form of the observed object. All these details can easily be followed by using

a visiting card in the same way as it was used by Mach. If this card, being first bent in the middle, is fixated monocularly at a point of its concave surface, we perceive it immediately as an illusory convex card. The illuminated part of the figure is now much more brilliant, the shadow deeper than it was in the moment preceding the inversion, or, strictly speaking, in the moment preceding the closing of the eye.

The shadowed part changes at the same time in color, passing through various tones, from gray or brown to yellowish-green. This is especially noticeable if we change the position of the head without altering the point of fixation. Given the same conditions the form of the card is modified again.

(*b*) The real-illusory image acquires a certain duration, difficult to maintain in the plane figure, but very easy in the figure of three dimensions. So for instance the inversion of a concave cone, made of copper wire, does not disappear when observed monocularly, even or when the observer retires and re-approaches a distance of a few meters; or when the point of fixation is changed, or when the observer lays down or takes up his glasses, or even when the observer closes the eye for 2–5 seconds. As soon as the eye is opened the inversion reappears again.

(3) Illusory movement is the third characteristic phenomenon of inversion. It can be observed in both the plane and the solid figure. If an illusory image attains a certain duration in the consciousness, nothing is easier than to put it in an illusory motion. This result can be obtained by quietly changing the position of the head in any direction. The retinal image then changes exactly as it would change if the observed object were in movement. If we observe for instance the illusory image of a concave cone while the gaze is fixed on the central point of the figure, the illusory image will be like that in (*a*) Fig. 3. As soon however as the position of the head is directed to right or left, upward or downward, the image will appear in quite other perspective, such as (*b*) and (*c*).

Supposing now this movement is very slow and progressive. Then the sensation given by one point of view will join with that given by another point of view, etc.; we perceive the ob-

ject in a synthesis of successive phases, consequently in what seems continuous movement. But if the illusion is to be perfect, it is necessary to change the angle of vision carefully and

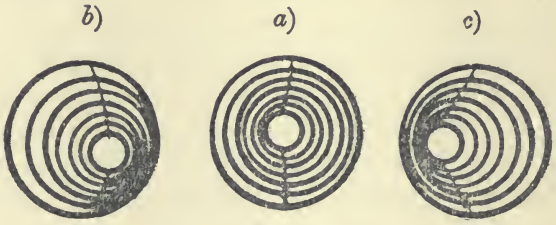

FIG. 3.

systematically, the gaze being strictly vis-à-vis to the observed figure. That is to say, the line that joins the fovea with the fixed point of the object must be the radius of a circle in which the head moves. The ciliary muscles should be entirely passive. (In order to facilitate this circular movement, a circle was made on the floor with chalk around the table which sustained the figure.) Under these conditions all the perspective phases of the illusory image display themselves freely, from the first front view to the extreme right or left view, where the illusory image attains the maximum of abbreviation, before it disappears completely. This passage from the maximum abbreviation of the image to complete disappearance is very characteristic, because once coming to this maximal point our attention finds itself in a moment of doubt, whether the observed image is an illusion or a reality. But having advanced a little in the same circular direction we are reassured on this point. We then feel a kind of start in the eye produced by the disappearance of inversion and particularly of the illusory movement and the apparition of the real object remaining in the same place as before.

(*c*) The illusory movement in the plane figures (of copper wire) can easily be observed if one acquires a certain facility in preserving a durable inversion. So, for instance (Fig. 4), if the observer places himself at point (*a*) (nearly 60° from the line b–b_1) of the circular line that surrounds the Necker's plane figure of copper wire, he has to fix monocularly the point marked

with a small cross and then to cover the second eye with the hand. He will obtain immediately the illusory image, namely, the illusion of a lifted hexahedron.

Having succeeded in making this illusion durable we have to follow very slowly and quietly the circular way from *a* to b_1. The image of inversion passes during this time through a series of perspective phases, but, strange to say, these changes do not develop themselves in the same way throughout the arc.

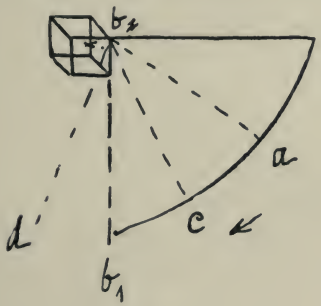

FIG. 4.

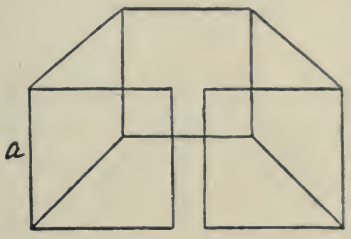

FIG. 5.

From *a* to *c* we observe the well-known changes of perspective phases, but from *c* to b_1 the perspective phases disappear at once and we are startled with an image of the entire plane figure that displays a movement of rotation around its axis, which axis is formed by one of the lateral sides produced. Now the entire figure moves like a door on its hinge. This movement propagates itself without interruption if we continue the movement of the head forward and downward between *c* and *b*. During these observations the figure appears continually as displaced, and this displacement is determined by the point held by the eye. If the eye is for instance in the point *c* 30° from the line b–b_1 the figure takes the direction of d–b_1 and so forth.

We can perceive the same illusion in many other figures, such as Fig. 5 (which must be fixated in the middle point of a lateral line, as *a*).

(*d*) There remains now the description of a most important phenomenon of inversion, namely, the inclination of the illusory image. This inclination is again in direct connection with

the position of the eye in reference to the observed object. If one fixates binocularly and intensely a bent visiting card in its central point for instance, in such a way that the line joining the fixed point of the object with the fovea forms a horizontal radius of a circle, he obtains after having covered the second eye with the hand an illusory superficial image which is nearly plane and without any inclination. We mark this point of departure in the movement of the head by the letter x (Fig. 6). Immediately if the eye is moved one degree up or down from the horizontal line, the same point being fixed, we obtain an illusory image of a slight inclination. These two points are marked on the figure with the letters m–m. If we continue now to move the head in the same circular direction from downward to upward, we come successively to the point r, r_1, r_2 of the circumference. At the same time the card changes its inclination in direct relation to the displacement of the eye. That means that to the movement of the head a, a_1, a_2, corresponds the inclination of the card in r, r_1, r_2. Once arrived to the point x_1 all illusion disappears. It attains its maximum at the point m_1. The eye traverses in this way 90° from the outset of its displacement (x) until it attains the point x_1; the card in the same time performs a movement of 180° around its horizontal axis. Beginning from the point m with a minimal inclination the card sinks more and more backwards, until all its points between e and b fall upon a horizontal line. The eye in this length of time traverses 45°, the card 90°. Then the card rises with the point e until it assumes an upright position at b. Meanwhile the eye again traverses 45°, while the card has completed the 180°. But if before reaching the point x_1 we arrest the eye at the point of the maximum of inclination in the card m_1, we can now proceed in the opposite direction, and the illusory image will pass successively again through all the phases of inclination r, r_1, r_2, and come to the point x, at which the illusory image is nearly plane.

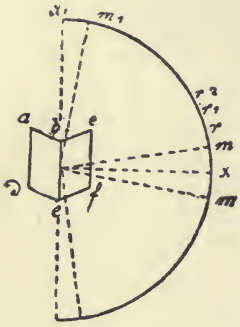

FIG. 6.

Similar changes of inclination can be made to appear by

changing the point of vision in the right or the left direction. These phenomena may be corroborated by observing a concave card instead of a convex one. Here as in the preceding case are to be noticed: (1) The point at which the inversion is nearly plane and that at which it disappears completely (x, x_1); (2) The points of maximum and minimum inclination r, r_1, r_2.

These relations will be the same if instead of moving the head upon a circular line, we observe the object during its rotation around a horizontal axis. The direction however of the movement of the card will be changed: if we move it downward we see rotation in the opposite direction.

These experiments prove that the relation between the movement of the head and the inclinations of the illusory image is a fixed relation. The inclination of the illusory image is a function of the angle at which the eye observes the object.

Summarizing the results obtained from these experiments, we observe:

1. That the maximum of rapidity of inversion is nearly the same as the frequency of the pulse, though the relation is not functional.

2. Inversion in plane figures does not appear without a change of refraction.

3. We have to distinguish real-illusory inversion, and a pure-illusory inversion which involves different physiological conditions.

4. Inversion appears in plane as well as in solid figures, and is accompanied by four distinct phenomena: (*a*) changes in the intensity of light, in the tone of color and in the form of the observed object; (*b*) duration in the illusory image; (*c*) movement of the illusory image; (*d*) inclination, which is a function of the angle at which the eye observes the object. These observations as well as the corresponding experiments permit us to explain the phenomena of inversion in the following way.

It is certain that the cause of inversion consists in the relation between the observed object and the central and peripheral parts of the retina in which the image of the object produces itself. The points that fall upon the fovea are estimated more distinctly and consequently as nearer to the eye; those on the

contrary that fall upon the peripheral parts, being less distinct, are considered as more remote.

These relations however are not sufficient to explain all the phenomena of inversion (its absence, for instance, in many cases of binocular or monocular vision) unless we take account of a certain irregularity of the vision when this illusion occurs.

The perception of an exterior object in its three dimensions can generally be the effect of binocular or monocular vision. In the binocular vision, as we know, the image of the retina, of the left eye for instance, is completed and controlled by the image of the right retina. Accordingly the coöperation of these two images, and at the same time the influence of accommodation and especially of convergence produce a normal representation of an object in space.

It is the same in monocular vision. We get no impression of the depth of an object with only one image of the retina, but only by two or more successive images of the same retina that complete and control each other. The representation of the object therefore is a result of two retinal images produced by the rays of light coming from two opposite directions.

It is quite different in the case of the illusion that we speak of. If we fix the object after closing one eye and by trying to immobilize it as much as possible, we suppress at the same time the control necessary to perceive the dimensions of the object. Closing one eye, we suppress the simultaneous image of the second retina; making the eye immobile during the monocular vision, we eliminate the successive image of the same retina. In this case therefore the part of the object that falls upon the central parts of the retina or upon its peripheral part are not completed and controlled by the simultaneous or successive images of it, the principal condition of a normal sensation. This stop of a regular progress of the visual function, suppressing the mutual compensation of images, is the principal cause of inversion.

It is clear now that a certain position of the eye is sufficient to produce one illusory form, the necessary correspondence between the parts of object and of the retina being given. But if we wish to pass from one to the other illusory form, it is

necessary that the point of the object falling in the first case upon the central part of the retina should fall in the second upon the peripheral part and vice-versa. And this can not appear without the help of movement of the ocular globe or of changes of accommodation. For this reason it is sufficient to close the eye and to immobilize it to perceive the real-illusory inversion, but it is necessary to change the accommodation or the position of the eye if one attempts to pass from one to another illusory form. But it is absolutely indifferent to the eye what means are chosen for producing inversion of a double form. It may be a change of accommodation, such as Necker and Loeb employed, or such reflex changes as were the case in our ophthalmometrical experiments, or the movement of the ocular globe used by Wundt. This is of no importance: any proceeding is acceptable which facilitates the passage of the rays from an object once on the central part to another on the peripheral part of the retina. It is indifferent to the eye again that this change is produced in a passive way, changing the relation between the object and the eye, or in an active way, by placing the eye in a necessary condition.

Three capital facts make for this theory: (1) The inversion appears even when the ciliary muscle is immobilized with atropin (experiment made by Loeb). (2) The inversion can be summoned binocularly every time that the eyes are in the condition to observe simultaneously two images. (This experiment was made by observing a remote point of a small chair made of copper wire. Two chairs were seen together with an inverted image.) (3) The duration of the illusory image that persisted notwithstanding the changes of accommodation or movement of the ocular globe.

Finally, this theory explains all the phenomena characteristic of inversion. (*a*) The rapidity of inversion that was graphically measured was, as is now easily shown, a measure of the passage from one to the other illusory form. And because this passage does not appear except through a movement of the eye or of a change of accommodation this rapidity consequently is proportional to the rapidity of these movements or to this change of accommodation. In reference to inversion in figures of three

dimensions the rapidity ceases to be characteristic, because the illusory image in this case can attain any duration.

(*b*) Again the duration of the image can be explained without difficulty. Because the inversion of an illusory form consists in a kind of stopping of the normal function of the eye, there is no reason why it should not persist as long as this irregularity lasts. In accordance with this, if one closes one eye to call up an inversion in a plane figure and endeavors to stop the movement of the eye necessary to evoke the passage of one to another illusory form, he obtains a durable inversion in the plane figure again.

(*c*) In reference to the typical movement and inclinations of the illusory image it is clear after what has been said, that successive positions of the eye, produced passively by the movement of the head without change of relation between a certain part of the object and the central and peripheral part of the retina, involve a continual change in the perspective of the retinal images. There is produced in the eye, under the influence of these successive displacements of the retinal image, a phenomenon nearly identical with what appears in such apparatus as the stroboscope or the cinematograph.

The only difference between these two phenomena consists in this: the stroboscope, being in possession of perspective images of an object in motion that were photographed from a central point but in different radia of the circle, supplies the means necessary to call into consciousness the synthesis of these images. But the images that are produced successively in the retina while the eye is displaced in different points of the periphery of the circle by the movement of the head, are, so to speak, successively photographed at different angles for the retina to produce a synthesis of an object in movement. Accordingly we can say the eye represents in this condition a living stroboscope.[1]

[1] The MS. of this article was received November 10, 1905. — Ed.

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The Psychological Review.

THE PSYCHOLOGY OF INTEREST (II.).

BY FELIX ARNOLD,
New York.

III.

It is seen from the above that interest is most generally considered as a feeling and that it is closely connected in some manner with attention. In this section I shall try definitely to establish the relation between interest and feeling, between interest and attention, and to show wherein interest itself consists.

First of all, is interest nothing more than a feeling of pleasure-pain? To make interest a feeling of this kind would be to establish an identity between interest and pleasure-pain. If this were so, then pleasure roused by an object would be interest in such object, and interest in it would likewise be pleasure in it, to take the positive aspect of the case. This, however, is by no means so. There may exist, for example, an interest for me in the preparations for dinner, but in the actual process of eating there would perhaps be a pleasure, but hardly an interest in the eating, *per se*. In the preparations I see good things to eat, pleasant company, an opportunity to expand and bring out my social worth, etc. In the process of eating as such, these various ideas become realized, producing pleasure. A rhythmic thrill of delight is felt in a present moment, is confined to the present, but if it has no other reference, it can have no interest. An object, perhaps displeasing in itself, but which is a means of producing such a thrill, will have an interest for me on that account. We are so used to consider everything of interest with which one is occupied, *that pleasure-pain as a self-sufficient*

means of stimulation seems to be overlooked. To take the illustration above, of eating. If the processes have in them no reference to some future condition, the interest nears its end, and the pleasure begins. There is then pleasure and nothing else. It is confined to, and ends in the present. As Baldwin says, "We would hardly say that an oyster is interested when a sharp instrument is thrust painfully between its shells. The intrusion affects him, and it is in his interest to avoid it; but it is truer to say that it hurts than that it interests him."[1] Where, as in secondary interest, there is an interest in some means because of their connection with a pleasurable or painful end, there need be no pleasure in the means at all times because of such connection. This would make life 'one long sweet dream.' We might say that interest is potential pleasure in that it may so end, but potential pleasure or pain is not the actual feeling. And a potential interest would be an interest which, when actually existing, would tend to realize a potential pleasure, this pleasure, however, being twice removed from the potential interest, and once from the interest as actually existing.

Pleasure-pain, however, is closely connected with interest from a genetic standpoint. Suppose a given situation, through difference, change or pleasure-pain, to produce in me a series of reactions to such situation. As the result of my experience with such situation, my reconstruction of such situation will take a certain form. The situation will mean to me the possibility of again reaching the condition which was reached in the first experience. It will be the means of my attaining a certain state which I have already experienced. As such it will have for me a certain interest. Ideally there will exist as the result of my reconstruction, a system of ideas, a mental disposition, which will act as a guide to my reaction in a similar situation, while at the same time there will be a tendency serially to go through the reactions which will produce the state or a similar state to the one experienced. If not through direct motor control, then through imitation of another who has gone through a similar process, my attitude will be directed to situations similar in kind. The situation and the objects concerned then point

[1] *Feeling and Will*, p. 143.

beyond themselves, and acquire a value because of their connection with a future condition which is possible through them. Pleasure-pain may be a starting point, as may also instinctive reactions, but they are not on this account, interests, as such.

Similarly interest, though closely connected with attention, is not attention. Perhaps to bring this out it may be advisable to give briefly the state of affairs as present in a moment of attention. Control and development of any situation demands a fixation of the objects concerned, a narrowing of the field under manipulation, a more definite and accurate series of adjustments, a more refined reaction, a higher degree of delicacy in interpretation, a finer 'feel' or body attitude, in short, attention. Several aspects in attention may be pointed out, some of which have, at different times, been unduly emphasized. If we consider the given situation in its more objective aspect, we find an increase in the clearness and distinctness of the field. This gives us the '*Blickpunkt*' view of attention.[1] If on the other hand, we consider only the residual effects on the self-concerned, we find that there is developed a disposition or system of mental elements, which tend serially to realize themselves in moments of attention to objects connected with them. These ideation masses serve as reinforcing agents in the process.[2] The actual process of adjustment and control, the manipulation and working over of the various parts of the situation constitute the motor aspects of attention.[3] Attention may therefore be defined as a process of adjustment and control, such adjustment and control in its advanced stages being guided by an ideational content and body attitude, resulting in a narrowing and illuminating of the field concerned.

[1] See Kant, *Anthropologie*, § 8, Wundt, *Grundzüge*, III., pp. 333–339, Jodl, *Lehrbuch*, III., p. 74, and Titchener, *Experimental Psychology*, I., Pt. II., p. 189.

[2] See Kohn, 'Zur Theorie der Aufmerksamkeit,' *Abhandlungen zur Philosophie und ihrer Geschichte*, 1895, and Bradley, 'Is There any Special Activity of Attention?' *Mind*, O. S., 11, 1886, and 'On Active Attention,' *Mind*, N. S., 11, 1902.

[3] See Ribot, *The Psychology of Attention*, Münsterberg, *Beiträge*, Heft 2, p. 121; Lange, 'Beiträge zur Theorie der sinnlichen Aufmerksamkeit,' *Philosophische Studien*, 4, 1888, and Baldwin, *Mental Development*, Ch. XV. and Ch. X., Sec. 3.

The relation of interest to this process is one of concomitance only. The state of clearness is not the interest, nor is the actual process of motor control. Interest is rather what gives the moving impulse to the process in question; it is the means of determining whether or not such process be initiated. Or rather it is one of the means, the other being actual pleasure-pain or instinctive reaction. For example we may suppose a farmer and a hunter simultaneously watching a hawk. The attention may be equal in degree, but the interest is somewhat different in each case. The hunter takes a certain attitude, this attitude being determined by a certain ideational content. In so far as the situation points to the future there is interest. In so far as there is control in the present there is attention. The farmer takes another attitude and for a different reason, though his control may be of a similar nature to that of the hunter. The hunter sees in the hawk the possibility of bagging some game, of probable congratulations on his marksmanship, of a feeling of expansion due to success, and the like. The farmer sees in the hawk possible damage to his poultry, means of avoiding this, and the like. Both are equally attentive or may be. Each has a similar control of the situation. But the impelling interest in each is very different. It might be said that since both are interested in the same thing, their interests are the same. But the occasion of the interest is not the interest. The different meanings attached, the difference in the guiding ideational contents, would preclude such a possibility. We may also attend to the same thing, but the attention need not therefore be the same in each case. We can, however, suppose that the controls in each case are about alike, that there is an approximately equal narrowing and illuminating of the field in question. From the nature of the given illustration such a supposition can hardly be made as regards the interests concerned.

My object thus far has been rather negative; to show what interest is not; to emphasize the fact that it is incorrect to identify interest either with pleasure-pain on the one hand or with attention on the other. I shall now attempt more closely to deal with the aspects of interest as they exist in foundation situations, dealing with them as conative and as cognitive. I shall deal

with each aspect separately for convenience, though both are, in greater or less degree, always existent together.

When I am interested in anything, I take a certain attitude towards it. I have a tendency serially to realize a set of reactions which will give me a more or less perfect control of the situation, and which will result in a certain state, at present in a more or less ideal form. The object or objects concerned mean for me a certain condition of the self. If the object pleases and carries with it no future reference, there may be pleasure but no interest. In the latter case the striving for the realization of a future state has vanished; the interest has disappeared. To illustrate: I have before me a highly colored chromo, of the kind usually given away for soap coupons. *Horrible dictu*, I take some pleasure in looking at the combination of colors, at the action expressed, and the like. I have little interest in it, however, interest here being used in a technical sense. On the other hand, I turn my attention to a small dirty cardboard calendar having on it in small print all the months, and through some of the days of the month of July small black crosses made in pencil. I look at this with interest, it has interest for me, for on each of the days in question I hope to engage in certain pursuits, to meet certain people, to do certain things. I anticipate a certain future condition of the self in which I shall realize a certain thrill of pleasure. I take an attitude towards the calendar which is due to the signification it has in connection with a future state of the self. But I do not consider it a thing of beauty in itself, and when it has served its purpose I shall throw it away. Similar interest exists for a person in a railroad time-table. Pleasure exists for a child in going through a picture book. This is why so much of the illustration of books for children, and so much class-room decoration loses its full value. They have only the incentive of pleasure, without any accompanying interest. We cannot say that the interest is future pleasure, for the interest is now, it exists in the present, and is a fact, whereas the future pleasure is not, it is something which may may exist, but it has no present existence and therefore it is not. The idea of the future state may be present in a more or less dim form, and if so it is

something added to the attitude present, and serves to guide such attitude.

By feeling attitude I do not mean an attitude felt as pleasure-pain, or a feeling of pleasure-pain, as Stout does. The attitude which is taken is a gradual development and is the result of reactions in a given situation. When I see an object which is not connected with my former experiences, and which may or may not threaten danger, but which none the less disturbs me in some manner, I react towards it a certain way. I examine it, touch it, feel it, test it in a number of ways, go through a series of reactions. After I have on different occasions done this a number of times, I stamp the object or the situation as something to be treated a certain way. It acquires for me a certain meaning. Now, upon meeting with such object once more, if I do not go through the whole series of reactions I tend so to do. I take a certain body attitude which is felt, and which may be called a feeling attitude, conative tendency, or what not. If I wish to realize such implicit reactive series, if I wish to develop the meaning of the object concerned, I go through the entire process of serial reaction, in whole or in part. Whether the object is a word or a symbol, or a 'concrete' object, the same holds. Various objects have for me a certain worth, and the consciousness of such worth is the result not only of my personal experience through direct manipulation, but of whatever indirect experience streams in, from the school, the home, the social environment, and the like. All such indirect experience, of course, must be interpreted in terms of what I have actually undergone. I thus may take an attitude towards some ideal end which I feel is closely connected with my welfare, *i. e.*, I may tend to go through certain reactions in virtue of such ideal end. The meaning or felt worth of an object is simply consciousness of the attitude roused by such object. An object has worth because it 'hits' me a certain way, and I am accustomed to call an object 'of worth,' to stamp it with meaning when I am affected in such a manner. This feeling is due to the attitude taken, such attitude being the tendency to go through some reaction or series of reactions.

In interest, the attitude is not only the attitude caused by the

object *per se*, but it is something more. The object as such produces a tendency to go through a series of reactions which will give a more or less perfect motor control. *In addition, there is always a tendency serially to realize reactions which will arise when the future condition is reached, and to which the present situation is a means. It is this latter tendency and attitude which in a large degree determines the series of reactions in the attempted motor control. Such tendency is felt as striving, appetition, conation, as interest.*

Now the striving to have direction has with it a more or less definite cognitive element. The future condition in order to be realized must exist in some ideal form, as a mental disposition, a system of ideal elements, or simply as 'meaning' undifferentiated and inchoate. *This cognitive element may be present in very dim form, in fact may seem lost in the presentation existing, may exist only as a fringe, as a meaning in the given situation, as general awareness. Unless, however, some cognitive element is present, no future reference is possible and no interest can exist.* Interest on its cognitive side is the special signification which an object or idea has with reference to some future condition of the self, the special meaning in this connection which is attached. During the process of realization this ideal element may assume a serial arrangement, may become explicated in a series affording a guide to the reactions involved. *In a more advanced state the ideal element takes the form of a more or less definite system of ideas, such ideas being excited by the situation in question, and being necessary for more perfect motor control.*

'Reference to the self' may need some further explanation. Anything which is connected with me in any pleasure-pain relation has reference to me, is connected with my future welfare and to a great extent determines my future attitude. Take for example, the given situation in a man's business. With this are usually associated for example, 'building,' 'fixtures,' 'safe,' 'wares,' 'telephone' and the like. This however is the state of affairs as interpreted by a social average. Any business may have these various things. But *A*'s business would mean to him in addition, 'food,' 'luxuries,' 'home,' 'ease,' etc., all

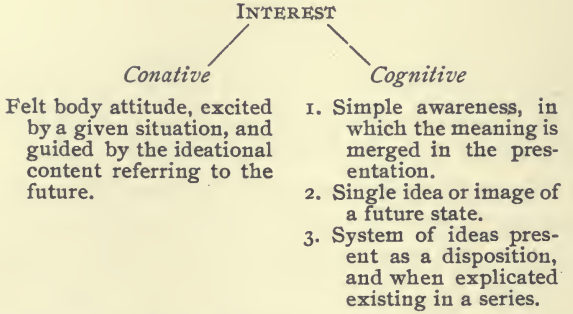
of which are to be enjoyed by *A*. If we take in *A*'s family as participants, we come back in the end to *A*. They enjoy the different things and in turn are enjoyed on the average by *A*. If *A* is working to feed the multitude, the interest exisiting must be connected with the self. *A*'s determining pleasure, satisfaction, feeling of expansion, of quiescence or what not would consist in seeing the multitude happy, or in seeing them not-miserable. This would determine his attitude. His interest on its cognitive side would be the meaning existing for him in the situation under control, in the ideas or systems of ideas determined thereby, the thoughts of the multitude in various states or reactions, of their happiness due to his kindness, of the opportunity they give him for social expansion, and the like. On the conative side would be the attitude caused by the situation as actually before him, and as mentally idealized. Were the self not concerned, *A* would probably let the multitude starve, as in fact he does (*i. e.*, *he* is all of us) when the situation is too far off, as in central Africa, or elsewhere. Altruism in the end reverts to the self, for we cannot abnegate nature. Selfish interest is so-called because only the self seems to be concerned. But as a matter of fact, 'disinterestedness' is nothing but a form of interest, an interest in which the various *socii* benefit. In fact it is the selfishness of these *socii*, a selfishness which sees only the benefit which accrues to *them*, and which neglects the feeling of the generous individual concerned, that stamps an act as disinterested. (The various *socii* are again, all of us.)

While in interest there may be the thought or the awareness of some state or reaction which is to be experienced by the self, and on account of which the self takes a certain attitude, it may also on its cognitive side be the thought or awareness of some state or reaction which is to be avoided by the self. For example, we may be interested in the movements of a rattlesnake, because such movements mean possible danger, a bite from the beast, pain from poisoning, and the like. We have a negative interest as it were. If merely a feeling of alarm is present, there is not interest, but simply feeling in the present. In the example given in the preceding paragraph, *A* was supposed to enjoy his

family. On the other hand he may hate them and still allow them to enjoy the fruits of his labor. In such a case he would have a negative interest as far as his family is concerned. *A* would see in his family the possibility of a disturbance of his social equilibrium, of dissatisfaction due to interference with his habitual method of living, of probable effort in readjustment should trouble come, and so on. As we usually say, *A* is, in such a case, interested in keeping the family peace. His attitude would be the tendency to avoid such a state of affairs, while the guiding aim would be the thought or awareness of the future state in question.

Any situation involving interest is thus seen to be connected with the future of the self concerned. Cut away all reference to the future and no interest is possible. Similarly remove all reference to the self and interest likewise will disappear. For example, a newly elected president of a rapid transit company is reported to have said, 'all the interest the people have in me is how much they are going to get for a nickel.' In this he was correct. The public were not concerned in him as an æsthetic production, as a pleasure-producing object. They were interested in him because they saw in him the possibility of influencing them in some more or less definite manner in the future.

Interest in general may be defined as *a body attitude, pointing ahead and to the future, such attitude tending towards serial explication under guidance of a concomitant ideational content, to which content it gives meaning. And by the series of tendencies or actual adjustments involved in the motor control of the situation concerned fuller meaning and wider content may be acquired. On its ideational side, the present moment need not be a single idea, but it may be an entire disposition, a more or less finished system, or on the contrary, simple awareness, fringe of meaning.* Given in outline we should have the following:



As an example we have, of the first case, a situation in which the future reference is merged in the presentation, in which it is present as simple awareness, *e. g.*, an individual observing the behavior of a spider constructing its web; of the second case a situation in which a more or less definite image or idea is present, *e. g.*, a little boy with the idea of a toy which he is to possess, and interested on that account in a task or bit of work; of the third, a situation in which an entire disposition is involved which disposition may become serially explicated; the higher type of mental activity directed to an end, *e. g.*, a general planning a battle, the end guiding the direction of thought. Of the various forms which interest takes the more important are desire, expectation and curiosity. Of the degrees of development in interest there are the stages of primary interest, secondary interest and acquired interest. The laws determining interest I shall reserve for the final paragraphs.[1]

Most German psychologists consider will merely as a form of striving, a feeling of appetition, of '*Lust*' or '*Streben*' resulting in a volition. This is the state of affairs in desire. Desire

[1] The fact that *simple awareness* is a cognitive aspect which may have future reference has been overlooked by the Herbartians who deal only with ideas and systems of ideas. Another point may here be brought out. Where a series of ideas has no future reference, they may be 'pleasing' but they are not 'interesting.' In fact the person concerned does not take that attitude towards them, though an outside observer may consider the individual in a reverie, as 'interested.' Pastness need not shut out possibility of future reference, and in fact 'pastness' from a psychological standpoint is simply an aspect of the present. And where the aspect has future reference, interest exists, but where the future reference is absent no interest is possible. I have touched upon this aspect in the PSYCHOLOGICAL BULLETIN of November, 1905 (Vol. II., pp. 367–368).

is essentially teleological. We always strive towards something which is beyond our reach either *to gain an end, to reach a condition of pleasure, of expansion, of quiescence on the one hand, or to avoid a condition of pain, of depression or of strain on the other.* With reference to the former state of affairs we have a form of striving called appetition, with reference to the latter, aversion; but the striving is there none the less. If I possess that something, then it evidently is not necessary for me to strive towards it. Desire has in it to a high degree the conative tendency or feeling attitude, though there is a more or less definite cognitive content. In a simple case, when an object is before me but beyond my reach, that is, when I am unable to control it, I strive so to do. I desire the object, that is, I wish to realize some future condition of the self which has been experienced before. This feeling of striving is present more strongly than usual in the common forms of interest, and is felt as conative tendency, as impulse, as appetition or aversion. When I desire something which is to be controlled by me, subject to certain conditions, I set about to remove certain obstacles, to do something, or actively engage so to do. I am unable to realize an attitude, a condition, a future state only ideally existent, because of obstructions which prevent this ideal content from becoming a fact. Hence my feeling of desire persists and my efforts continue. The interest in such cases is the feeling of '*Streben*' plus the guiding and directing cognitive content, the conative aspect being the more prominent. When, however, the desire becomes so great as to overwhelm all future reference, and is felt simply as feeling in the present, the interest disappears, swamped in a flood of feeling. This often happens when a desire for a certain object becomes an end in itself, the object being entirely forgotten in the process. When I actively engage in the doing of what is necessary to bring me nearer to the future condition or the motor control ideally existing, I have the process of volition, and this volition is *in part* the interest, so long as the striving continues, until the end is reached.

In expectation there is an awareness or an image or an idea of something more or less known which is to affect us in a more or less definite manner and towards which in the present we take

an attitude. The conative and the cognitive elements balance about evenly. The future condition existing in the awareness or in some cognitive content influences my present condition rather strongly, but not to so great an extent as to drown out or to predominate over my present state. Where the 'something expected' is clearly known, my attitude towards this future state or control may be rather definite and constant, the expectation becoming realized on the arrival of the future moment with all that it has for me. Where the 'something expected' is not so definitely known, imagination supplies what is needed, guided, if necessary, by the existing situation, aspects of the situation, etc., whether ideal or real. For example, a hunter in a forest on the watch for game may expect something, he is not quite sure what; but his cognition of this 'something' is more or less conditioned by his surroundings, etc. He will hardly expect elephants if in Canada, or polar bears if in Florida. Interest is evidently present, for we have the attitude towards some future state of the self which is to be realized, and a guiding cognitive content.

Expectation and desire both refer to the future, have in them each a strong conative attitude, and as such are forms of interest. They may, however, be differentiated. In expectation, the only obstruction to the realization of my future state is either time, or the action or non-action of some other person. Expectation is essentially a static aspect of the situation as far as I am concerned. I cannot struggle; I can do nothing to bring about this realization more quickly, *as expectant;* I may set about to influence the other determining individual, or read to kill time, but this has nothing to do with the expectation *per se* and as a *felt moment of interest.* In desire, on the contrary, there is an active struggle to remove the obstacles to the realization of the future state, a more or less strenuous reaction. Desire is rather a dynamic aspect of the situation as far as the self is concerned. Desire must not be confused with mere 'wish.' In desire the feeling-attitude is emphasized at the expense of the cognitive elements, and may at times even suppress the latter. In this latter case it becomes simply a present feeling.

Where interest exists in a situation more or less known and

when we do not know exactly in what way such situation will affect us, we imagine from our past experience how it *might* influence us, what future state *may* be produced. Such interest is curiosity. Curiosity, therefore, consists in an attitude determined by a cognitive content excited by a partially unknown situation, for the purpose of securing more perfect control of the situation in question. We desire further knowledge that better reaction and control be possible. The self is concerned, an attitude is taken because of the influence which the present situation may have on the future. Interest is present. The relation of the partially unknown object or situation to our future welfare is not sufficiently known, hence the object or situation possesses an interest for us, a tentative interest, as it were. Such interest becomes a more or less permanent one when the actual signification of the object for the future condition of the self becomes more fully known. Such tentative interest disappears when further reaction and knowledge show that no or little reference to the self is present, or when the curiosity becomes satisfied, *i. e.*, when the ideal state becomes realized. Novelty may cause curiosity, but it is neither the curiosity nor the interest. Curiosity is therefore an interest of a certain kind, a tentative interest, as has been said. When the relation between the self and the object or situation becomes more fully known, the interest either becomes a more or less permanent one, or else it disappears altogether. That is why curiosity is such a dangerous incentive to appeal to in teaching. It may run down like a clock without becoming fastened more permanently. The end must be shown to be worth striving for again, if interest is to persist. Curiosity about fits Stumpf's '*Lust am Bemerken*,' though it seems incorrect to confine interest to this alone.

Curiosity may be differentiated from expectation, though they have some features in common. In curiosity there is a definite situation before me, to which I take an attitude, because of a supposed significance for me. In expectation there is no actual object present; it is ideal in form and is to exist. The situation which is to influence me and which I expect will exist some time in the future exists for me only as a mental con-

struction. In curiosity the situation which is to influence me is actually before me, but its full significance remains for me partially unknown. In curiosity there is a definite starting point about which revived meaning, images, etc., cluster, while in expectation the revived images or ideas of the situation to be realized exist first and form the starting point for any further ideal revival or control. In expectation the situation is to come, in curiosity it is already partially present and becomes subject to our control for more perfect control.

'Rouse interest in a person and attention will follow' is a more or less popular opinion, and much used in so-called pedagogical discussion, though more up-to-date books on pedagogy follow the doctrine of concomitance. Exact analysis will show that interest as actually present is concomitant with attention, in fact is the incentive to the motor control involved in attention. Interest and attention, except in most elementary and primitive forms of attention, run side by side. The moment we see in an object some special meaning, as soon as we take an attitude because of such signification, motor control becomes necessary for further development of this meaning and attitude. The incentive present, further differentiation and control of the situation is begun, and we have interest on the one side and attention on the other. *In the blind manipulations of the infant, in the aimless working over of a situation by the newly-born child (or as soon after as he is capable of this), the very first control involves no interest to the infant, though to an observer it might seem so to do. Only after the manipulation has resulted in a certain condition of the self, that is, only after the situation has acquired a meaning can interest exist.* Efforts towards control and instinctive reaction are determined by levels below the stage even of awareness. To consider interest present in this stage would be to posit ready-made adjustments and attitudes *as felt*, and innate meaning for the child on the one hand; or on the other hand, it would deny that such instinctive reactions are acts of attention, in that they are below the conscious levels. But in instinctive reactions of this kind, at least the visual elements, etc., are conscious ones, and these visual elements, etc., acquire meaning only *after the process*

of control has resulted in a certain state of the self concerned. Development of interest is the process by which instinctive reactions lead to control, such control resulting in a certain condition of the self. The situation giving rise to this condition may then possess interest, but only after the motor control has taken place. The child (and where can we find it?) which is born with cognitive elements giving meaning to situations to which it never reacted, may have interest in its first attempts at motor control. But the child which instinctively seeks motor control, because of innate impulses within it, acquires interest only after such control has taken place. Or in other words, *meaning is an acquired thing, is due to motor control, and comes after motor control.* As such, interest does not exist in acts of attention purely instinctive. Of course such naïve states are few and far between in more advanced conscious life, but the point I wish to make is that they exist and must exist at some stage in the process, unless as I have said before, we are to posit ready-made attitudes, innate cognitive elements, 'instinctive' meaning. This is a small matter for the psychology of interest, but it is weighty with importance for the teacher, who deals almost entirely with motor control. Granted ready-made interest *on all occasions*, and teaching becomes one long sweet dream, which it is not by any means to the best of the teaching body. We may represent the relation of concomitance between interest and attention in the following schematic outline:

INTEREST.	ATTENTION.
Conative.	*Conative.*
Felt body-attitude, tending serially to realize a *future* situation.	Body adjustments for more perfect motor control, with feelings of strain.
Cognitive.	*Cognitive.*
Mental construction of the situation to be realized, existing as fringe of meaning, simple awareness, or as free ideation.	Ideal elements reinforcing and guiding motor control through fusion with, assimilation of, complication or association with impression or idea.
Subjective.	*Objective.*
Possible feeling due to anticipation, to a partially revived body thrill.	Clearness, distinctness, vividness, persistence of the situation.

Where, however, interest may be said to exist before attention is in the case of potential interest. Such interest, however, exists in advance of attention, *only as potential.* The moment attention exists, such interest becomes actual and is then concomitant with attention. Where we have a mental disposition favorable to the reception of an impression, and where such disposition points to the future of the self concerned, there we have the cognitive element of an interest which becomes actual when the attitude is taken. But there is no real interest until the whole system, impression, plus ideal revival, plus attitude is a fact. In potential interest we have interest before attention, but such interest is only potential. It may be said that such potential interest is concomitant with potential attention, and when realized, with real attention. Where, however, there is no actual interest present, where mental construction has not yet taken place, where meaning is attached to an object only during the process of motor control, there we have interest concomitant with attention and not before it as is sometimes loosely said. It is the incorrect identification of interest with feeling or with instinct which brings about the notion that interest may exist before attention.

The simplest form of interest is that in which motor control of a situation has given the situation meaning in itself, in which, therefore, the situation is looked upon as a direct and possible means of affecting the self in the future. Whether the object *per se* be tinged with negative or positive feeling does not affect the interest as such, since this interest is the meaning the object has for our future welfare, the attitude roused by the awareness or thought of such welfare. An ugly looking case may rouse in me no interest. But if I know or suspect that it contains some things for which I have sent, and which I can use, it becomes for me an object of interest. My attitude is taken because the case and contents mean the possibility of passing some agreeable hours, and the like. So too, a rattlesnake as such, *e. g.*, in a cage and apart from its possible action on me, may be a very pleasing object. I may admire its graceful movements, its sudden darts against the glass, etc. But place it before me on the highway and it becomes fraught with meaning.

It will then have for me a negative interest in so far as it means to me a possible danger, etc., as above described. In addition to the interest, certain feelings may or may not be present, as those of alarm, excitement, tension, and so on, but these, being merely present as concomitant phenomena, do not constitute the interest. Interest of this kind may be called primary interest, in that the object or situation itself, and without any other connections, will lead to the future state idealized in awareness or thought.

As more often is the case, however, the given situation to be reached, and the object or objects through which this is directly possible are not present, cannot be manipulated at once, are not directly amenable to the motor control necessary to realize the future condition ideally existent. It is at this stage that mental construction enters. Aspects of the objects concerned, possible connections with them and leading to them are imagined or thought out, the awareness or image or idea of the object needed becomes developed and assumes numerous ramifications which are further developed till they connect in some manner with the motor control directly possible. The original awareness assumes a more definite shape (if only awareness is at first present), there is consciously developed the image or idea of the end situation to be reached, and from this end stream the various explications connected with the present, for it is only from the present that motor control can start. In such a case the end to be attained is similar in function to the object in primary interest, but it is only a step removed from the final realization, and is only ideally existent. In primary interest, some object or situation, A, leads to the realization of the interest immediately and directly. In the more developed state which we may call secondary interest, A' is some end to be realized, and this is connected ideally with a series of means over which control is necessary before the terminal situation can become a factor. In this case b leads to the end A' and A' leads to the realization of the interest. The interest exists in A' and is the moving force, the impelling motive for control of b. In this manner we may have a whole series of connections, in which c leads to b and b to A'. The interest in c, b, etc., up to the one preceding ultimate realization is

secondary interest in that it is derived from the interest in the original situation which is to become subject to motor control. A student, for example, may be interested in psychology. If psychology means for such a person, on the first reading, possible intellectual enjoyment, feelings of expansion, of satisfaction and the like, such interest would be either primary, or, as will be explained, acquired. But the interest in psychology may be secondary. The interests for the student may be of the following kind: He may see in psychology the possibility of passing some examination; such examination may mean the possession of a certificate or of a degree; such degree may mean a position in a high school, college, etc.; and then this position may mean probably the possession of money, of a position, of a name, and the like; or there may be still higher aims. And during the existence of the secondary interest, the final aim gives power to its means, *which do not so much lead up to the end, but which rather have been developed out of the end.* Secondary interest may be defined as an interest existent in a means or a series of means which have been developed from a terminal situation or the image or idea of such situation, and which means or series of means have interest only because motor control over them is necessary before the terminal situation can be realized. The impelling force exists in the interest in the final situation out of which the means have been developed.

In the course of the various processes leading to final realization, none of the means may have pleasure *per se;* in fact, as is usually the case in many instances, the means are more or less repelling and have interest only as secondary, as a means to what is to come. During the process, however, a residual modification of the self may lead to greater possibilities for expansion, for enjoyment, for development, which at first were not seen as inherent in the means. *There may be developed what has been called an increment of power due to possession.* There may be developed on the cognitive side an apperceptive basis which can be used in interpreting and controlling situations before outside of the activities of the self concerned. Most of the interests, in fact, I may say all the important interests seem to have been developed in this manner. Insofar as they are the

product of man they may perhaps be stamped as artificial, but insofar as man is a part of nature such interests are just as natural as is the rest of man's development. But they can hardly be called primitive. Acquired interest (this seems to me to be the best name), is that attitude and determining cognitive content which is a residual development of secondary interest. Acquired interest differs from primary interest in that it is the result of secondary interest, being constituted by the residua of the latter, as it were, while primary interest is the result of direct motor control.

Interest as thus conceived does not exist in acts of instinctive attention, as I have already tried to show. In instinctive attention there is a feeling of pleasure-pain, etc., but no interest. Interest is present only in the more or less advanced stages of attention, and is built up of the residua of many processes of instinctive motor control. Since interest has on its cognitive side simple awareness or ideal construction, that is, some sort of meaning, it is evident that the interest must, to a large extent, be dependent upon such cognitive content. Interest as a general power can therefore never exist. I can not develop an interest in study, work, etc., but only in those kinds of study, work, etc., which have meaning for me, are connected in some manner with some future condition of myself. Only insofar as a number of such cognitive contents have features in common can we have interests in common. The widest possible kind of interest seems to be that in which the content is some aspect of motor control, and the feeling to be realized a sense of satisfaction, a feeling of expansion and the like. That is one reason why manual training is so valuable an instrument in education. General control through the fingers, *e. g.*, cutting, painting, hammering, sewing, analytic and synthetic manual space perception and the like have an extremely wide applicability. And control in most of our daily life and daily actions is just the sort of motor control developed by the manual arts. I think it safe to say that for the few times one needs to find the square root of a number over a thousand, or to know a rule in grammar or a date in history, one will have used his fingers hundreds of times in various acts, be such acts merely grabbing firmly the

handrail of a car in motion, or quietly arranging the material in a business house or dwelling. In addition most of the meaning the various cognitive elements and situations acquire, is acquired just through this motor control.[1] The range of the interest concerned depends, therefore, upon the guiding cognitive content, and is general only as the content is general. Power of interest means nothing till connected with a content, and then its generality depends upon the generality of the content in question. It becomes a question, therefore, whether it is good as pedagogues claim, to develop an interest solely in the subject *per se;* or whether it is not better to cultivate an interest in some more general end, as virtuous possession of money (and I name this without blushing), possession of social good will, an idea to be somebody of use to the community, and the like, which can then be applied and connected with any number of studies, occupations, etc. Such an end is by no means abstract, and when developed will be connected with some means. This is why, to a great extent, so many newcomers prosper in our land. They are filled with one ambition, have one aim, to own land, get money, possess ease and the like, which they connect with whatever occupation or study affords the nearest and surest road to success. To return, the dogma of formal discipline goes to pieces with interest as elsewhere, and the interest is as restricted as the end in question. Only as the study or the work expands can the interest do likewise.

I shall end my discussion with a treatment of the laws which govern both the formation of interest and the use of such interest when formed. This portion of the paper will probably be of greatest use to the teacher, or it ought to be of use if the points thus far brought out mean anything. There are two phases of the question where the use and applicability of interest are concerned. In the first place there is the question as to the laws underlying the *development* of the interest, and in the second place there is the question as to how, once such interest is

[1] See Binet, 'Perceptions d'Enfants,' *Revue Philosophique*, 1890; Shaw, 'The Employment of Motor Activities in Teaching,' *Popular Science Monthly*, Vol. 50, and 'A Comparative Study of Children's Interests,' *Child Study Monthly*, Vol. 2; Barnes, 'A Study on Children's Interests,' *Studies in Education*, 1897.

present, to make the most *use* of this interest. In examining these phases of the situations concerned I make use of ground which has been thoroughly ploughed by others, and hope simply to enforce what others have already presented.[1]

I shall discuss the laws underlying the development and the use of interest under the following heads:

1. *The law of expression and motor control.*
2. *The law of imitation.*
3. *The law of habit.*
4. *The law of appetition towards a situation producing feelings of*
   (*a*) *pleasure.*
   (*b*) *expansion.*
   (*c*) *quiescence.*
5. *The law of aversion from a situation producing feelings of*
   (*a*) *pain.*
   (*b*) *depression.*
   (*c*) *strain.*
6. *The law of apperception* (*concerned in the use of interest*).

It is evident that any given situation can acquire meaning for the individual only as the individual comes in contact with such situation, reacts towards it, manipulates it, attempts a more or less perfect motor control. *And the basis for such reactions is the impulses which exist in the individual concerned.* Given a situation present to the child, and he instinctively *shoots off* as it were in a definite manner without forethought, without awareness of meaning or cognition of the result. An infant will just as readily tear up a ten-dollar bill as a newspaper, will just as soon swallow cyanide of potassium as a lump of sugar. The result of his reaction, of his adjustment, of his attempted control will determine the meaning of the situation when again presented (if the child of course is still alive) will give the foundation of a primary interest. The state reached after such control will determine future reaction in the individual. In teaching,

[1] See Baldwin, *Feeling and Will*, Ch. VII., and *Mental Development*, the whole book. The notion of *motor control*, and the more exact presentation of *means and end* I have taken bodily from Dewey whose lectures on kindred topics are illuminating, though rather abstract.

the question is to determine what objects will be presented, so as to produce the highest possible degree of pleasure, expansion or quiescence compatible with the end sought. No direction is needed where spontaneous expression or motor control are relied upon to develop the interest. Selection of subject matter only is here the problem for the teacher. The use of the sand heap, of clay, of stories told *by the children*, etc., all come under this law. The feelings of satisfaction, of expansion, etc., after such processes have been gone through will be sufficient to stamp the objects or situations as worth manipulating, *i. e.*, they will acquire a fringe of meaning for the child (be he old or young) and as such will have interest. Furthermore, interest will be strengthened if the social appeal is used to rouse pleasure, expansion, etc., in the individual concerned. When this control is sought only for the sake of the approbation from others, or for a little black mark in a book, the interest becomes secondary, and in this case, perverted.

More often, spontaneous control is aided by a copy set for guidance before the control is attempted. The impression, image or idea thus first presented will, by the law of dynamogenesis, tend to work itself out in action, and we have the law of imitation operating. Imitation is the most potent factor in the development of interest. It is to be noted that the ideal copy existing may be merged in the presentation existant, *may be present only in the fringe of meaning in the object or situation, as simple awareness.* If, for example, a teacher finds the center of gravity of a ruler, makes a dent at the point and twirls it around on a pencil point, the pupils will do the same, without any other stimulation. The pleasure, etc., resulting will give meaning to the process, will determine the attitude to the situation, will result in interest. If again a mark, some artificial sign, social approval, etc., are given, these aid in strengthening the interest formed. Where further meaning is given through diagraming, drawing, coloring, illustration, etc., the interest is likewise strengthened; *but some sort of expression or motor control should be the basis.* The entire range of instincts and impulses (*which are not interests*) may be appealed to in the process. In order of vividness, the copies set may be, (1)

actual control of an actual situation, (2) *actual control of a similar situation*, (3) *representation of the control*, (a) *by photograph or colored picture*, (b) *by simplified illustration*, (c) *by schematic outline*, (d) *by oral explanation and gesture*, (e) *by writing and print*. The last usually accompanies the others, as does sometimes the fourth mentioned, (*d*). As examples of these forms of 'copy' set, we have of (1) actual gardening in a real garden. making of a real chair, speaking of a correct sentence, etc., by the teacher or one able so to do; of (2), gardening for example, in a soap-box, making a chair in miniature or in paper, giving a sentence in writing, to be spoken, etc.; of (3), (*a*), the usual pictures of gardening in the geography, the pictures in an 'Everybody's Book,' the pronouncing of words like those to be used, etc.; of (*b*) unfilled drawings of the processes in gardening, outline representations, etc., and use of words simpler than those to be spoken, etc.; of (*c*) schematic outlines of the process involved, and in speaking, phonic analysis, use of rules (may they rest in peace), and the like; (*d*) *oral explanation and gestures are almost useless in many of the school subjects, unless they come from the children concerned or unless they are called in as auxiliary;* with more advanced students they form a more important medium of instruction; (*e*) book instruction should, with children, come last of all if it is to be used at all. The set 'book lesson' is an instrument of torture which only the least capable instructors of children use. With advanced students the text-book is of the greatest use, and with many, it usurps the place of the instructor. *But the foundation elements are not obtained by this means.*

The outline as thus given is suggestive only and by no means complete. I wish solely to emphasize the importance of the process of imitation in the formation of interest, and the necessity of the right kind of 'copy' set.

It is to be noted that such copy set may appeal to an already developed interest of curiosity, but is of little value unless the actual process is attempted by the self concerned. The interest to be developed is not the interest of curiosity, the interest of the idle who like to 'nose' around, but rather an interest in some creative control. The interest of curiosity is an elementary stage which should lead to more active expression.

It is generally understood that habit deadens interest, that conscious meaning becomes less and less as the process becomes more and more automatic.[1] Habit no less than instinct is more or less mechanical and as such is not interest. It is not this negative phase of interest which I wish to bring out, but rather the means of utilizing just this automatic nature in the formation and development of a new interest. Where a situation of a certain kind always produces response of a definite order, the content of the situation may be somewhat different, and through the mere force of habit motor control will be started. After such control the situation with the changed content may contain possibilities which result in interest. The usual habit of response which can be used is of the motor kind. If, for example, I have the habit of taking a book and looking through it from mere force of habit, progressive control may lead in the growth of a new interest. So, too, in a school room, a teacher may start a process of control in the children merely by giving an order to proceed a certain way. It seems that habit of reaction is determined by a certain objective form which may be filled with a number of contents. The student who goes to college day after day reacts to certain objective features, *e. g.*, the horse or trolley car, the building, the seats, etc. Once there, further processes may lead to new interests, or development of old ones. The use of habit however is of a secondary nature and should be used more as a reinforcing agent.

By the psychologist's fallacy, the feelings of pleasure-pain, etc., which find their greatest value when they come *after* control of a situation, are sometimes placed *before* by the teacher who arbitrarily creates standards of value according to his or her whim or caprice. But where an impossible or useless course of study is forced down a teacher's throat, or where conditions forbid (*e. g.*, the 'big-class, cage-seat, silent-room and ramrod' system), he or she is justified, I think, in creating artificial values, *e. g.*, marks, punishment, driving, etc., if for self-protection only. The importance of the feelings given under the law of appetition and the law of aversion is self-evident. This calls for all those aids which will intensify the natural result of

[1] See Baldwin, *Feeling and Will*, p. 141.

a proper motor control, *e. g.*, social appeal, dynamic coloring of objects used in control, sympathetic atmosphere, æsthetic surroundings, and the like.

The laws above given deal with the development of an interest or system of interests; they are not the result of an interest or system of interests which is appealed to, but they are principles which govern the acquiring of interests. Once these interests are on a fair way of development, any appeal to them will be for the purpose of their further expansion and development, and can be roused only by connecting with them in some manner the situation or some aspect of the situation in hand. Apperception here lies at the basis of the process, and the related known becomes important in such stimulation. It is seen, or should be seen from the discussion thus far, that the Herbartians deal only with the *use of interests already existent*, and with the *necessity* of developing such interests, but the actual processes involved, and the underlying laws are neglected. This is why the theory of interest is so exasperating to the teacher, who usually scoffs at it as mere 'theory.' Interest is not a mere tickling of the sensations for the purpose of rousing attention in the children and of making life easy for the teacher. It is, as Volkmann has said, a more enduring thing. Interest is rather a manner of interpreting and reacting.[1]

INTEREST.

Aspects.	*Kinds.*	*Stages.*
Conative.	Desire (Will).	Primary.
Cognitive.	Expectation.	Secondary.
	Curiosity.	Acquired.

Concomitants.	*Laws.*
Attention.	Spontaneous expression and motor control.
Apperception.	Imitation.
Possible feeling present or revived.	Habit.
	Appetition and aversion.
	Apperception.

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[1] On apperception see Stout, *Analytic Psychology*, II., Ch. VIII., and Lipps, *Einheiten und Relationen, Eine Skizze zur Psychologie der Apperception*, 1902.

In the diagrams in sections I. and II. — means 'concomitant with' and = means 'equal to.' For purposes of reference, I append an outline of the main points taken up in section III. of the above paper.

ON THE ANALYSIS OF THE MEMORY CONSCIOUSNESS: A STUDY IN THE MENTAL IMAGERY AND MEMORY OF MEANINGLESS VISUAL FORMS.

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A. The Problem and the Experiment.

The general purpose of this study has been to contribute something to the analysis of the memory consciousness. Its more special efforts, however, have taken two more definite directions. (1) To determine the nature of the imagery in the recall of a given material. (2) To determine the nature of memory errors and the causes that produce them. Its general

aim, therefore, differs from practically all previous memory studies in that no attempt was made to study the quantitative aspect of memory, the question as to how much can be remembered, and the conditions upon which that amount depends. At the same time no claim can be made for entire originality in either its purpose or in its methods. The need of the investigation of both these problems had been urged already by Kennedy in his review of the methods and results of experimental studies of memory.[1] Since his writing, one phase of the former problem has been definitely attacked by Angell and Harwood,[2] Bentley,[3] Whipple,[4] and Schumann.[5] Perhaps some of the earlier studies and discussions on the nature of the recognitive elements in the memory consciousness should also be mentioned in this connection. All of these studies, however, were limited to the *recognitive* consciousness, with the interest centralized further on the part the image of the first stimulus plays in the recognition of the second. Angell and Harwood's results were mostly objective. From the difference in the number of right and wrong judgments on the pitch of the second clang, given with and without distraction between the first and second clangs, they infer as to the possible influence a memory image of the first clang could have had on the judgment of the pitch of the second. Schumann's study is more of the nature of a general argument in which introspective observations are not quoted with much detail. To my knowledge, Bentley, and Whipple are the only authors, so far, who have seriously attempted to study the problem introspectively and who have at the same time adequately recognized the need of applying this method rigidly to the more general problem of the analysis of the memory consciousness. The second problem stated, the causes that produce memory errors, has not been directly attacked in any extended study.

[1] 'On the Experimental Investigation of Memory,' PSYCH. REV., 1898.

[2] 'Experiments on Discrimination of Clangs for Different Intervals of Time, *Am. Journ. Psych.*, 1899 and 1900.

[3] 'The Memory Image and its Qualitative Fidelity,' *Am. Journ. Psych.*, 1899.

[4] 'An Analytic Study of the Memory Image and the Process of Judgment in the Discrimination of Clangs and Tones,' *Am. Journ. Psych.*, 1901 and 1902.

[5] 'Beiträge zur Analyse der Gesichtswahrnehmungen. Dritte Abhandlung. Der Successivvergleich.' *Zeitschr. f. Psychol. u. Physiol d. Sin.*, Bd. 30, 1902.

Considerable recent work has appeared on its quantitative aspect, the degree of memory error and some of the objective conditions under which it occurs. This is the central interest of the studies by Stern and his co-workers to whose results the *Beiträge zur Psychologie der Aussage*, the second volume of which is now current, is devoted. The objective results of the quantitative studies on how much can be remembered have incidentally thrown some light on the analysis of the memory consciousness. In quite the same way the studies by Stern and others throw some light on the causes of memory error.

The present study is most closely related to those of Bentley and Whipple, having in common with them, in the first place, the introspective method of study. The first problem stated above differs from theirs in being that of the analysis of the memory consciousness in the recall of a stimulus, instead of that of the memory consciousness in the recognition of a stimulus given a second time. The same stimulus was never repeated. A group of meaningless visual forms, five to nine in a group, was presented to the subject for ten minutes, and once only. Immediately afterwards, and again after a number of different intervals of from two to ninety days the subject was requested to recall the forms, giving as detailed an introspective account as possible of the nature of the imagery, the process of recall and recognition, etc. He was also requested each time to draw the forms thus from memory as accurately as he could. The forms were not equally meaningless, but were so constructed as to allow of a classification into three classes, viz., the altered familiar geometrical form, the continuous irregular curve, being the most meaningless, and the several-part form of simple straight and curved lines. With this procedure the results are of two kinds. The introspective notes give the direct evidence on the first problem, and are supplemented only a little by the objective drawings. The drawings constitute the main results on the second problem, and, from the nature of the problem, can furnish only indirect evidence. The subject not knowing the errors he made in recall could have nothing to say as to their causes. These must be inferred from the data at hand. But the introspective results supplement the drawings to such a de-

gree as to make the inferences perfectly evident in most cases.

B. Analysis of the Results.

1. *The Subjects' Methods of Learning the Material.* — Before considering the nature of the imagery in recall it will be well to take account first of the subjects' methods of learning the material. This will throw considerable light upon the later results concerning the nature of the imagery. By alternately trying to learn and then trying to recall the forms during the ten minutes in which a group was presented the subject at once found that the forms were not equally difficult, and much more time was then put on learning the hard ones. The methods employed in impressing the various characteristics of the forms on the mind may be classed into direct methods, and certain aids to these that were used. Under the direct come then, first, merely looking at the forms and noting their details visually, and second, motor processes of the eyes following out the forms and also of the hand tracing them. To these the aids were associations made with individual forms or their parts and verbal descriptions. The direct methods need no further consideration. The use of the aids may be further described. In every case the subject consciously sought for associations, and the question, 'What is this form like?' or its equivalent, was probably always present in the subject's mind. They were sought for as a means of fixing the memory of the form as a whole. This search ended, in the different instances, in a variety of results. The outcome might be successful in an actual association made. Secondly, an actual association might fail while yet the form attained a familiarity that it did not at first possess. In these instances the form would be regarded as something familiar and known; it would 'look like something they knew, but they could not tell what.' Thirdly, in some cases the form was broken up into parts which were learned and recalled in a definite order. These parts had an evident definite individuality which made them parts and thus, it seems, must have had some sort of meaning for the subjects. But it was not so regarded by them. They denied all associations and familiarity in these cases. Fourthly, the form might, of course,

remain entirely meaningless and unanalyzed into parts. The effect of an association made or of an associated familiarity was always that of putting the subject more at ease with reference to the form in question; it made the form easy, and with this much accomplished he would leave it, feeling satisfied that he could recall it when wanted. The verbal descriptions were made mainly for the purpose of fixing minor details of the forms. They were used for the alterations in the familiar geometrical forms, for the difference between the actual form and its association, and sometimes for the whole of a form that remained entirely meaningless. In the last case the description was that of a general characteristic with the same function as that of an association with the form as a whole. The minor details thus fixed in memory by description were further, relations, positions, proportions and sizes of parts, the angle a part made with another, the position of a meeting or crossing point and of endings of lines, the nature of a particular curve, length of lines, etc. No particular attention was as a rule given to sizes. When sizes were specially attended to the total amount and proportion of the page the forms took up might be noted, and to remember the particular size of each form that of one might be fixed and the relative sizes of the others noted. For this descriptive aids were usually used. Positions were fixed in memory by imagining the forms arranged on certain lines. Such lines were made use of in every case. They were so drawn through the forms as to make familiar forms themselves, and were dealt with in the same way as the forms they located.

2. *General Analysis of the Nature of the Imagery and of the Process of Recall.* — In considering the results of this section it will be helpful to keep in mind the fact that in order to draw the form again just as it had been seen in the original the immediate thing, the only thing really necessary was a correct visual image of the form. All the rest could come in only as a means of getting that visual image, and of recognizing it as the correct one. I shall attempt first a general analysis, disregarding for the present two large factors that were found to influence the nature of the imagery, viz., the nature of the form to be recalled and the time elapsed since the last. In this I shall

consider in order the visual imagery, the associations, the verbal descriptions and the motor impulses, and describe their nature and relations when a definite recall is the result.

(*a*) *The Visual Imagery.* — After the first sitting the subject never imaged the forms in the color of the original. In most cases he was quite unaware of the fact that the originals had been in white on black. Generally they were described as colorless when questioned on this point, or that the color in the image had never been noted. Undoubtedly this was due to the fact that no demand was made on the subject to remember colors. In some cases the subject visualized the page in proper size and form and the different forms would then be visually located on it. But quite as often perhaps the group as a whole was described as being visualized 'off in space,' or 'off at reading distance,' with no particular consciousness of the relations of forms to the page. Whatever the nature of the visual was in this respect probably depended mostly on whether or not the subject specially related one or more of the forms to the edges or other portion of the page as a means of remembering its relative or absolute position. Some sort of a visual representation of its position was the most frequent immediate antecedent to the visual image. In those cases in which the recall took place with the aid of an associated name or equivalent, the association generally followed the idea of the position of the form with which it was connected. Thus the subject nearly always stated that he knew where the form belonged before he had any further clue to its recall, and only several instances out of about a thousand are recorded where the form was recalled without a memory of its position preceding. With this much given, several grades of spontaneity of the visual image of the form itself might be described. Beginning with the most spontaneous are the cases in which the visual of the whole form comes out in a flash as soon as the recall is attempted, and in such completeness of detail as to seem absolutely perfect to the subject at once. Next in spontaneity are the images that show a distinct course of development. According to the nature of the form, it may come up in parts with time intervals between the visual recall of the different parts, or

it may develop gradually and evenly from one end to the other. A third class are those in which there is a considerable interval between the visual image of its general position and that of the form proper. The subject knows where the form belongs, but there follows some time before he gets a complete visual image of it. That interval may be entirely blank as far as any clue to recall goes, or it may be filled with one or more of such aids, visual, or in other terms. Recall with the presence of such an interval was the most common form. A fourth class was frequently noted. In these the attitude with which the subject approached the form was also characteristic. When the subject felt assured at once that he would have no trouble at all in recalling the form, he would not stop to get a complete visual image of it before he began to draw. The image would then develop part by part or in a continuous manner as he drew it, running a little ahead of the drawing. The character of the visual image varied also with reference to the ways in which the recognitive consciousness entered. The memory sanction might come in at once with a ready and complete appearance of the visual image. Or, the image might develop in wrong directions, more or less similar, that would be at once recognized as wrong. Sometimes the subject would state that he purposely tried on a number of different images to see which seemed most correct. Closely related cases were those in which the form was drawn from a tentative image and its correctness or wrongness recognized only after the drawing. This was a very common procedure throughout, and occurred especially with difficult forms and in the latter recalls. The subject might fail to decide whether a form as visualized was correct until he could actually see it on paper, when recognition might be quite prompt and decisive.

(*b*) *Uses Associations and Verbal Descriptions have in Common.* — The associations and verbal descriptions that were made have several things in common which may be noted before considering them separately. In the first place, both were used as aids to the recall of the visual image. When the direct recall of the visual failed the recall of an association or verbal description made at once sufficed to produce the visual image sought

for. Secondly, associations and verbal descriptions might come in after the visual had already appeared. In these cases they might reinforce the recognitive sanction of the visual image. They would come in to verify the visual, and the subject would then feel doubly assured of its correctness. Thirdly, either or both might follow the visual image without adding anything to the recall or affecting the recognitive state. They would then be regarded by the subject as a useless addition to the total process which might have once served its purpose but was now of no further value. Finally, both might be so very closely bound up with the visual, and be of so incipient a character as to make it impossible to decide certain aspects of their relations from introspection. The statement that the subject does not know whether the visual preceded or followed association or verbal description, that he does not know whether the latter were present at all or not in recall, or what use was made of them if they were present, occurs very frequently in the notes. In harmony with this is the very common observation that they were much in the background of consciousness, with the visual as the prominent and main process. This does not mean, however, that there were not plenty of instances in which these relations and the use made of the associations and verbal descriptions were perfectly clear to the subject. We may consider the associations and the verbal descriptions separately now very briefly.

(*c*) *The Characteristics of Associations.* — Several forms of associations and grades of closeness of connection with the visual image of the form can be made out. The association might be in the form of a visual image of the associated thing. There was then a real duality of visual imagery, and the name of the associated thing might not come in at all. But more usually the connection was closer than this. There would not be two visual images, that of the associated thing serving as a cue to the recall of the actual form and as a pattern to model it by, but the associated thing would be read into the form which was then usually named. Thirdly, the connection might be remote. The form might be named with the feeling that there was but little justification for the name. The name was then usually

the most prominent thing in the association. Fourthly, an emotional reaction giving meaning and familiarity to the form was sometimes present when the subject denied the existence of an association of any sort. While the association proper, visual image or verbal, had always the effect of adding this emotional complex, the latter might exist alone. It was quite common, too, for that feeling to precede any trace of a visual image of the form. In such cases the subject would describe his experience as that of feeling that he knew the form, of feeling sure that he would recall it in a moment, while yet he failed to do so. There was a different atmosphere surrounding the different forms that gave each more or less an individuality of its own, which caused the subject to approach the recall of the forms with different attitudes. While this was not marked enough in many, perhaps in most of the cases to receive special mention by the subject it seems very feasible that this emotional complex played a large rôle in the actual recall of the forms. But its analysis or even the determination of what part it played in recall was beyond the methods of the present study, and no special efforts were made in that direction. Whatever the form in which associated processes appeared, their general use as means to recall was to serve as cues to the recall of the visual image of the form as a whole, and in this respect, whether in terms of visual or verbal imagery, differed from verbal descriptions as a class. Considering only those cases in which they were thus means to recall, the associations aided in bringing up a general, often indefinite visual image of the form as a whole, or of the parts to which they were attached. As the subject often stated, they prevented the form from being forgotten altogether. They did little further towards filling in the details. These had to be recalled for the most part by other methods. The degree in which this was the case depended, of course, on how closely the actual form resembled the thing associated with or read into it.

(*d*) *The Characteristics of Verbal Descriptions.* — The part played by verbal descriptions in the recall of the forms can be inferred largely from what was noted above as to how they were used in learning the material. They were used for the forms

and parts which the subject found difficult to learn by merely looking at them. In a very rough way they entered the later recalls in the ways they had entered in learning the forms in the first place. The difficult parts were as a rule not recalled directly in terms of the visual, but the visual was built up through a recall of the verbal descriptions. Unlike the associations, however, they were rarely used for the recall of the visual of the form as a whole. They applied to the details after a general visual outline or pattern was already present; an outline that the subject at once regarded as only an outline in need of corrections and completion. They played their part further in getting the visual corrections for the associations made, so far as the latter varied from the actual form. And again with the forms that were more or less difficult throughout so that hardly any visual image of its general outline preceded, the recall of verbal description might come in almost at every point in the form. Special mention should be made here again of the very incipient character of the verbal descriptions in which they so often appeared. Apparently there was a very strong tendency for all but one of the subjects to describe incipiently the characteristics of a form in a visual image as he noted them. To attend to such characteristics meant largely to thus describe them.

(*c*) *Motor Impulses.* — It was observed that the development of the visual image might be gradual and continuous from the beginning to the end of a form. This carried with it a strong tendency to a corresponding eye-movement. As the image developed the eyes incipiently followed its progress. In some rarer instances this tendency to eye-movement assumed a greater independence of the visual image. In these the subject described himself as 'feeling' that the form extended in a certain direction, or that the eyes moved back and forth several times from one point to another with the expectation that the visual image would appear accordingly without it doing so at once. About the same is to be said of tendencies to hand movements, the movements of writing or of drawing. These were less frequent but with one subject seemed to be more prominent than the eye-movements when they were present at all. About

the part these motor impulses played in the recall of the visual very little can be said. There were not very many instances in which the subject stated that they preceded the visual. Their simultaneous appearance with the visual was the rule. The inference might be, therefore, that they were, so far, not aids to recall. However, the observation was made a few times that they not only preceded the visual but were the means of its recall.

(*f*) *Relation of Factors when Recall is Uncertain.* — There remains to be considered some of the ways in which these different factors in recall are related when the recall is uncertain. Recall might be uncertain because of a rivalry, when some sort of memory sanction went with each of two or more factors that conflicted. Or, it might be uncertain in the absence of such rivalry, from other causes. To the latter naturally belong by far the larger number of cases of uncertain recall. There are, of course, many instances in which the subject has tried on all the methods of recall, has brought in all the aids without complete success. The last resort in these instances is generally visual recognition. The form is actually drawn from a tentative image to see how it looks, and then re-drawn a number of times to make it look more satisfactory. The final outcome of such a procedure was often the statement of the subject that the drawing looked wrong but that he did not know where or how to change it so as to improve it. A special instance of this kind that was quite common were cases in which a description on account of its ambiguity was itself inadequate for the recall, and recognition remained indifferent to the several different visual images that might be constructed. A real conflict or rivalry between the different factors or between different imagery of the same class occurred in several different ways. In these a distinct memory sanction went with more than one construction of the form and resulted in uncertainty as to which was correct. This might occur between two visual images. A form or part might look right when taken by itself, but when considered in relation to some other form or part it might appear wrong as imaged or drawn, and seem right some other way. More frequent were the conflicts between the visual image of a

thing associated with a form and that of the actual form. Here of course, no separate and definite visual image of the actual form would be present, but rather the subject would feel, recognize, that the form as he imaged and drew it was too much like the associated thing, while yet there was something about the former that tended to make him accept it as correct. Still clearer cases of real conflict were those in which a visual image would come up and by itself be regarded as quite correct, while at the same time certain verbal descriptions recalled would contradict the visual image. Quite a number of these cases occurred and in many of them the subject in the end gave up the recall with the statement that he did not know whether visual image or verbal description was correct.

3. *Dependency upon the Nature of the Form.* — We may turn now to a special consideration of the factors already named that influenced the nature of the imagery. The forms as given could be roughly classed into three groups. (*a*) The familiar form with some alteration attached. (*b*) The continuous irregular curve. (*c*) The several-part form of simple straight and curved lines.

(*a*) *The Altered Familiar Form.* — The familiarity of a form depends of course on the degree of the subject's success in reading meaning into it. First in this class were the altered geometrical forms and I shall limit the description to them. The subjects, without exception, regarded these as easy forms. In learning the group they were at once recognized and picked out as such, and but little time was spent on them. The exact nature of the basis for this faith that they could be easily remembered seemed peculiarly hard to determine. It was not the presence of the association, the name of the form, nor a general visual image of an associated thing. These were in by far the majority of cases quite in the background or entirely absent, and did not affect for this reason the feeling of the subject towards these forms. It was rather a distinct characteristic emotional attitude together perhaps with certain characteristics of the visual imagery itself. No further analysis was made of this. In the recall of the form this attitude was a part of the recall. The subject approached it with ease, and certainty that there would

be no difficulty. With the general clue to recall given, described before as some sort of visual representation of its position on the page, the subject would at once know its general character and that the form could be recalled at will. The visual image would be described as easy and very spontaneous. It would come up in a flash and stand out as a whole in clearness, in a definite, unambiguous, unwavering character. Or, it would come up part by part or develop continuously as it was needed while drawing the form. In the latter the subject was so certain of its recall that he seemed to deem it not worth while to go to the trouble of first getting a complete visual image of it before beginning to draw it. Cases of this sort were very frequent with this class of forms. Whatever the character of the direct visual image, the nature of the recognitive sanction was the same. It was immediate and decisive. There was no need of resorting to the recognitive method, drawing the form and then re-drawing until it looked right. All these characteristics, however, hold true only of the main parts of the form, of it so far as it corresponded to the familiar geometrical form that was read into it. The recall of the alterations was quite different. These constituted the details, and in learning and in recalling them verbal descriptions entered in the same ways as they did for any other kind of form.

(*b*) *The Continuous Irregular Curve.* — In most of its essential characteristics the imagery and process of recall for the form that consisted of a continuous irregular curve was strikingly different from that just described. These forms came nearest to remaining entirely meaningless. They were at once recognized as hard to learn, and received special attention. With the general impression of meaninglessness went a special effort to read meaning into them, which was found difficult. When an association with the form as a whole was made it usually needed so much revision as to be of little service in recalling anything but the roughest outline of the actual form, and for this it was hardly ever needed after the extra time spent in trying to fix it visually. Characteristic in learning them was the abundant use of verbal descriptions. The fixing of the visual had to be helped out at every point by description. In the

recall later the attitude present in learning reappeared. They were approached with the feeling that there would be difficulty in recalling them accurately. The next thing then in the recall was visual imagery, direct, perhaps quite as often as some association or general description. The visual might be an indefinite, wavering image of the form as a whole. Or, it might start at a certain point in the form and then slowly develop through for the rest, with many hitches, ambiguous, and uncertain places. When it came up as a whole certain loops or large turns in the curve would stand out roughly more prominently than the rest, with only a vague consciousness of connections or other parts, and of their general position in the form relative to the parts that stood out more clearly. This much might come up quite readily. The form as a whole might be fairly easy to recall. The difficulties came in attempting to fill out the rest. The general character of the procedure in the other form of development of the visual image, when it developed slowly from one end to the other, was not so much different in its essential nature. In this case, too, the image would be made up of prominent, more or less clear, and indefinite, unstable parts. In both instances the recall of verbal descriptions came in at the points where there was hesitancy and difficulty in the visual imagery. It did not, however, enter so abundantly as might have been expected from its extensive use in learning the forms, although it was still much more frequent than in the recall of the other forms. Strikingly characteristic was the recognitive method of recall, one that in general was applied when all other aids failed.

(*c*) *The Several-part Form of Simple Straight or Curved Lines.* — In its more important aspects the recall of these is of an intermediate nature to that of the two classes of forms just described. It is a form made up of familiar, known parts, and to that extent it is easy. But the parts are put together in an unusual way, and in this respect the form is hard. The first thing characteristic about their recall was the frequent use of associations for the form as a whole. In the first class of forms, the familiar geometrical, the visual alone was so self-sufficient in the recall that the associations were rarely made use of. In

the second class the form was so irregular and unusual as to make it very difficult to read any meaning into it. In this third class the association with the form as a whole was both possible and necessary. With these they came in more than with any other as real means to the recall of the form as a whole. In accordance also with what we might now expect, the recall of the parts was easy. They needed no descriptive or other aids to decide their exact nature. The aids to recall were used in getting the relations between these parts, the ways in which they were put together. Thus the subject would seldom fail in recalling all the parts with certainty, but would often be very uncertain about their relations. Here the verbal descriptions, the special associations and the purely recognitive method were all employed because they were found necessary. There was more occasion for the description to be ambiguous. The subject would often recall in descriptive terms that a form was made up of certain angles, curves, straight lines without any further recall of their relations. The visual imagery in the recall had only one point that was characteristic of this class. It was more distinctly broken up into parts than was true of the other forms, as a rule.

4. *Dependency upon Repetition of Recall and the Lapse of Time.* — The time intervals between successive recalls of a group were short for the first few, and very much longer for last recalls. The differences that were found to go with these conditions were great enough to be distinguishable at least into three grades or classes, and I shall attempt to describe them in this way. The second stage will show the influence of repetition of recall after short time intervals. The third will show the influence of long time elapsed during which the forms were not thought of at all. It is not to be understood, of course, that a certain kind of recall always went with a certain time interval, nor even that the memory for each form passed definitely through the three stages to be described. All that the results show is a constant tendency in the same direction. Whenever changes occurred, and there did in most cases, they were of the same nature. But in the individual cases the recall of some forms could never be classed under the first, while that of others never reached the third stage.

(*a*) *First Stage.* — The cases that fall under this class are limited almost entirely to the first recall of a group. Its main characteristic is the rapid dropping out of the verbal descriptions used to fix the details that had been specially noted. During the ten minutes allowed for learning the group many such descriptions would be made to fix the visual. Half an hour or so later in the first recall it was a very common observation on the part of the subject to note that he had used many descriptions in the learning which now were not made use of in the recall. He recalled the forms directly in the visual, with the recall of the descriptions following, or with merely the recall that some descriptions had been used but were already forgotten. This was much less true of the associations that were made with the forms as a whole. Such an association was but very rarely forgotten during the first sitting. It was also more apt to be really used as a means to recall at this time than it ever was later. The visual imagery was of an average spontaneity. Much of it came up only through the recall of associations and verbal descriptions. With this recall went only about an average degree of certainty on the part of the subject, perhaps even less.

(*b*) *Second Stage.* — The main characteristic of the second stage is an increased spontaneity of the visual imagery and the relative absence of associations and descriptions as aids to recall. The forms are recalled for the most part directly in terms of visual images, and the corrections and revisions to be made in the first image take place without descriptive or other aids. Further characteristics of greater spontaneity of the visual image are its more ready appearance, with less pauses, and less hesitations as to correctness. There is an immediate and greater certainty and satisfaction. The associations and descriptions that do come in are more apt to follow than to precede the visual, and the greatest use that they can have is to strengthen the recognitive sanction that goes with the visual image. This they may do, but the cases in which they are regarded by the subject as entirely useless in the recall are most frequent in this stage.

(*c*) *Third Stage.* — The last recalls show the marks of a

partial loss of memory of the forms. The first of these is a general inefficiency of the visual imagery, and a lack of spontaneity. The recall is more likely than before to be preceded by an interval in which neither a visual image or any aid is recalled. When a part of the visual arises it proceeds more slowly in its development, is more apt to be broken up into parts with time intervals between the recall of the different parts, and with decidedly more wavering and hesitation as to the correctness of what comes up. Several slightly different images are apt to arise, having attached to them hardly any recognitive sanction. The recognitive method is more frequently resorted to. The subject's attitude towards the form as he finally draws it is also characteristic. It is likely to be either that of indifference, or of uncertainty. In the first stage he may be uncertain, but rarely indifferent. In the second he is generally certain. This indifference means that a visual image of a form comes up perhaps with relative ease and absence of rivals without any definite or strong memory sanction going with it. There is nothing to suggest that it is wrong, and in connection with the other characteristics its correctness is taken as a sort of matter of course. It is of the nature of the cognitive instead of the recognitive state. With the difficulty to recall the form at once in purely visual terms goes the attempt to find aids to the recall. The associations for the form as a whole are likely to come in again as a real aid. Aids are found more necessary for the recall of the details, but here the subject finds that he has forgotten much of the verbal descriptions once used. He may remember at what points they were used before but have forgotten what they were. This is quite common. The recall of false descriptions is also characteristic of this stage. Often the subject stated that he recalled a certain description when that description did not fit the original form as presented to him at all. These are probably mostly instances in which he had on previous occasions descriptively noted certain characteristics of his visual images, cases in which these images were wrong. In some instances they are descriptions of previous drawings that are wrong. Finally, these last recalls are characterized by a greater frequency of rivalry between the different

factors in recall; rivalry between the different visual images, and between a visual image and a verbal description.

5. *The Errors Made.* (*a*) *Their Relation to the Subject's Attitude.* — The errors made by the subjects in the drawings of the forms should be considered in close relation to the foregoing description. That will make many of them already intelligible, and a further consideration of their causes will throw additional light on the nature and analysis of the memory consciousness. It would be natural to suppose that the errors would be most frequent at the points where the subject found the most and greatest difficulties in learning the forms, and again in the recall where he was not certain of the correctness of his results. But, as a matter of fact, there are so many important exceptions to this that neither of these generalizations would be valid. It is true that errors occurred most for the minor details, and these were the things for which the visual imagery alone was found most inadequate, for which various descriptive aids had to be brought in. But this was not true of all details. And again, it was often in the forms that the subject called easy that he made the most and greatest errors. The frequency of the errors made, therefore, has no regular relation to the subjects' feelings of the ease or difficulty in learning the form. At certain points the subject was especially aware that he was probably making errors, and in a few instances he even noted a possible cause of error. Of the details of the form made up mostly of one continuous irregular curve the subject was as a rule more or less uncertain. In this his memory judgment was usually correct. Errors were frequent here. But errors were perhaps quite as frequent in some other kinds of forms in the recall of which the subject was entirely unaware that any could possibly have occurred. There was, therefore, no regular relation, either, between the frequency of errors and the subjects' degree of certainty and the correctness of his recall.

(*b*) *Their Permanency.* — A cursory examination of the results suggests a two-fold classification of the errors. First, on the basis of the permanency of the error after it once appeared, and of how it changed when it did not remain constant in the successive drawings. Second, on the basis of the causal

factors that are evidently at work in producing them. Briefly followed out, this scheme will make their description complete. Something may also be suggested at the same time towards accounting for their permanency or variability. By far the majority of the errors that occurred were present in the first drawings, and remained more or less constant throughout the successive recalls. This was unquestionably a consequence of the conditions of the experiment. The subject had only ten minutes to look at the original forms. During the first sitting and again in each following one he had occasion to look at and consider his own drawing of it for about an hour. Thus the later recalls were perhaps recalls of the previous drawings as much as of the originals. All the errors, therefore, that appeared in the first drawings would be permanently fixed and regarded as part of the original ever after. A much smaller number did not remain permanent. In some of these the changes took place in a constant direction. The error would remain the same in character, but increase in degree in the successive recalls. In others the error changed in character, or at least did not simply increase in the same direction. In cases of the latter class the explanation of their behavior is by no means entirely clear. It can for the most part not be safely inferred either from the drawings or from the introspective notes. The notes are not always complete enough to include full reasons why a particular part in question was drawn just that way. When the changes in the errors were all in the same direction the causes were in nearly every case quite readily determined. These need not be taken up separately at this point. In the following classification and description of the errors according to their causes, the latter are taken up in the order of frequency with which they produce errors.

(*c*) *The Errors According to Their Causes.* — It might be supposed that an inference as to the cause of any memory error would necessarily be very unsafe. Our memory consciousness is so very complex and the number of different possible causes in any given instance so very great that we should hesitate to say anything about what the real cause was in any given case. On merely *a priori* grounds this attitude would

be quite the correct one. But the nature of the results in this case is such as to dispel this difficulty. At least those causes that will be enumerated are perfectly clear.

(1′) Ambiguous Verbal Description: A small number of errors resulted from ambiguous description. The subject might, for instance, note that a form was made up of certain familiar parts, curves, straight lines, angles, etc. This in itself would make the form seem easy. But when he came to the recall of such a form later he would often find that the relation of the parts had not been sufficiently observed. He would recall the names of the parts and their exact visual imagery quite readily. But he could not put these parts together so as to be recognized as correct either from the visual imagery of the separate parts or from the descriptive names. Again, a form might be described as large or small in relation to some other, or a position might be described ambiguously in relation to some standard, as out of the vertical, or horizontal, or not quite parallel or perpendicular, as far or near; or the nature of a part be described as curved or angular. These descriptions were indeed aids to recall, but since the recall through them could never be more accurate than the descriptions they sometimes left room for a wide range of error.

(2′) The Influence of Associations: The influence of an association as a cause of error has already been suggested. This was quite common in the cases of an association with the form as a whole, in fact, it was the rule when a definite use was made of the association in recall. That influence consisted simply in changing the form as recalled so as to resemble the associated thing more than the original form as presented did. The change tended to take place gradually. Apparently the subject forgot gradually more and more the points of difference between the associated thing and the real form, so that when in the later recalls the association was still made use of the visual image of the associated thing took the place of that of the real form without any suggestion of error to the subject. Out of quite a list of illustrations of this influence there were very few clear instances in which the subject was suspicious of it. In these that suspicion consisted merely of a vague feeling that

surely the real form was not so much like the associated thing as drawn, while at the same time when the drawing was considered by itself with no special attention to its great similarity to the associated thing it seemed quite correct.

(3′) The Influence of Certain Standards in Forms, Positions and Relations: A third source of error is quite similar to the influence of associations, but appeared in a variety of ways, or consisted perhaps of slightly different factors. These may be enumerated separately without a special consideration taken of the characteristics they have in common, for these will be evident enough. First among them to be mentioned are the standard, simple geometrical forms. In the cases where the form or a part as presented very much resembled one of these the small differences tended to drop out in the later recalls. A special instance of this that was very frequent was the part of a form that consisted of a slightly irregular curve. The irregularities dropped out making the part a smooth even curve. This might be the effect of an association were there not so many cases of this sort in which the subject denied that the idea of the geometrical form had at all occurred to him, and were there not so many quite similar cases in which no such association was possible. These similar cases are instances, first, in which errors in position of a form or part occurred. A line that was not quite vertical or not quite horizontal in the original form tended to be recalled as just vertical or just horizontal. Secondly, the parts of a form tended strongly to take on certain standard relations to each other. Parts that were not quite parallel or perpendicular to each other tended to be drawn just parallel or just perpendicular. Thirdly, parts that were not quite equal in length tended to be drawn equal. Fourthly, parts tended to be arranged symmetrically where no exact symmetry existed in the original, in some instances changing the nature of the parts considerably at the same time. Crossing points were placed at the middle when in the originals they were a little away from the middle, or were placed at the ends when in the original they were not quite at the ends.

C. Discussion.[1]

This study was made in the spirit of Titchener's recent reassertion that the best way to make a mental analysis is to appeal to consciousness directly, rather than to use the psychophysical methods in which the analysis is an inference from objective data instead of the introspective.[2]

Memory studies in which the former methods have been used are numerous. These have clearly established a number of things, first among them in importance for our present consideration being the fact that very much less can be remembered of a material that is very simple in its nature than of a material that is more complex. The inference also from this that the amount remembered depends in the first place on the number and closeness of associative connections with the material and between the different elements of it is undoubtedly largely correct. But it is wrong in so far as it overlooks the extent of the influence of the other factor which introspective observation brings out. The few results of the present study show clearly enough that associative connections are a great aid to recall, if any further proof of this were needed, but they also show that the matter of inherent spontaneity of the imagery directly concerned in the given material is an aspect of recall equal if not of greater importance than are associations, and that spontaneity is not necessarily dependent upon associative connections if introspective observation is to be at all relied upon. The familiar geometrical forms were the easiest to recall, but also those for which the subject was most apt to deny the use or presence of any associations whatsoever. Again, the spontaneity of the imagery in the three stages described varied independently of the frequency of the use of associations. The second stage, *e. g.*, showed the greatest spontaneity of the visual imagery, but the least use of associations. To what extent spontaneity is to be attributed to what psychologists have usually called the influence of repetition needs no discussion

[1] For a summary of results see pp. 343 f., if this is desired, before considering their discussion.

[2] Titchener: 'The Problems of Experimental Psychology,' Am. Journ. of Psych., 1905.

here. The interest in this kind of fact lies not in its cause, but in what evidence it gives in favor of one of the two opposing theories of recall, the theories, viz., that all recall is mediated through some associative connection, and second, that recall is sometimes of a spontaneous origin, thus breaking the associative continuity of mental processes. In this connection it is to be borne in mind that the associations made use of in the recall of the forms in this experiment were not associative links between the different forms of the group. They were associations with one or the other particular form and were entirely foreign to the rest of the group. The only reason why they could come in at all was because they could be more easily recalled directly than the forms themselves with which they were associated. In other words, the imagery of the associations possessed a greater spontaneity than did that of the form itself. In all these cases we have instances in which the mind makes use of the fact of greater spontaneity of certain imagery to insure recall of the thing with which it is associated rather than depend on the law of contiguity for the recall of the other forms of the group. In the present study indeed the latter was found again and again entirely inadequate for the purpose of recall. Nearly all the characteristics of the recall were not such as pointed to associative connections mediating the results, but the ways in which the imagery came up indicated rather that it depended much more upon its own inherent nature and organization. To say, then, that a complex material is better remembered than a simple because of more associative connections becomes in the light of this consideration not more than a half truth. The complex material is at the same time the material that has been most frequently an object of consciousness. The fact that small differences in sense qualities, *e. g.*, can be remembered but for so short a time may be due more to less spontaneity than to less associative links on account of the simplicity of the material. The objective results of psychophysical methods have carried the analysis further by showing that more is remembered of a given material if the subject is allowed while learning it to (*a*) articulate the associated names, or is allowed (*b*) certain motor processes of hand movements at the same time while he is look-

ing at the material; or if (*c*) the material is presented jointly to more than one sense than when it is presented to one sense alone. This involves more than merely the increase of associative connections. The results of the present study are in harmony with all and they verify the first two. We have seen what part verbal description and associated names play in the recall of the material used, and also, to some extent, how motor processes come in. The objective methods of Stern and others have also already taught us much on the degree of normal memory illusion, and have indicated some of the external conditions on which that degree depends. My results do not give much on the *degree* of memory illusion. But they give at least equally important data; they show something of their nature, and very distinctly some of the causes that produce them, and, in my opinion, establish the validity and greater usefulness of the method for working out their whole psychology.

These are all the general points of any significance that the results of this study have in common with others in which introspective observation was not made use of. Let me turn now very briefly to their further interpretation. Limited as the results are to the mental imagery and memory of meaningless visual forms, they cannot go very far towards an analysis of the memory consciousness in general. Their significance should be judged only in the light of the much larger program for this general method of approach. If we had much more extensive results not only for visual material of different kinds, but the same also for all the other sense departments, we have reason to suppose that they would give us a far better understanding of this whole question than the results of objective methods ever could give. At the same time a few points of general significance that even this study has brought out may be considered here. The analysis has not merely shown the existence of certain associated processes in the recall of a material that is presented to one sense alone, but it has gone a considerable ways towards determining at just what points, in what ways these processes enter, and what their exact function in the memory consciousness is. In the present experiment the tendency is for the material to be recalled directly in terms of

imagery that belongs to the sense to which the material was presented. This is the simplest expression of mental economy. It indicates that, so far, nothing enters consciousness that does not serve directly the end desired. But the visual imagery was found so inadequate for its purpose that at many points associative aids had to be resorted to in order to reëstablish the visual in its full integrity. With the frequent repetition of the recall the visual attains a greater degree of spontaneity. This, taken in a large way, is a gradual process, during which the associative and other aids recede step by step. They first come in as aids to the recall, then only to reinforce the memory sanction that goes with the visual image that is already present, then cease to do even this while yet they enter, and finally drop out altogether. This gradual elimination of the aids to the recall is another expression of mental economy, which culminates at the point where the subject not even goes to the trouble of first getting a complete visual image of the form, but begins to draw at once from the first suggestion, letting the visual image develop as needed while drawing; or, if the few observations on this point are to be taken as indicative of the direction in which the truth lies, it culminates where the subject draws from a motor memory, where he denies the presence of anything that can be called a visual image.

This strong tendency for the mind to follow 'the line of least resistance' is reflected again in the character of most of the errors that are made. These can almost all be described by the one general characterization that an easier visual image that is more or less incorrect is substituted for the correct image of the actual form which would be more difficult. At least this description applies to all those errors that are not due to errors in the aids to recall, but are connected directly with the visual image. The visual image constantly tends to take the form of one that possesses the greater spontaneity. It tends to the visual image of the association that is made, an association whose only reason for existence in the first place, as was just noted, is the fact that it possesses a greater inherent spontaneity than does the exact visual image of the real form. It tends to certain standard positions and relations, such as the exact vertical, the horizon-

tal, the symmetrical position, in each case undoubtedly because these relations are more easily held in mind and recalled than the exact amount of variation from such a relation would be.[1]

This brings us to a second matter of general significance which the results clearly indicate — the degree of resemblance between the inner organization of the memory imagery and the process of recall on the one hand and that of the perceptive experience on the other. There is still a tendency in psychology to accept the naïve conception of memory consciousness as weakened copy of original perception with a recognitive factor added. Perhaps there is no great need any more of combatting this conception. But it may be well to let such results as those of the present experiment remind us of the degree and ways in which such a view is a misconception. Compare on this point again the kind of consciousness, its content and organization, involved in learning the material with the kind of consciousness involved later in the act of recalling that material. Certainly the process of recall is not a weakened repetition of the process of learning. The total process of recall in the later instances was a quite different thing from the first recall immediately after the presentation of the material, and between these, for the different time intervals, were found many variations in that total process. Further, these variations had a wide range, not only for the different time intervals and the frequency of the recall, but were influenced also by the nature of the form. Nor can it be said with much more validity that the final result of the recall, the completed imagery that is used in drawing the form again from memory, is a weakened copy of original perception. In striking contradiction to this view is first the fact that in many instances no such completed image came in at all in drawing the form. Consider in this connection the differences in the nature of the visual image accordingly as the form was a very easy and familiar one, or, on the other extreme, was the very meaningless continuous irregular curve. Yet, on the side of

[1] This is in close harmony with Leuba's hypothesis, which Stratton also accepts and elaborates, that our memory tends to the more usual and common in our experience. Leuba, 'A New Instrument for Weber's Law, with Indications of a Law of Sense Memory,' *Am. Jour. of Psych.*, Vol. V., p. 370. Stratton, *Experimental Psychology and Culture*, New York, 1903. Ch. IX.–X.

mere perceptive experience there could be no great difference between the form that was easy and the form that was hard to learn and to remember. The characteristics of the continuous irregular curve were as easy to perceive as were those of the simple square or circle. With the same visual perceptive experience we find the visual memory image at times more or less adequate for the purpose of drawing the form again correctly, at other times we find it hopelessly inadequate. And again, the visual image might be regarded by the subject as 'good' while his drawing is quite inaccurate, and *vice versa*. Less intensity and vividness is among the least of the characteristics in which the memory imagery differed from its perceptive experience. Lastly, the function and importance of what is usually termed the 'recognitive factor' is not adequately described by calling it merely an added factor in the sense usually meant. It enters into the inner organization of the memory consciousness at every point in the recall, rejecting here and accepting there, thus determining the whole course of recall and the final product together, as well as being a mere reaction to that product when already present. Whatever the elements are in this emotional reaction, it is a reaction that enters before as well as after the image is completed. In addition to this there is another 'added factor' that is perhaps closely akin to the recognitive. This is what has been described as the characteristic attitude with which the subject approaches the recall of the difficult and the easy form. The emotional reaction that is characteristic of expected ease or difficulty of recall is often a very prominent factor after the first clue, such as the indefinite visual representative of its position, is given. Nor is the subject indifferent in this respect at any point in the recall. Every step is wrought with tinges of emotional reactions to what else is going on in consciousness, although this may often escape the subject's notice because of its nature it is difficult to analyze out and describe. The original perception of a form may be a very 'cold-blooded' affair while its recall from beginning to end is alive with a content that did not enter into the original perceptive experience. In a word, taking all these several matters into consideration, it must be observed that what we have called the total process of

recall is very largely not recall at all, and can never be described even half correctly by calling it reproduction. It is rather a construction, not a reconstruction, a construction of a certain result that is accepted in place of the original, and far from a reconstruction of a past perception.

D. Summary.

In learning the forms the subject alternately noted their characteristics and then tried to recall them. This was a method of determining difficult points and to these special attention was then given. They consciously sought for associations for a form as a whole, and, less frequently, for certain distinct parts of a form. These associations served as aids to the recall of the form as a whole or of the parts in question. A second general aid for fixing, and for recalling the visual image of a form was verbal description. This was used for the most part at the points where special difficulties were found, for the minor details, and for necessary corrections in associations that were used.

In the recalls the direct visual imagery showed distinct grades of spontaneity, and differences in the order of its development. With the somewhat indefinite visual representation of a form's position given, its visual image might flash up at once as a whole, clear and distinct and without any alterations taking place. With these acceptance as to correctness was mostly immediate and complete. In other cases a certain interval, variously filled, might follow the first recall of its position before anything about the form would come up. The visual image of the form itself might develop slowly, in a fixed order from beginning to end, instead of all parts simultaneously. In this gradual development several similar images might come up one of which is finally kept as correct or nearest correct. With those not kept usually went a slight memory sanction, a recognition that the real form was something like this. Sometimes the subject guided his imagery purposely in this way as a means of accurate recall when there was some difficulty. Or, instead of this sort of gradual development, the image might simply stop at certain points, and after some hesitation proceed again

in a direction that was accepted as correct. For particularly easy forms the subject would be apt not to go to the trouble of first visualizing the form in all its details before drawing. The visual image would come up part by part, or in other ways as needed while drawing. For particularly difficult forms or parts the subject resorted to the recognition method. He would do the best that he could with his visual imagery, draw the form accordingly, and then decide from the looks of his drawing at what points it was wrong, and re-draw it until it looked as satisfactory as he could make it.

The uses made of associations and verbal descriptions have certain things in common. Either might be used as real aids to recall the visual; it would be recalled first, as a means of suggesting the visual. Or, either might be recalled after the visual image had already appeared. In this case it might strengthen the memory sanction as to the correctness of the visual, giving added assurance, or it might leave the recognitive state entirely unaffected, coming in as an entirely useless factor in the process of recall.

The association, as a rule, was connected with the form as a whole, and was a means of preventing it from being forgotten altogether. It might be in the form of a visual image of the associated thing, or consist merely of the name of the thing. Various degrees of closeness of connection existed.

Verbal descriptions were used for the most part for minor details, for the relations of parts, for the positions of crossing points and endings of lines, for corrections necessary in the associations made, etc., and sometimes for a general description of a form as a whole, approaching more in this case the nature of an association. They were quite apt to be of a very incipient character, so that the subject was not always certain whether they had come in at all, or what use had been made of them.

Certain motor impulses were sometimes described by the subject. These consisted of tendencies for the eyes or hand to move along the form as it appeared in the visual image, in the direction and order followed in the drawing. In a few instances these preceded the visual image and were regarded by the subject as real aids to recall.

Two large factors present influenced the character of the recall and the nature of the imagery. (1) The nature of the form. (2) The frequency of repetition of recall and the time elapsed. The recall of the altered familiar geometrical form the subject approached with a characteristic attitude, a feeling of ease and certainty that there would be no difficulty. The visual image came up readily, unwavering in character and was at once accepted as correct. Associations very rarely were needed as aids to recall, and as a rule remained much in the background of consciousness. Descriptive aids for the alterations in the actual form from the familiar geometrical were used here as in other forms to recall details. The forms consisting of a continuous irregular curve were the most difficult and their recall approached with an attitude the opposite in character to that in the preceding. Associations were specially sought for but difficult to find. Much verbal description was needed for the various details in the curve. In the recall a first very general and schematic visual image, which was at once regarded as such by the subject, might be quite easy and spontaneous. Special and great difficulties were then found in recalling the details, in which the recall of verbal description generally came in as an aid, and for which the resort to the recognitive method was frequent, with the final result often uncertain. Or, the visual for the form as a whole might develop in order from one end to the other, with the hesitancies, resorts to aids, and uncertainties entering at the difficult points of details. The recall and nature of the imagery for the several part forms of simple straight or curved lines was in a way intermediate in character between the other two. In these the parts were familiar and easy, but their relations unfamiliar and difficult. Associations were found necessary and also possible. Their use as real aids for the recall of the form as a whole was frequent. The recall of the parts by themselves was relatively easy, but their exact relations difficult and aids often resorted to.

The influence of repetition of recall and of the time elapsed was great enough to make distinguishable at least three stages. The first is characterized by a rapid dropping out of verbal descriptions as aids to recall which had been used in the learn-

ing, while yet they come in as real aids more abundantly than at any other time. The more frequent use of associations, an average spontaneity of the visual imagery and degree of certainty are also characteristic of this stage. In the second stage the visual imagery shows the greatest spontaneity. It comes up readily at once, without associative or descriptive aids. The first image is more apt to be correct, and if not, the corrections are made directly in the visual. Immediate and a strong degree of certainty goes with the visual imagery. Associations and verbal descriptions come in after the visual images and without affecting the recognitive state oftener than at any other time. Marks of a partial loss of memory characterize the third stage. There is a general inefficiency and lack of spontaneity of the visual imagery. It develops slowly, with many hesitancies and intervals during which neither visual or other aids arise, and in wrong directions with only a slight degree of recognition of their inaccuracy. Previous associations are sought for and enter again as aids to the recall of the form as a whole. The subject tries to recall verbal descriptions for the details, but finds that he has largely forgotten what they were. False description, and rivalry between the different factors are frequent. Resort to the recognitive method, drawing the form and determining corrections from the drawing, is found more necessary than ever before, and the subject is more often uncertain or indifferent to the final result.

The errors made in the successive drawings of the forms had no regular relation to the subjects' judgment of ease or difficulty of the form while they were learning it, nor to his certainty or uncertainty as to the correctness of his drawing. With reference to the permanency or course of development they fall into three classes. (*a*) By far the majority of the errors appeared in the first drawing of a group and remained constant in the later drawings. A smaller number did not remain permanent. (*b*) Some of these remained the same in character but increased in degree in a constant direction, generally indicating a definite cause of error at work. (*c*) Others changed in character, or at least not simply in degree in the same direction. The causes of these were not often evident.

With reference to their causes, the errors fall into three classes, though in the last possibly several slightly different factors are included. The definite objective results together with the detailed introspective notes generally left no doubt as to the interpretation as to the cause of the error. (*a*) Ambiguous verbal description when the visual alone was inadequate to correct recall often results in error. (*b*) The influence of an association made with the form as a whole or definite part tended to make the drawing more like the associated thing than the real form. (*c*) (1′) Certain parts of a form approaching in character that of parts of certain familiar geometrical forms tended to be drawn more like the latter than they were even where the subject denied all traces of any association with the part in question. (2′) With reference to position on the page, lines that were not quite vertical or horizontal tended to be made just vertical or horizontal. (3′) Parts of a form that were not quite perpendicular or parallel to each other tended to be made just perpendicular or parallel. (4′) Parts that were not quite equal in length tended to be made equal. (5′) There was a tendency to arrange parts symmetrically.

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DISCUSSION.

ORGANIZATION IN PSYCHOLOGY.

The demand for organization in psychology arises out of a dual interest. First, there is that of the teacher who desires to give a continuous account of his subject; second, that of the student, who would satisfy logical and æsthetical demands for unity.

One of the greatest difficulties that the teacher of psychology meets in the pursuit of his vocation is the almost total lack of plot in the average text-book. One could wish that the several chapters of the text, while serving to elaborate the general theme through the analysis of some particular character, might make the various characters so interact in the successive scenes as to stimulate interest in the development of the theme as a whole. Under such circumstances the psychologic story would move as it does not now. The sense of continuous movement, of interesting development of the theme, of a unified resultant conception in which the manifold analyses of the argument synthesize into an intelligible whole, is one difficult to bring to consciousness in the student. This difficulty, I believe, finds its main source not in the inaptitude of the student to the subject nor in the unpedagogical methods of the teacher, but in the text and in certain transitory conditions of the science itself. As I have indicated the text lacks plot and plot interest. Plot demands that the characters function one with another in a continuous movement. Each, while playing its own part, must be other, sufficiently, to suggest that there is an inclusive whole, an immanent unity. In such circumstances curiosity, that universal principle of interest, asserts itself instinctively. Suggestive parts and elusive whole reciprocally stimulate and support one another. The theme lives in an ever-increasing interest which is satisfied only when it is fulfilled in the denouement. Now can we assert, fairly, that text-books in psychology have, as a rule, met these demands and realized this interest? I think not. Few are the psychologies that arouse and maintain a powerful interest in the average student. However intensely they may excite his interest in detail they fail to carry him along with increasing momentum. His enthusiasm attaches to parts and not to the whole. Frequently it is difficult for him to realize that a whole is intended. The volume is a series of

chapters dealing with individual topics, conjoined but not organically united. As to plot — it is rare. Conjunction of parts is not plot; nor is every arrangement, even though it be according to a defined scheme. Plot demands a principle of movement which is immanent and dynamic in the parts, as well as parts each of which after its own kind and in its own degree consciously exhibits the movement of the principle. Now, how frequently do we find a single unifying principle consciously presented as a clue in the opening chapters of our psychologies and wrought thoroughly to the end? How often do the various chapters look beyond themselves revealing traces of antecedent conditions and opening up vistas of subsequent circumstances determined by their own movement? Can one hold as a truth concerning our text-books that, as in well-wrought pieces of literature, the chapters mutually assist one another and consciously advance the movement of a unifying theme? The majority of our psychologies are written from the standpoint of psychophysical parallelism considered as a working hypothesis. This, in itself, is fatal to all attempts at plot. Of every fact we have two descriptions and for every change we have two explanations. And this the student is quick to perceive. The separate stories cannot be woven into a single plot. Interest is divided and in division tends to lose itself. Were the study unified according to the tenets either of materialism or of spiritualism it could have a plot. In the former case the resultant conception would have tragic consequences for ethical presumptions; in the latter, the implication might appear to have a relation to the practical world similar to that now accorded to 'castles in Spain.' Nevertheless, there would be unity of organization and plot interest.

Furthermore, this desirable end would be attained also if the viewpoint of psychophysical parallelism were transcended and a working hypothesis substituted for it which would regard the distinction between physical and mental as functional and not as existential. Curiously enough, such unity of organization as exists in most psychologies falls mainly upon the physical side. We can unify nervous structure in terms of neurones and nervous function in terms of instincts and habit. We can trace their groupings and organizations to a very considerable extent. On the mental side a similar unity has been aimed at but has not yet been attained. It is common tradition that ever since faculty psychology received its coup de grâce at the hands of Herbart the science has moved forward steadily upon the assumption of there being unity in mental life. But it is one thing to be conscious of the actuality of such a unity and another to exhibit its imma-

nence through the organization of its parts. Doubtless it was natural that the developing science should center its interest in structure and in detail rather than in function and in the whole. Observations had to be made and observation means isolation and detail in work. Transitive activities had, in a sense, to be arrested, and such arrest resolves function into structure. Now, such piecemeal analysis, however necessary it may be, has the disadvantage that it does not conduce to exhibiting the vital interreaction of factors. On the contrary, it necessitates the substitution of a dissected body for the original organism. No matter how thorough the dissection and how clever the classification of the parts, they are none the less *disjecta membra* and must fail to exhibit the functioning of parts within a whole. This is the reason, I believe, why so many of our psychologies lack plot. Psychology has, in the main, been structural and not functional. Thorough studies and analyses of mental processes have been undertaken and carried through. The results have been registered and classified. But there has been an almost complete lack of such functional organizing of these results as would stimulate curiosity with reference to their interplay and would exhibit their interaction as well as the manner in which they are unified in their ground, the self. This isolation of parts, this lack of organization in the whole, forces itself upon the student and stands in the way, alike of his comprehension of the subject and of the development of an inclusive interest in it. He may be interested intensely in specific topics, but is keenly conscious of a marked hiatus in passing from one topic to another. This is true even of that God-send to teachers, James's psychology. The student's interest in it is of the episodic and not of the dramatic variety. He is charmed and enthusiasm is awakened in him in unique fashion by each of the successive chapters. But there is no denouement in the revelation of an organic whole. And what is true of James is true generally. The fatal hiatus existing between the contents of the successive chapters of structural psychology must exhibit the paradox of assuming an essential unity which its own method conceals. The truth of this contention is proven by the fact that symptoms of a definite change of view-point may be discerned in recent writings. This applies especially to the later writings of Baldwin, to certain portions of Miss Calkins's work, to the underlying method of the contributions of Dewey and Royce, to say nothing of others. But it has remained for Professor Angell to make the change consciously and to apply the new method with characteristic thoroughness and lucidity in a systematic work His volume has a

marked plot interest and is functional to the core. Not only has he a single theme — that of the interaction of the psychophysical organism with its environment — but the successive chapters, while portraying their own distinctive characteristics, contribute each to the natural development of the theme and are constantly illuminated by the light cast upon each by every other. As a consequence the argument unfolds with constantly increasing interest and moves steadily to a unified conclusion. It is almost superfluous to recite that the volume appeals strongly to the student. Among my own pupils (the full Junior class of the college — 150 strong) it is held by all in equal favor with James and by many in greater favor. It is the only psychology that I have yet been able to place side by side with James without remarks disparaging to the newcomer being made.

As, for pedagogical purposes, there is a grave lack of plot in psychological treatises, so, also, for theoretical purposes, there is a similar lack of system. Ordinarily, no unifying conception is propounded at the beginning and its validity demonstrated through the progress of the investigation. There is no theory which defines psychic functions individually and also correlates them into a systematic whole. The nearest approach to this requirement has been made from the standpoint of physiological psychology. The hypothesis that every mental process has a physical basis or correlate has, without doubt, enabled the science to advance by leaps and bounds. But although we can, with moderate success, indicate the probable physical basis of the majority of psychic activities and can roughly schematize them, still two things much to be desired are lacking. First, the functional relationships of the varied physical bases have not yet been worked out; second, the knowledge of physical correlates in individual cases has not enabled the psychologist, in any marked degree, to bring mental functions under a single principle and to exhibit their organic unity. Moreover, even were these two requirements fulfilled the parallelistic hypothesis would still bar the way to unity as it has done in the past. So long as psychologists accept the psychophysical distinction as existential and not as methodological so long must they bid farewell to claims for systematic unity in their science. That psychologists, quite generally, accept parallelism as a working hypothesis will scarcely be doubted. It is an obvious inference that the science must exhibit a fundamental dualism.

Aside from this, psychology lacks organization in the arrangement of its subject matter. Suppose we take the well worn general divisions into intellect, feeling (affection) and will (conation). Is not this

a survival from a pre-scientific age in psychology? Is there any rational motive for treating intellectual functions first, affective second, and conative last of all? One might question whether placing the entire system of intellectual activities in the forefront of a psychological treatise is consistent either with the instrumental, pragmatic function ascribed to intellect as at least one of its critical phases or with a sort of spiral movement attributed to psychic functions in this development by the so-called circular reaction theory. Again, is not the position assigned to affection out of touch with the theory that emotion is the immediacy of our consciousness of the tension constituted by the clash of instinctive (and habitual) activities in misadjusted activity? This point is emphasized further by the theory that it is out of just such tensions in action that the mediating intellectual function arises and that it plays the rôle of opening up the way to a possible reunification of activity.

Again, we may ask, is the order of topics in psychological treatises indicative, as a general thing, of any ascertainable principle of organization? Has the semblance of order any more definite basis than that similar functions are usually classed together, that a certain endeavor has been made to place the complex after the simple and the reproductive after the original? At critical points the arrangement is anomalous, a fact sufficiently indicative of the absence of a thoroughly organized arrangement. For example, if instinct plays such a fundamental rôle, with reference to all conscious processes, as we are now coming to believe that it does, it is a curious arrangement that delays its appearance upon the scene of mental development until a very late hour. Habit, also, although it plays a part equally important with that of instinct, does not appear to have any well defined position of its own. Attention is gradually gravitating toward a position in harmony with its prominence as an intellectual function. The fate of interest and of belief, however, has been sad. Their lot — bandied about as they have been from point to point, when they have not been overlooked entirely — is worse almost than that of lost souls in Hades. Finally, the position assigned to the self in such a treatise as that of James, would seem to be conspicuously out of place. If the concrete self be the sole psychic reality one would expect that its consideration would furnish the grand conclusion in which the master-word would be spoken and all previous considerations unified in the presentation of the final all-embracing fact.

The lack of system is illustrated perhaps as fully by the omissions of individual psychologists as by any other circumstance. There

appears to be no common ground comprehensively covered. It will suffice, in proof of this, merely to call to mind the presence or absence in individual texts of such topics as interest, desire, belief, ideals, imagination (in distinction from the treatment of varieties of imagery).

If we view these facts together I believe that we shall be convinced that the time has come when structural psychology must pass definitely into functional psychology and when a unifying principle must be sought for the organization of mental activities. Furthermore, this principle must transcend the dualism of parallelism. For just so long as we work intelligently upon the basis of this method we must emphasize diversity and not unity. Yet every science must aim at the unification of its data. Either, then, we must admit that physical conditions are inessential to psychology or we must endeavor to transcend the dualism of psychophysical parallelism. Now I do not intend to enter upon a serious discussion of psychophysical parallelism at this juncture. Nevertheless, one may point out certain peculiarities of the hypothesis which may suggest the manner in which it is to be transcended. These peculiarities may be summarized as follows. The doctrine contradicts itself or, otherwise, the distinction and the parallelism asserted by it have merely methodological and functional values. If we regard the distinction of physical from mental as grounded in an existential separation of processes and then take parallelism seriously the theory lands us in absurdities. It presupposes what it must deny. We contrast the two processes and consequently must have knowledge of each. Yet, if there were an exclusive parallelism our psychoses should be totally and eternally unaware of, as well as uninfluenced by, their parallel neuroses. Our contrasting of the terms would indicate that they had a common basis; the parallelistic character attributed to them would suggest, further, the idea that a single process was under description, that a single fact was being read now in one set of terms, now in another — hence the marvel of the parallelism. Finally, their apparent duality for consciousness would indicate a polarity of function and not a dualism of process. Hence the real problem is to ascertain under what conditions and in what circumstances this polarity arises, its method of operation and its significance in the development of organic activity. To determine this and to utilize the insight as a clue to the organization of his science is the fundamental problem of the psychologist. The further question, as to how the quantitative values, to which the physical is most naturally reduced, are related to the qualitative of the psychical is one that falls within the primary problem in psychology as it does

within many others. No doubt it is of vast importance but after all it has no more special application to psychology than to physiology, biology and, chemistry. Indeed, it is essentially a question of pure methodology, viz., the part which mechanical and quantitative formulations play in the exact description, measurement and control of qualitative processes.

The unifying principle, therefore, that psychology demands is one which accounts for the polarity of the psychical and the physical functionally and which recognizes in them describable movements of a single organic process. It must enable the psychologist to use both methods of description in an entirely natural manner, to indicate how the single activity is modified now in terms of one phase of its movements and now of the other.

Now just as Professor Angell satisfied the demands of plot interest on the pedagogical side, so theoretically, he fulfills the primary demands of system. His psychology centers in a single unifying principle whose ramifications and bearings are exhibited at every turn of the argument. As a consequence the treatment is highly illuminating. The chapters do not follow the outworn arrangements of other days or by accident fall into a certain order. Each has a definite and noticeable position in the elaboration of the central theme and exposes in its own movement an individual characteristic of the unifying plot.

This principle is his conception of the psychophysical organism and the development of its conscious life through the solution of the practical problems set it by the necessity of constantly adjusting its activities in the presence of a changing environment. Although this biological standpoint[1] is not original with Professor Angell but is the expression of a dominant tendency in current psychology, nevertheless his thorough functional application of it is decidedly novel and original. His emphasis of the point of view and his consciousness of the necessity of system in psychology has opened up the way to an entire re-writing of the subject.

I shall next attempt to emphasize the necessity for organization by a brief outline of psychologic functions as this is determined by tracing out the clues furnished by the biological conception.

The biological conception, as I understand it, holds that the distinction of physical and psychical — of body from mind — is not one of which we are continually conscious. Under ordinary circumstances

[1] Especial recognition is due Professor J. M. Baldwin for his distinctive work in 'setting' the biological tendency as distinct from the physiological; see his *Mental Development* and *Development and Evolution*.

and in so far as our organic activities operate smoothly our experience is single. Individuality, qualitatively appreciated, is that of a continuous stream of activities unified as a single reality. When, however, this vital activity experiences inhibition within any phase of its movement tension arises and at once the distinction of physical from psychical emerges. In this tension of vital activities we locate the physical as that phase of the complex which serves as the dynamic base or support of the necessary adjustment. The psychical is the phase in which the adjustment is constituted. In so far as the adjustment is completed and perfected tension disappears and vital unity re-asserts itself. In further readjustments of activity the form of organization gained by previous adjustment appears as an integral part of the basis, *i. e.*, on the physical side. Now we apply the term instinct to native coördinations and habit to those which are acquired. Thus we may say that the distinction between physical and mental arises out of the reorganization of functional activities in which the tendencies toward the persistence of the native base are denominated instinctive; the tendencies toward reorganization — the psychical; the completed coördination, itself — serving as a basis for further adjustments — the habitual. Hence instinctive adjustments of function take on the form of the psychical and the complete organization of the psychical emerges as habit. Generalizing, therefore, we may say that the instinctive and habitual bases of organic development constitute what we designate bodily function; that the momentary reconstitutive adjustments comprise mental function: that the distinction is entirely functional and that the unitary living organism is the sole individual. It would appear necessary therefore that an exact treatment of the characteristics of instinct and habit and of their relation to psychic function should be given early in any general treatise upon psychology. Such a treatment would naturally lead in two directions. First, it would initiate such a general chapter upon the nervous system as is ordinarily given and which would serve as a basis for the special treatment of the physical functions which constitute the bases of mental activities in individual organic adjustments. Second, it would emerge in a chapter dealing with the general characteristics of psychic activities such as James treats under the title 'Stream of Consciousness.' This should emphasize the momentary and individual character of mental states, the unity of successive psychic streams, their discreteness, the organic and functional conditions alike of the discreteness and of the continuity which they exhibit, the focalizing power of the stream — with the conditions of its operation and direction, its discriminating and correlat-

ing moments with their organic motives. Moreover, such a chapter should also adjust the relations of the intellectual, feeling and conative phases of psychic activity in accordance with the clue furnished by the primary conception of the psychophysical relation.

According to my own notions this adjustment would take the following form. States of feeling should be taken first in order of treatment; intellectual states,— second; and conative,— third.[1] My reason for this arrangement is the following. In any adjustment involving tension the phase of psychic function directly evoked is that of feeling whether as sensibility, emotion or ideal. The organism, as it were, turns out as immediate appreciation its own inner value or quale. This view is supported in the extreme by the prevalence of intense sensibility in cases where nervous forces are strained to the limit and where the organism cannot, immediately, bring the irritating conditions under control; by the prevalence of emotionalism in the period of adolesence; by the emphasis upon feeling when old habits (*e. g.*, belief) have been broken up and when new methods of action have not yet been defined nor put into operation. Feeling, in short, is the phase of organic activity wherein an old coördination is undergoing strain or disintegration and where it has not yet got itself sufficiently in hand to define its own position or to control it. Conformable with this is the fact that in phases of activity where feeling predominates we look neither for defined views nor for effective action. They are states of confusion. The moment, however, the organism masses its activities positively and proceeds to the examination of its own condition for the purpose of overcoming the inhibition, feeling passes into intellect. Herein discrimination and correlation, leading to explicitness of definition, expose themselves. When definition has been completed, conation supervenes and the basis for a new phase of habit is established. Each phase of psychic activity may occupy a shorter or a longer period of time or its natural course of development may be aborted but wherever adjustment fully asserts itself feeling arises on the basis of instinct, defines itself as intellect, establishes itself as conation and emerges as habit. In further adjustments the gains made assert themselves as physical basis, *i. e.*, as habit-instinct, coördinations. As such they furnish material for richer appreciations as feeling, for fuller definitions as intellect and for greater effectiveness as

[1] However, as will be seen in what follows, this does not mean that feeling should be treated in its entirety before any investigation of intellectual and conative states is made. Only, *that on any given 'level'* it is more natural that feeling should precede intellect and conation.

conation. Consequently the chapter on the stream of consciousness should close with an elaboration of the circular reaction hypothesis of organic activity as a fundamental principle for the more complete understanding of the interrelation of the physical and the psychical and of the concrete development of our experiences in their totality.

Psychologists as a usual thing pass from such a general chapter as we have described (*i. e.*, if they insert it at all) to the detailed treatment in turn of the entire list of functions exhibited by each of the phases of psychic activity. For example, — attention, sensation, perception, memory, association, imagination, and reasoning are treated fully before any states of feeling are examined and these in turn before the conative field is explored. This procedure, it seems to me, is erroneous. It makes an organic treatment of psychology impossible, inasmuch as it takes each one of the phases of psychic activity out of its functional relationship to the other two and from within the organic movement of which it is a phase. If the intellectual function can be understood only in relation to feeling and to conation is it not essential that we should examine sensation and perception with reference to feeling on the one hand and to conation upon the other? In other words, is it not necessary to treat functions of the same level of simplicity or complexity in their natural order and relationships as phases of a single movement before passing from a lower level of complexity to a higher? Shall we not gain a better understanding of the individual states themselves and of the psychic activity of which they are phases if we examine sensibility, sensation and perception, impulse on one level; emotion, memory and association, character (so-called conscious habit — a misnomer) on another level; ideals, imagination and reasoning, volition on the third and highest level. The theory back of the classification is that the phenomena of any given level are really one fact considered in several phases. Organic adjustment, if taken in its most individual and most momentary function, constitutes itself as sensibility, or as sensation and perception, or as impulse according to the stage at which it is taken. A similar identity of function will be found to operate in the more complex groups of phenomena, the distinguishing differences within each being accounted for by the form of the total reaction constituting the several phases of the common movement. Having introduced simplicity into the treatment of phenomena upon the same level it remains to be noted in this connection that a like simplicity can be introduced into the treatment of the relations of the different levels one to another and to the total psychic movement. Here we avail ourselves of the light cast upon organic

development by the circular reaction theory. It was noted above that the psychic phase of organic activity tends, as the adjustment is more fully accomplished, to pass over into the physical phase of activity. From this, an occasion of further adjustments, it passes into richer, more defined and more effective forms of psychic activity. Thus every moment builds itself into the organism and exhibits traces of its effectiveness in the development alike of physical and psychical function. Accordingly, in emotion, in memory and association, in character we trace the continuity of organic life. In emotion, feeling no longer presents itself in the simplicity of sensibility, but modified by the articulation and enlargement of the total organic activity. The tension which in sensibility was confined to a relatively simpler complex of coördinations involves in emotion ever larger groups until, on occasion, the whole organism may be in reverberation. Thus momentary feeling becomes infused with the consolidated gains of the psychophysical organism, or at least such of them as its quality appropriately evokes, and as these are incorporated into it in the form of affection. Memory and association, as also character, exhibit the direction of similar organic mediation, the one in terms of the intellectual phase of psychical activity, the other in that of conation.

On the level where ideals, imagination and reason, volition play their parts in a self-conscious medium, mediation takes on the form of development in terms of ever more complete organization. The entire organism tends toward articulate and complete self-expression. This organic self-expression, developed through tension and appearing in the immediacy of feeling, constitutes the ideal within us. Defined as intellect it takes on the forms of our life of imagination and reason. Operative again as conation it is our voluntary behavior.

Certain peculiarities of this scheme of organization are to be noted. I believe that some attention to these will give added force to the general arrangement. First, it will be observed that psychic functions in their intellectual phase arrange themselves in pairs. That such an arrangement is natural is shown by the fact that it has been found impossible to give an account of one member of any of the three pairs without involving the other. Sensation cannot be treated without reference to perception or *vice versa*. And the same thing is true of memory and association, as also of imagination and reason. The situation simplifies itself when we observe that in these three pairs of terms we have the developmental history of a single pair on three levels. The single pair are the image and the idea. What is meant is that sensation,

memory and imagination are functions whose essential feature is the psychical image, whereas perception, association, reason have as their essential feature the idea. Now just as the members of the several pairs were indissolubly united so also are the image and the idea. They are distinguishable but not separable moments of the intellectual phase of organic adjustment. The image is ever the aspect of the adjustment in which the material of reorganization is defined: the idea that in which the material is correlated into a definite method of reconstruction. The one is analytic, the other synthetic. The life of feeling which provides the motive for intellect is single because undefined; the life of action — the terminus of the intellect — tends toward singleness because it has been defined; intellect is dual because in it the material and method of adjustment is being defined. Second, it will be noted that three important psychic phenomena are missing from the scheme. The three are interest, attention and desire. It takes no great insight to discern that these are functional centers to the three great phases of psychic activity. In other words, interest is feeling observed in its essential principle; attention is the intellect in principle; desire in itself is conation. Sensibility, emotion, ideals as forms of feeling are phases of interest. It is the unifying principle of which they are the concrete circumstantial manifestations. The same thing is true of intellectual states with reference to attention and of conative states with reference to desire. Once more we are brought back to the thought that feeling, intellect and conation are distinguishable only by their functions, for interest, attention and desire are the same active principle of adjustment taken now in its appreciative phase, now as definitive, and now again as executive. Moreover, this point is emphasized by the fact that even as psychic life is a unity, so its fundamental principles of psychic organization unify themselves in a single function — belief. In belief we find the fundamental principle of psychic organization. It is the common denominator and focal principle of interest, attention and desire. Operating as faith, it is the control center of feeling, *i. e.*, it is interest; as conviction, the control of intellect, it is attention; as practice, it is the essence of desire.

These considerations lead naturally to the final factors in psychic organization — the subject-object consciousness, time and space perception, and the self. When examining into the problems of psychophysical values we discovered a single fact — organic experience — which was thrown into contrast by the presence of inhibition and consequent tension. In taking into consideration the further fact of or-

ganic readjustment we were led to the identification of the physical with the forms of coördination (instinctive and habitual) which were sufficiently fixed to serve as bases in the reconstruction. The psychical was identified with the movement of adjustment itself. If now we take into account our fullest organization of the base of organic adjustment we describe the function as body, the immediately defined object in experience. If, on the other hand, attention be directed to our fullest organization of organic adjustment we describe the function as mind, the immediate subject in experience. The larger vista opened up by the interaction of the organism with the environment is the world of experience. It is not difficult, therefore, to see that the treatment of space-perception should give definite form to our view of the object both as body and as world, whereas the treatment of temporal perception should round out the subject of experience and should deepen our conceptions of the object. There remains the self. If we bear in mind that body and mind, object and subject, are but functional phases of organic activity, we are led to the conclusion that the unitary experience which is ourselves is to be identified with our total organic activity. Thus the self originates as organic activity, develops itself through tension and adjustment as body and as mind, and perfects itself in those forms of effective self-conscious activity in which the distinction of subject and object has been merged in the self-consciousness of free adequate function.

If this analysis be correct the problem of arrangement of topics in psychological treatises becomes relatively simple. It would seem natural that the general chapter upon the stream of consciousness should be followed by the treatment of the fundamental principles of organization in feeling, intellect and conation, *i. e.*, with interest, attention and desire in their general relations one to another, and to the development of psychic life. This would lead naturally to the treatment of sensibility, sensation and perception, impulse as phases of a single movement and with constant reference to their physical basis. Next, the growth of physical and mental functions should be traced in emotion, memory and associatien, character. After this would follow a similar treatment of organic development into its free creative forms as ideals, imagination and reason, volition. Such a treatment would naturally lead to a general unification, first, on the side of principle, and second, on the side of concrete content. The first would emerge in the examination of belief as the unification of interest, attention and desire, as also of its elaboration in complexity, range and freedom through the development of psychic activity into ultimate creative

form. The second would emerge, on the one hand, in the study of the problem of space-perception as unifying our conceptions of the object in experience, and, on the other hand, in that of time-perception as unifying our conceptions of the subject in experience. Finally, our entire study should unify itself in the thorough investigation of the self as it manifests itself through the various stages of organic development.

Thus pedagogical and theoretical interests alike emphasize the necessity for a more complete organization of psychology than is found at present. The central principle of such organization must be biological. Its application must be natural and organic. Psychological treatises must refuse even formal recognition of pre-scientific divisions and must adopt such an order as conduces best to the exhibition of that development upon whose actuality they insist. By such procedure we may hope that in the future psychologies may be enabled to reflect in their structure and movement the organic unity of the life which they describe.[1]

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REASONS FOR THE SLIGHT ESTHETIC VALUE OF THE 'LOWER SENSES.'

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From the standpoint of esthetics the division of the senses into a higher and a lower class has often been made, even after the ancient ethical basis of such a classification was discarded. Visual and auditory qualities have been universally regarded as the aristocrats in the world of sensations, while all others have been relegated to plebeianism. The significance of this division has never been systematically studied except by Volkelt;[1] the vast majority of investigators have dismissed the question very briefly, not because of its unimportance for esthetic theory so much as by reason of its apparent simplicity perhaps. The popular verdict that the arts appeal to us overwhelmingly through colors and sounds is generally admitted to have good psychological grounds; but just what these are has been more a matter of ingenious guessing than careful analysis. The present sketch aims to review critically the various suggestions that have been offered and to find, if possible an explanation containing the truth in these without their errors.

1. Volkelt has observed that in the lower senses we feel objects in direct contact with us, while in vision and hearing, the case is reversed the qualities being at a distance and 'free.' Disinterestedness is therefore impossible when we experience the lower qualities, for their hard reality forces us to take a

[1] *Zeit. f. Psych. u. Phys. d. S. O.*, vol. 29, 205 f.

practical attitude toward them.[1] This view confirms the usual philosophical one which places the esthetic in sharp opposition to the practical attitude. But it does not seem to explain the prevalent difficulty most observers have in pronouncing esthetic those lower sensations which are regularly accompanied by distinctly pleasant feeling-tones. Shall we say that these have associated to themselves the stern reality-feeling of the unpleasantly toned sensations? That would be a remarkable state of affairs, it seems to me, and one incapable of any descriptive verification; I do not know what there is in a 'reality-feeling' as such which prevents the contemplative attitude. True, Volkelt declares that the lower qualities are more pleasant in memory than when immediately given, and he cites in this connection the fact that literary artists employ allusions to them much more regularly and effectively than they do in the case of visual and auditory qualities; but the first statement does not accord with the facts, and the second one has a wholly different explanation. There are surely not many persons who are willing to admit that the memory of a cup of coffee is more pleasant than the taste itself; indeed, it is rather hard to see just what that could mean. And, as for the literary use of lower qualities, this is surely not because they are more pleasant as memories but rather because they are more effective in suggesting (recalling) situations and objects. This power, too, depends primarily upon visual and auditory elements; the words used suggest first of all things and these in turn are recalled most sharply and unambiguously by their olfactory, gustatory, or other lower qualities. This clearness of recall is to be explained, not by the clearness of olfactory or gustatory recall-images — for these latter are notoriously weak in most persons, but rather by their uniqueness, or 'individuality.'

Smells and tastes do not form two closely constructed systems as sounds and colors do; hence the individual qualities do not lose themselves in the group because of a too conspicuous resemblance or relation to other qualities. Thus it is that a very faint recall-image of an odor may be much more distinctive and definitive of a complex object than a much more powerful

[1] *Ib.*, 209.

color image. Likewise with regard to the stability of the images; while a color image might last much longer in revival than an odor image, still the latter might surpass the former as a mark of a complex for the reason already given. Stern's studies in evidence[1] show the remarkable lack of fixity in colors as identifying marks of objects. The reason seems to be that objects really do present greater color varieties than, say, order varieties. Dogs of all colors smell about alike.

To return to the 'reality feeling'; I do not see how this prevents the pleasantly toned lower sensations from being esthetic. And Volkelt has apparently felt this same difficulty for he employs other principles to help him out. These we may treat under separate heads.

2. It is not mere contact and the 'reality' feeling alone but the induced effects of the contact which check esthetic approval. Thus, all contacts not resulting from voluntary movement or acquiescence involve a pain-tone, commonly nothing more than a shock of surprise, and widely irradiating motor reactions. And it might be assumed that even expected and desired contacts tend to induce the same feeling-response, are mixed with suspicion and caution at least. Perhaps there is some such tendency, but in many instances it is vanishingly small; new-mown hay, coffee, tobacco smoke, and many other lower qualities are not only immediately pleasant but have, for most persons, reinforcing associations rather than opposing ones. The pleasure-tone is indubitably dominant here; whence then the difficulty in naming the toned qualities esthetic? There seems to be an inclination on the part of most inquirers to seek the solution of this difficulty in either the pure *feeling-quality* or the secondary *effects* of the sensations in question; and the procedure tends in every case to draw the distinction between esthetic and non-esthetic wholly in terms of the degree of pleasure or pain. Whenever a sensation is pronounced unequivocally non-esthetic, this is interpreted to mean that, somewhere or somehow in its conscious history, the pleasure-tone it may possess is overcome or vanishes. Even Mr. Marshall, who in many respects has freed himself from this tendency, relapses

[1] Cf. *Beitr. z. Psych. d. Aussage*, Heft. III.

into it finally with his theory of 'relatively permanent pleasure.'

If this be the accepted criterion, though, how shall we account for the great difference between the ugly and the intensely pleasant lower sensation? Must we say that fleeting pleasures are equivalent to permanent pains? The suggestion itself is ridiculous. Or must we say that the fleeting pleasure is, in the long run, neutrally toned? In this case we must distinguish two interpretations: firstly, we may mean that the fleeting pleasure dies out rapidly of itself so that there is virtually no tone surviving a moment afterward; or, secondly, we may hold that the neutral tone is a result of counteracting pain-tones which are somehow induced by the sensation in question. In this latter instance the 'surprise-pain' might be referred to; but also, and with much greater justice, the second fact used by Volkelt to good advantage, namely that in the lower senses under ordinary conditions more than one sense is stimulated, so that the resulting feeling-tone is an irregular, more or less indeterminable mixture of the feeling-tones of the compounded sensations. We need only assume what is highly probable, namely that the feeling-tones of the various elements involved have different directions and rates of change, in order to explain the frequent uncertainty and shifty character of the resultant feeling-tone.

Nevertheless, this unquestionable fact can scarcely explain what it is here made to do. For it merely goes to show that the *number* of distinctively pleasant sensations is small. It cannot explain why these same, in spite of their unequivocal tone, are usually treated as non-esthetic. One may grant though that naïve judgment may incline to confuse the importance of the class (in the world of art, for instance) with the esthetic nature of the members of that class; Sergi, Bray, Santayana, and others have followed this possible naïve verdict in declaring that the small range and variety of pleasure-toned qualities of 'lower' order explains the non-esthetic character of this species of qualities. It scarcely requires subtle logic to realize the untenability of this view; to ascribe to a species minor esthetic importance is not equivalent to rating it as non-esthetic. With the facts used by the above writers, though, we must agree on

the whole; in esthetic theory the lower sensations as a class must be ranked relatively low, largely on account of their obviously lower organization. Nevertheless in rating them thus, the real problem of esthetic interest has not been touched upon, viz., how is it that, although a sensation-quality may be powerfully pleasure-toned and 'fringed' with associations, we have a certain undeniable difficulty in calling it beautiful or ugly?

3. Santayana[1] has urged that inability to give spatial form to the lower sensation qualities is our reason for regarding them as inferior, for without spatiality they cannot represent nature. It is probably true that we rate them as inferior for this reason — among others — but, as Santayana seems careful to admit tacitly, this fact cannot explain why we say that many such qualities are *non*-esthetic. It is one thing to call a quality slightly beautiful and quite another thing to say that the predicates, beautiful and ugly, have no meaning in connection with that quality.

One objection to Santayana's suggestion must be raised and, so far as I can see, cannot be answered favorably to his view; inability to take on spatial form somehow or other cannot be decisive in checking the esthetic judgment, for we do find persons who take a genuine esthetic delight in odors and tastes and yet, in all probability, are incapable of spatializing these qualities. And on the other hand, those persons who show marked cases of synesthesia of the tone-taste, tone-odor, color-tastes and color-odor types[2] do not, so far as observations on these rare cases have shown, display any remarkable esthetic appreciation of the lower qualities. It must be confessed, though, that systematic investigations on this point are lacking; we have the mere probability to fall back on. The first point above is much easier to confirm and is decisive, I think.

4. Ribot's explanation succeeds only in advancing a possible reason for the minor importance of the qualities in question: together with their low organization they fail to act directly (esthetically), only reviving visual and auditory representations.[3]

[1] *Sense of Beauty*, p. 65 ff.

[2] Cf. Wallaschek, *Psych. u. Pathologie d. Vorstellung*, pp. 151–181.

[3] *Psychology of Emotions*, transl., 351–2.

The inadequacy of this contention, or rather its irrelevance, has already been noted.

5. Guyau, in maintaining that all qualities (sensational) are esthetic,[1] is in the opinion of so many observers, simply avoiding the real issue by philosophical generalities, so that we hardly need discuss his view. It may be that all qualities may enter into esthetic complexes somehow or other, as for instance in the case of a landscape which combines very often colors, sounds and odors; but it is impossible for many persons to judge a glass of milk esthetically save under very exceptional conditions. What these conditions are constitutes a goodly part of the real problem. It seems hardly enough to say that every quality is potentially esthetic; one would like to know when and why it is not, for then and only then does it become clear when and why it is.

6. Marshall's theory has avoided most satisfactorily the logical confusion between minor esthetic importance and non-esthetic character of qualities. In developing his general thesis that 'only that pleasure is judged to be esthetic which appears permanently pleasant in revival,' Mr. Marshall says that the lower pleasures have been powerful in our original experiences, but in memory their recall-experience is not pleasurable, or else they are bound up with ethical painfulness so as virtually to love their own peculiar quality.[2] For the developed man of today, it is urged, the so-called lower senses do bring pleasure in presentation. Their associated elements check their effectiveness though.[3] This theory demands primarily two conditions, pleasant presentation and pleasant representation of the qualities in question. It is not enough that a quality be immediately pleasure-toned, its pleasure-tone must persist with the quality, reappearing with it regularly. It is not demanded by the theory though that the recall-image of the quality be as distinct as the recall-image of the pleasure-tone; it is enough if both quality and feeling-tone are recalled somehow together.[4]

[1] *Problèmes de l'esthetique*, etc., chap. VI.

[2] *Esthetic Principles*, pp. 31, 115, etc.

[3] *Pain, Pleasure, and Esthetics*, p. 159.

[4] It has been objected that the merely average or even sub-average visualizing power of painters and sculptors indicates that representational power

And an implication of the theory is that the esthetic predicate is predicate in a more or less formal judgment and not an immediate feeling quality; in deciding that a quality is beautiful a process of comparison is involved, in so far as some reference is made in every instance to the regular recurrent connection of a given quality with a given feeling-tone The esthetic judgment depends upon a realization, more or less distinct, of this association. So we have in Mr. Marshall's theory a peculiar associational, intellectualistic interpretation; not only must there be an association of quality with feeling-tone but also an association of the regular coexistences of these two.

In fixing upon the value of Mr. Marshall's explanation of the lower qualities we shall have to criticize briefly his general theory. To what extent can we agree with him in his definition of the conditions determining the esthetic character of qualities?

7. The esthetic character is less intellectual, less a product of a series of individual experiences brought together in a single judgment, than the theory would have it be. While in general it is doubtless true that esthetic predicates are judgment predicates in the narrower sense of the term, still the experiences to which the esthetic judgment harks back need not be so remote as Mr. Marshall's view implies. Within a single immediate experience complex the esthetic judgment may be formulated, and it need not involve any reference to other experiences than just that one in which the quality being judged is actually given. In short, wherever we may have a formal judgment there we may have an esthetic judgment provided the quality being judged behaves in a certain way which we shall try to describe. When Mr. Marshall demands that a quality be pleasant in revival, he is asking too much if he understands by 'revival' what this term usually means. The really essential condition, it seems to me, is that the pleasure shall persist in connection with

is of no significance in the esthetic judgment. This objection is singularly deficient; for, in the first place, there is probably no direct connection between artistic ability and esthetic appreciativeness. The artistic function is an imitative motor one predominantly. And, in the second place, as already indicated, there need be no direct correspondence between *intensity* of recall-image and *possibility* of esthetic judgment. Regular coexistence of quality and feeling-tone, regardless of respective intensities, is the only essential condition.

and *in reference to* the quality in question. How long this persistence need be is just the question which needs answering; but it seems clear that the usual verdict would be against Mr. Marshall's claim that the original quality must first disappear as sensation at least once and then reappear, either in a new sensational form or as a recall image, in order to be called beautiful or otherwise esthetic. This need of a preceding mass of experiences is essential, no doubt, to the actual fulfilment of a judgment act; but for this reason it need not be a determinant of the specific *Sachverhalt* described in a specific judgment act.

In other words, the real test of the esthetic character is to be found in instances of immediate revival or direct persistence. The way the original qualities *plus* their immediate feeling-tones persist as such or else pass over into primary memory forms, after-images, and the like is what decides whether those qualities can be called esthetic or not. For in the character of this persistence or transformation we find the conditions which make possible or impossible attention to and reflection upon the quality-feeling complex, *i. e.*, the conditions allowing or forbidding judgment about this complex. Let us look then at the phenomena themselves a moment.

What the organic connection between sensation quality and feeling tone is has not yet been made clear. Ribot's belief that both are results of currents along the same nerve-path, the sensation being the swifter and the feeling-tone the slower one, is of course only a conjecture. At all events though, everybody is probably convinced that there is some profound organic connection, and a corollary to the belief is that there is also an organic connection between revivals and persistences of those same experience *quales*. But whatever the principle of this connection is, it is, so far as its ordinary manifestations disclose, not very simple; for we find striking irregularities in the persistence and revival of sensations and their feeling-tones. In some cases the sensation persists unchanged while the feeling-tone has been highly modified; in others we find the sensation vanishing while the feeling-tone lingers most distinctly some moments longer. Numerous other complications will suggest themselves to the reader, those of most significance for the

present discussion however, being such wherein the recall-image of the sensation is either connected with or again wholly free from a recall feeling or, again, a new immediate feeling-tone (attaching to the recall *act*).

8. Returning to the particular case of lower sensations now, we can conceive of at least two possible causes of the truly non-esthetic nature of a given quality-complex: first, the sensation quality itself may not revive or persist strongly enough to make its original and 'natural' feeling tone revive; or, secondly, there may be some 'irregularity' in the fusion of sensation quality with feeling tone such that the former might persist without the latter. When we leave conjecture and turn to facts, we find two large bodies of well confirmed observations which indicate quite clearly the most vital connection between esthetic effectiveness and ease and vividness of persistence; the Galton tests and studies in after-imagery. A cursory glance at the results of these experimental investigations reveals, it seems to me, a strikingly suggestive fact. It is generally found that by far the strongest imagery (both after-imagery and secondary revival) is confined to visual, auditory and kinesthetic qualities. When we look to the field of esthetics and ask which quality-species are unambiguously esthetic we find that, apart from complexes depending obviously upon ordinary associations, music, painting, sculpture and variants of these (rhythm, versification, color and form schemes, etc.) constitute a realm of art and appreciation almost transcendent to all other possible objects of reflective enjoyment. In short, the same line of cleavage runs through the results of studies in imagery and through the esthetic field. It is difficult to look upon this as a mere coincidence.

If there is an organic connection between imagery and esthetic judgment power we should expect to find individual differences, in esthetic judgment corresponding in some degree to differences in after-imagery. And, so far as rather general observations are concerned, this seems to be the case; studies (all preliminary) made of students in Barnard College shown no decisive results except in the extreme cases, which however are highly instructive.[1] Students with exceptionally low

[1] I hope to be able to publish detailed results of further experiments on this subject before long.

visual imagery (after-imagery and secondary revival alike) proved but slightly susceptible to colors and color schemes; the 'ideas' expressed in pictures and natural scenes affected them normally, but sketches in black and white were neither less nor more 'beautiful' than colored pictures. Of considerable interest is one observation made, namely that one student found pleasure in colored pictures but upon examination, attributed it simply to the higher degree of imitation. None of the students in question suffered from color-blindness. One other extreme case was found in a student with slightly inferior auditory imagery but very remarkable olfactory imagery; to her, perfumes and many nature odors such as wet grass, wet streets, hay, tar, night air, etc., were much more 'beautiful' than music. She affirmed that she 'often gloated over the smell of rain in memory.' Unfortunately, no kinesthetic tests could be made in order to fix upon the source of low musical appreciation.

The most significant experimental fact, however, is one which I have confirmed in over one hundred cases, of which less than one half were students, and which probably many persons have incidentally observed; an observer with the usual development of imagery, when asked to decide whether tastes, smells, temperatures, pressures and the like are 'beautiful,' 'esthetic,' 'pleasing to contemplate,' 'charming' and so on, almost invariably confesses to a sheer inability to pass such a judgment. The predicates simply lack meaning, do not apply *even in their negative forms;* very often the answer that, for instance, perfumes are not esthetically effective will be recanted as soon as the observer is asked whether he means that they are esthetically ineffective and positively unpleasant to contemplate. A common revision of opinion among keener observers is this: 'perfumes are not unpleasant as objects of contemplation, to be sure, but they do not seem to be contemplatable at all, or at any rate they do not improve by contemplation.'

This indicates the more logical sense in which the term esthetic should be employed; we must use it in such a way as to permit the most exact and clear distinction between non-esthetic (extra-esthetic) and unesthetic (a bad word, meaning strictly negatively esthetic). Only by preserving this difference

can we retain the dual nature of the esthetic experience, the immediate pleasure and the pleasure of attending to this first pleasure in its secondary (persistent, after-image) form. The term 'esthetic' is accordingly not to be used as referring merely to acts of intrinsically pleasant attention to a content immediately and persistently pleasant; it refers more fundamentally to acts of attention to the feeling-tone of a larger content (*e. g.*, a content involving sensational, imagery and other factors). Only by so using the word am I able to make clear to myself the relation between the beautiful, the ugly and the extra-esthetic; the ugly is that which can be contemplated in precisely the same way as the beautiful can be, but the feelings resulting from such contemplation are negatively toned. In the case of tastes, temperatures, and the like we have in most individuals no true attention act, or else — what is much more likely in many instances — attention fails to develop any distinct feeling tone of its own.

9. We may now sum up the revisions we would make to Mr. Marshall's theory: what is here advanced is perhaps radically different from anything intended by Mr. Marshall, for, instead of relying upon revivals of qualities as Mr. Marshall does, we believe that the immediate persistence of qualities is the decisive factor; finally, as already indicated, the use of the term 'esthetic' varies markedly from Mr. Marshall's. Nevertheless, what is here suggested seems more in the spirit of his theory than in that of any other, and especially so when one takes into consideration the fact that Mr. Marshall accepts and has developed Shadworth Hodgson's theory of immediate representation, according to which representation is necessarily involved in every presentational experience.[1] Were Mr. Marshall to construe 'revival' so as to mean this immediate representational background to every perception, the present hypothesis would be compatible with his. On the other hand, such a concession on his part would apparently demand a revision of his use of the term 'esthetic.'

The striking differences in esthetic value between various sensation-species is traceable, in the last analysis, not to the imme-

[1] Marshall: 'Presentation and Representation,' *Mind*, N. S., 57, p. 53 ff.

diate feeling accompaniments of the various sensation qualities but rather to a peculiarity of the judgment function, which demands for its very existence a 'content' with some degree of central development, *i. e.*, a content which is something more than 'pure sensation.' Psychologically described, a certain amount of time is required for the stimulus to develop into that form which makes attention to it and to its feeling accompaniment *possible*.[2] There is a strong temptation to interpret this fact to suit some theory of simple association; for instance, the need for a certain duration of the stimulus might be explained by the time involved in inducing associations, affective and otherwise. The 'width of field,' emphasized by Lotze, Guyau, Marshall, and others, would then be made the true determinant. But this is only a shifting of the problem and a postponement of its solution; for here it is implied that association, 'degree of reverberation,' or the like is the *sole* source of esthetic pleasure. The ambiguities and difficulties of extreme associationalism in esthetics are too well known to be rediscussed. If we grant, as virtually everybody does, immediate esthetic values we must try to find the reasons for the presence and absence of such values in the conditions determining the nature of immediate experiences; this can be done without precluding the possibility that associative factors have genetically influenced the receptive character of the nervous organism so that certain stimuli have gained thereby an esthetic power lacked by others. Finally, even if we were to grant the primacy of association here we would still have to admit that the complexity of the imagery-background in any given case is dependent upon the absolute power of persistence of the factors in that background; otherwise we would deny indirectly the cumulative character of association and would admit that an almost momentary fringe might be quite as effective as a relatively stable one.

[2] Fechner, *Vorschule der Aesthetik*, II., 241–3, was probably the first to observe certain general facts cognate to this one. He remarks that 'every stimulus, and accordingly every esthetic one, must persist a certain time before its effect is observable.' He seems to have had in mind, though, only the rougher differences between relatively complex art objects, *e. g.*, art lines, pictures, melodies, etc. The bearing this same fact has upon the differences between the senses was not noted by him, so far as I have been able to discover.

In speaking of the persistence of the 'content' it must be borne in mind that both sensation quality and feeling-tone are referred to. There must be feeling after-imagery above all things and the feeling thus persisting must have a constant intrinsic reference to a definite sensation quality. This being true, it now becomes clear that many various relations between quality and tone are possible. For instance, an original sensation may have one feeling tone while its after-image in its pure form (*i. e.*, unmodified by the sensation persisting) may have another, as in the sense of a very intense light which, as is well known, we may declare beautiful although the stimulus is decidedly painful. Or, again, a sensation may persist longer than its original feeling tone, becoming being neutrally or negatively toned, as in the case of many tastes and smells, which show rapid changes in affective coloring- Or, once more, the original feeling tone can outlast the sensation quality; this is perhaps the commonest case, for the affective tone is, in colors and sounds and rhythms particularly, often very vivid long after even the distinct after-images have faded away. Quite commonly our 'memory for' sensation complexes is really a memory of the feeling phase of these same; and the same is true of the less remote forms of such experiences, *e. g.*, these experiences during the first few seconds of their existence.

In the case of 'lower' sensation species it is well-known that we find a much more rapid 'dampening' of the after-images as well as more rapid adaptation; the duration of distinct after-images in odors, tastes, pressures, and temperatures is conspicuously less than that of visual, auditory and kinesthetic images, while the persistence of the former class of sensations without qualitative variation is almost immeasurably briefer than the persistence of the latter class. Both of these facts plainly contribute to explain how it is that, when called upon to judge the lower sensations esthetically, we find it much simpler and more natural to admit that we cannot do so than to decide for or against them. And this is true even when the feeling tones of the sensations in question are unambiguous (pleasant or unpleasant). Viewing this phenomenon from the standpoint of the psychology of judgment it seems safe to con-

clude that, by virtue of the non-parallel variation of sensation quality and feeling tone, this latter loses its reference to the former so that, although we may well be aware of our affective state now and also may *recall* that it originated contemporaneously with the recalled sensation quality, nevertheless *quality and tone are empirically distinct experiences, neither being a mere predicate of the other.*

Furthermore there is a greater mass of imagery elements in the background of the higher sensations; that is, with higher persistence we find richer after images forming a virtually homogeneous constellation, or rather nebula, which, by virtue of its structure and elements, fluctuates much less violently (under favorable conditions), lasts longer, vanishes more imperceptibly than do the backgrounds of the lower sensations. It is this peculiarity, more obviously than any other, which makes judgment easy. It is that characteristic which in its more complex and mixed forms, has long since been recognized by estheticians as highly significant, namely 'ease of attention' or objectively put, 'the stability of the object.' If either sensation quality or feeling tone dampens or changes too rapidly, there is difficulty found in attending and in passing judgment; and — this the really important case, I think — if the rates of variation of the two phases are too different, the difficulty of passing judgment upon an affectively toned sensation is excessively great, if not absolutely insurmountable.

In conclusion it may be wise to state that the above explanation leaves us free to regard the difference between higher and lower sensations as relative to the individual and subject to genetic variations; but at the same time we cannot deny the genuineness and reality of the difference. Guyau's belief that any quality may be esthetic is to be rejected save perhaps in its rather fruitless metaphysical sense that there is nothing intrinsic to sensations as bare *quales* which prevents these from ever being esthetic. Lastly, there is no intention to reduce all differences in esthetic values to a mere difference in imagery persistence. Imagery persistence is rather an esthetic *a priori*, whose presence makes the esthetic attitude possible (but not necessary) and whose absence inhibits that attitude totally.

Esthetic differences between colors need not be attributed solely to different imagery coefficients of these latter, although it is possible that such may play some part in the differentiation. But the difference between qualities — usually visual, auditory, and kinesthetic — which are unmistakably esthetic and those with reference to which esthetic predicates seem simply meaningless is, I think, wholly explicable in the above manner. [1]

[1] The MS. of this article was received June 16, 1906. — ED.

STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF CHICAGO.

COMMUNICATED BY PROFESSOR JAMES ROWLAND ANGELL.

A Study of Certain Phenomena Concerning the Limit of Beats.

BY DR. A. WYCZOLKOWSKA.

I.

Wundt[1] gives as the limit of beats (Schwebungen) 30–60, Helmholtz[2] 132, Shaefer 253–341, Stumpf[3] 427. What can be the reason of these differences?

As I began my observations of beats my attention was called to the fact that an error could easily be introduced in these researches, due to the influence of noises that accompany every tone. This led me first to the analysis of the entire scale of tones from 8 to 36,000 vibrations, with reference to the clearness of separate tones. I conducted this analysis first alone and then with five persons, mostly specialists in psychology in the psychological laboratory of Berlin. I had at my disposal the tuning forks of Engelmann [20–853 vibrations], Koenig [512–2,048] and Appunn [8–56, 2,048–40,960], together with organ pipes ranging from c^1 . . . . up to e^6.

All tones of the scale were sounded in turn lightly and sharply and were observed and compared until a statement could be made concerning the degree of clearness or the kind of noises accompanying them.

The result of these observations was the division of the scale into the following eight types of tones:

	Vibrations.	Mr. P. and Mr. F.	Dr. L. and A. W.	*Vibrations.*
I.	8–18 C_3 D_2	Countable and fluttering.	Countable and fluttering.	8–18

[1] *Phys. Psychologie*, II., 95, 104 (5th ed.).

[2] *On the Sensations of Tones*, 171 (3d English ed.).

Tonpsychologie, II., 461.

	Vibrations.			*Vibrations.*
II.	20–60	Fluttering.	Fluttering.	20–60
III.	64–120 C H	Rumbling and rich in tone.[2]	Rumbling and rich in tone.[2]	96–170
IV.	288–480 d^1 h^1	Metallic and completely smooth.	Metallic and buzzing.	320–640
V.	853–1,536 a^2 g^3	Sharp pointed but smooth.	Sharp-pointed but rushing.	853–1,920
VI.	3,200–4,096 $g\#^4$ c^5	Painful although with distinct tone quality.	Painful and shrill.	3,072–4,266
VII.	6,826–9,216 a^5 d^6	Consciousness of the pitch begins to vanish.	Poor in tone quality and hissing.	7,680–9,600
VIII.	10,240 e^6	Limit for pitch discrimination. Twittering.	Twittering overpowered the tone.	10,922–16,384

Between these special rates of vibrations were found transition tones that belong to neither one nor the other neighboring type (white spaces in Figs. 1, 2 and Fig. 4, *b*).

Interesting in this research are the individual differences. Two observers, namely, Mr. P. and Mr. F., discriminate noises only up to 120 vibrations. They stated positively that the tones between c^1 and d^6 were perfectly smooth. Nevertheless they continued the discrimination of the special types of tones.[2] They differentiated in the middle scale metallic tones from sharp-pointed and from painful ones. Other observers, on the contrary, affirmed that every tone is joined with a certain kind of noise which changes only with the change of pitch. Dr. L., after examination of every tone of the scale, called these noises fluttering, roaring, rumbling, buzzing, etc. Concerning h^3 he said: "I hear again a kind of roughness and I think it will never disappear completely." He affirmed the same in regard to tones of 1,200, 2,400 and 4,800 vibrations. The tones between $g^{1\#}$ and f^2 are the smoothest [d^2 to d f^2 bring 'silver-tones'], but are not perfectly free from noise.

[1] The vibration rates are given in accordance with the tables of tones issued by Stumpf and Schaefer, 1901, Leipzig.

[2] Preyer observed the discontinuity of tones up to 300 vibrations: "Ueber die grenzen der Tonwahrnehmung," p. 14; Stumpf describes the lack of smoothness in the lower tones and a kind of trembling (Zittern), perceived by the touch sense, up to 1,500 vibrations. *Tonpsychol.*, I., p. 203.

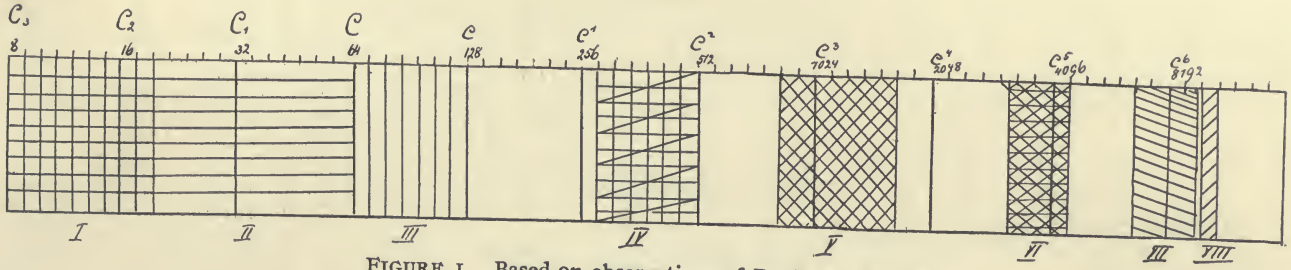


FIGURE 1. Based on observations of Dr. P. and Mr. F.

I. Countable tones. II. Fluttering. III. Rumbling and rich in tone. IV. Metallic. V. Sharp pointed. VI. Painful. VII. Consciousness of pitch begins to vanish. VIII. Limit for pitch discrimination.

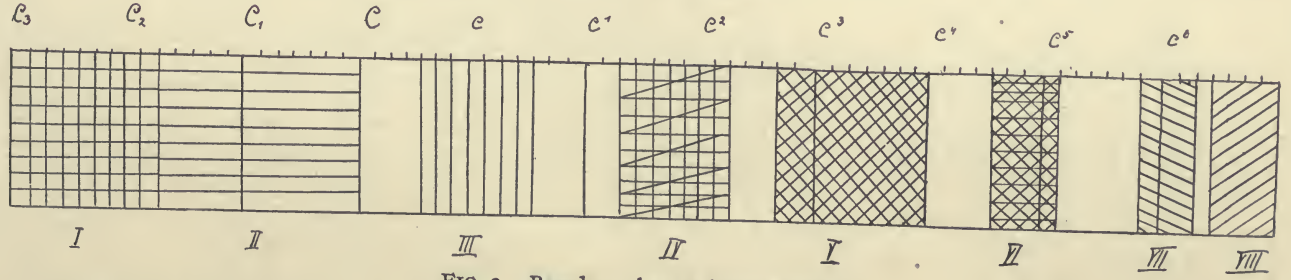


FIG. 2. Based on observations of author.

I. Countable and fluttering tones. II. Fluttering. III. Rumbling. Metallic and buzzing. V. Sharp-pointed and rushing VI. Painful and shrill. VII. Hissing, poor in tone quality. VIII. Tone drowned by twittering.

It is to be mentioned that a^1 of this part of the scale serves as a standard in Europe for the tuning of all instruments.

A Swedish physician, Dr. S., expresses himself to the same effect. From E_2 up to g^1 he describes these noises as distinct and exciting attention. Of d^2 he says 'I hear a whistling similar to that heard in valvular disease of the heart.' Of g^2, 'I hear the sound separately from the noise.'[1] He designates the noise belonging to C^3 by a Swedish word 'stráj.'

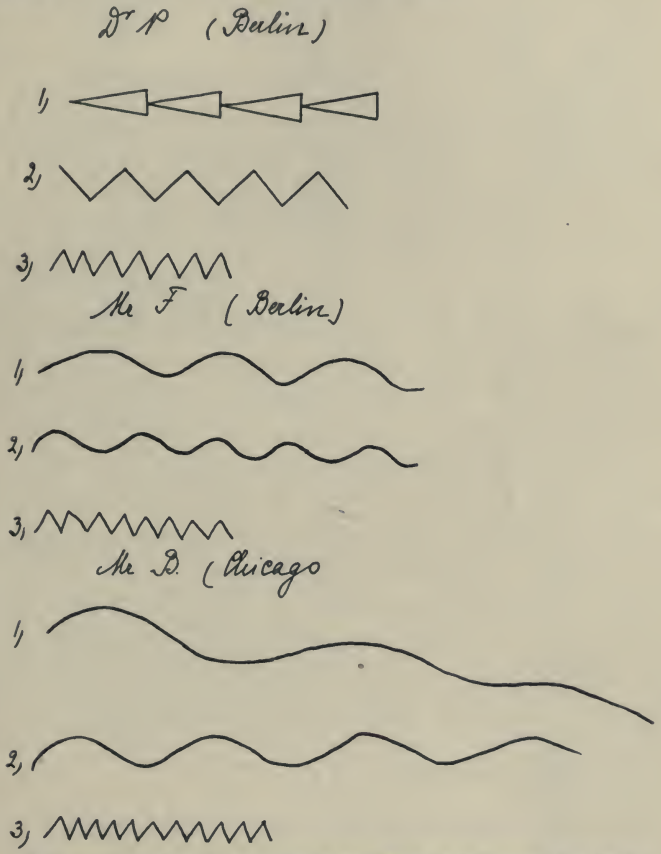


FIG. 3. Showing visualization of beats as explained in text.

Special Details. — In every tone we can hear different kinds of rhythmic fluctuations that are the most distinct between e^1 and a^2. These fluctuations were visualized by a few observers

[1] Max Meyer in his article 'Ueber die Rauhigkeit tiefer Töne,' *Zeitschrift für Psychologie*, 13, p. 75, expresses himself theoretically in the same way.

in the following way: Fig. 3. They are slow in the cases numbered 1, quicker in those numbered 2, and quickest in 3.

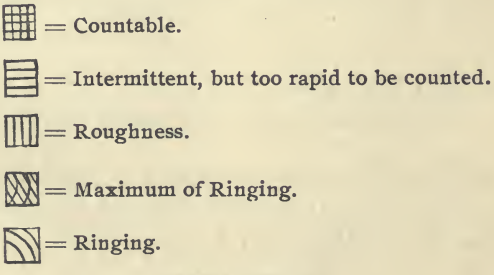
The comparison of the most prominent fluctuations with the pulse by help of the metronome gives the following average from four persons (the metronome being adjusted to coincide with the fluctuations):

Tone.	Metronome.	Pulse.
D	56	72
C^6	58	70
$d\sharp^4$	72	68
d	69	66

A later measurement of the same phenomenon in reference to the time gives in five seconds 5 fluctuations of the first, 10–12 of the second, 20–24 of the third kind. This measurement must be regarded as approximate merely.

II.

Observing the beats I have searched first to find their limit. After a long analysis of all intervals of the perceptible scale I found that a certain kind of roughness was still to be heard in d^3 a^3 with tuning forks of Engelmann and in c^4 g^4 with the organ pipes. I found a confirmation of it in the statement of other observers. Dr. L. says, "I hear in c^4 g^4 something like traces of beats." A second confirmation I obtain in the tuning forks g^4 c^5 of Landry. (Physical Lab. Chicago Univ.) But I would not assign too much importance to such results, for they are not only dependent on personal differences but probably on the degree of perfection in the tuning forks. More valuable seemed to me an approximate topography of beats with refer-



Key to FIG. 4a.

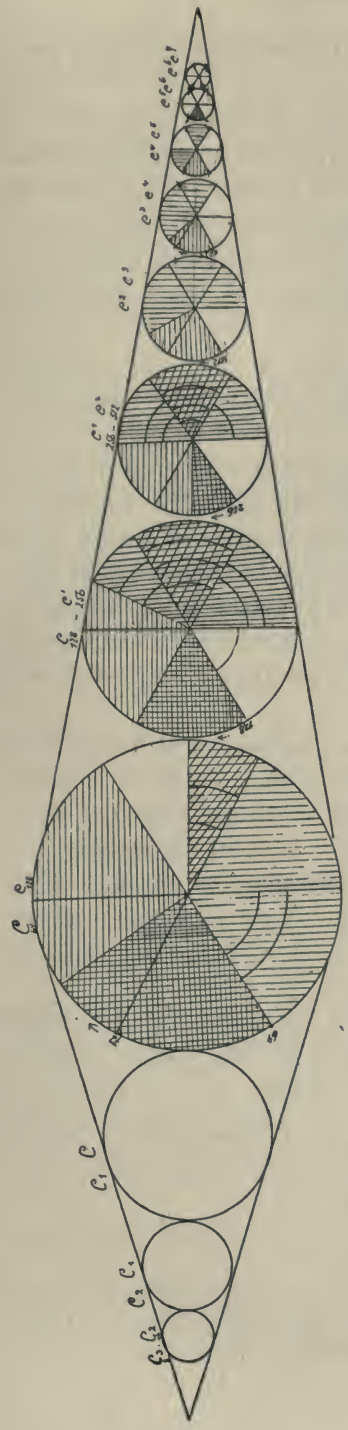


FIG. 4a. For explanation see key in diagram just preceding, also Fig. 5 and description in text.

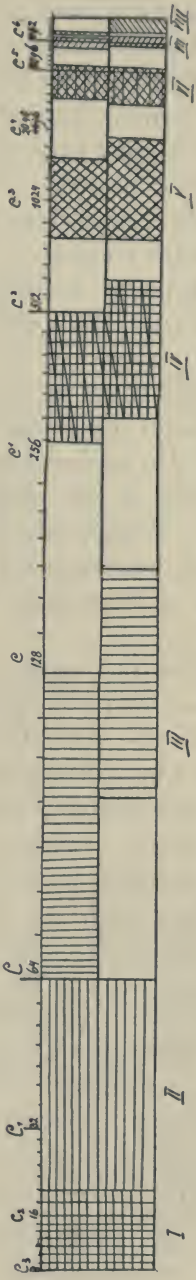


FIG. 4b. For explanation see legend under Fig. 2.

ence to their quality, intensity and feeling-tone which is indicated in diagram 4, *a*.

A close observation of all intervals in every octave shows that there are three kinds of beats: (1) Beats of the main tones, which break into two subdivisions: (*a*) beats that can easily be counted, and (*b*) beats of distinct intermittence too fast however to be counted. (2) Beats, or better roughness, originating mostly from difference tones. (3) Beats recognized as a characteristic ringing.[1]

Beats of the first kind expire in c^1 d^1 (Fig. 4, *a*, small squares). We count them easily in c^1 $c^{1\#}$ but with great difficulty in c^1 d^1.

The beats in which the intermittence is still prominent are of longer duration. They are still heard in c^1 e^1.[2] In c^2 e^2 we hear also an intermittence of two tones, but mixed with a shrill outburst of difference-tones which makes the observation difficult. With larger intervals the beats of basal tones can not be heard, but there is a certain roughness in which the difference-tone is prominent. Traces of this roughness persisted until c^4 g^4.

Now if I strike a fifth c^1 g^1 more sharply, or if I strike the lower tone of the fifth lightly and the higher one more strongly after a few seconds, I obtain beats of a different kind, usually a kind of soft and countable ringing. It is an interesting fact that this ringing, though weak in the fourth and the sixth, is much stronger in the fifth. The fifth seems to afford a maximum for this ringing, while the second is a maximum for the beats of the first kind.

But these beats do not appear in the same way in all the tuning forks. They are very distinct in the tuning forks of Engelmann (Psychol. Laboratory, Berlin) and of Edelmann (Lewis Institute, Chicago), are less so in tuning forks of Koenig (Psychol. Labor., University of Chicago) and of Landry (Physic. Labor., University of Chicago).

[1] Max Meyer (Zur Theorie der Differenztöne, *Zeitschrift für Psychol.*, 1898) compared it with the ringing of church bells.

[2] According to F. Kruger ('Beobachtungen an Zweiklängen,' *Phil. Stud.*, VIII., 335), who indicates the limit of beats with tempered tones in and above one octave, the major third c^1 e^1 is considered free of beats.

The soft ringing is prominent in the following intervals with the tuning forks:

Engelmann.	Edelmann.	Koenig.	Landry.
cis gis^1	c^1 g^1	c^1 g^1	c^1 g^1
fis cis^1	d^1 a^1	d^1 a^1	d^1 a^1
g d^1	e^1 h^1		g^4 c^4
c^1 g^1	c^1 f^1		
d^1 a^1	d^1 g^1		
	c^1 a^1		
	d^1 h^1		

In order to render graphic all these details I use the following easily understood figure (Fig. 4,*a*). The musical sign of 'crescendo' and 'decrescendo' is used as a kind of frame for a series of circles that represent so many octaves of the scale. This sign by a progressive enlarging and diminution of circles represents graphically the maximum and the progressive diminution of intensity in the beats. Each circle is divided into 6

FIG 5. To illustrate the divisions into intervals of the circles in Fig. 4a.

sections of 30° each which represent 6 intervals of every octave (Fig. 5). Various forms of lines (as explained in the legends and key) represent beats that are caused by the main tones and by the difference-tones. Small squares indicate beats that can be counted; horizontal lines, beats with prominent intermittence. Vertical and diagonal lines illustrate the roughness of difference tones; parts of black circles the soft ringing, diagonal lines with circular cross lines its maximum.[1]

Special Details About the Feeling-Tone. — The beats generally are not disagreeable in the middle octaves, but in the

[1] This diagram can be used easily to show the beats of tempered tones or of intervals wider than one octave.

lower and the higher ones they produce sensations that are unpleasant to the ear. So, for instance, the beats called 'Stösse' or strokes of the lower tones are disagreeable because they produce sensations of touch upon the tympanum. The beats of the difference-tones in the higher octaves are disagreeable because of their shrillness.

Very characteristic are the beats of every third. It seems as if the tones of the third were æsthetically better united with each other than those of other intervals and richer in upper-tones, which give to the third a more harmonious sound.

Lastly is to be noted the correspondence of the beats with the division of tones made before. (Fig. 4, *a*, and 4, *b*.) The beats appear in the region of tones in which the intensity and the pitch of the tones is easy to appreciate; they disappear in the region in which the perception of tones is very disagreeable and the pitch difficult to judge. The ringing appears mostly in the tones that are characterized by prominent rhythmic fluctuations. (Fig. 4, *a*, circumferential lines.)

This topography of beats now permits an answer to the question asked at the beginning of this article, namely, why the limits given by Wundt, Helmholtz, and Stumpf are so far removed from one another.

Wundt has observed only the beats of the main tones. He says:[1] "Bei Schwebungen, welche die Zahl 30 merklich übersteigen, vermag unser Ohr die einzelnen Töne nicht mehr auseinander zu halten." Or:[2] "Ich verhalte mich demnach allen Behauptungen gegenüber, nach denen noch weit über 60 Schwebungen als solche wahrnehmbar sein sollen, skeptisch. Ich glaube, dass sie theils auf mangelhafter psychologischer Unterscheidung der verschiedenen Stadien des Schwebungsphaenomens theils auf der Vermengung mit den Schwebungen von Differenztönen beruhen."

Fig. 4 shows that the beats which can be counted nearly disappear at 32. The second c^1d^1 is difficult to count. But a prominent intermittence is to be found up to 64 vibrations;

[1] *Phys. Psychologie*, 3d ed., I., 438.
[2] *Phys. Psychologie*, 5th ed., II., 104.

$c–f\sharp = 51$ vib.
$c^1e^1 = 64$ "
$c^2d^2 = 64$ "

In the octave c^2c^3 the intermittence is less conspicuous because the beats of principal tones are mixed with the outburst of the difference tones.

The beats that were observed by Helmholtz are in the basal tones again. He pointed out the limit in h^3c^4 (= 132) saying, however, that the beats in this octave are much weaker.[1] "Taking b′c″ one octave higher we have b″c‴ with 66 beats, and another octave would give us b‴c⁗ with as many as 132 beats, and these are really audible in the same way as the 33 beats of b′c″, although they certainly become weaker in the higher positions." Or: "We can pass gradually from 4 to 132 beats in a second, and convince ourselves that though we become incapable of counting them, their character as a series of pulses of tone, producing an intermittent sensation, remains unaltered." Stumpf[2] identified the beats with the roughness of difference-tones at 427 vibrations. He says: "Bei a^4 h^4 war die Schwebung für mich noch deutlich und zwar fasste ich sie als die Rauhigkeit des Differenztones."

The roughnesses that I found with d^3a^3 or with g^4c^5 are the traces of this ringing described before. The reason for this seems to lie in the summation of the rhythmic fluctuations, the speed and even the inconstancy of both being nearly the same.[3]

[1] *Op. cit.* 171.

[2] *Op. cit.* 461.

[3] The author herewith extends her cordial thanks and hearty appreciation to the officials of the various laboratories in which the present investigation has been conducted for their courteous assistance and encouragement.

The MS. of this article was received July 28, 1906.—Ed.

INTRODUCTION TO EXPERIMENTAL LOGIC.[1]

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§ 1. What Experimental Logic Is.

In opening the discussion of the more refined operations of the logical mode, together with its meanings for consciousness, we should first of all justify the term 'experimental' logic which we are applying to this branch of the larger subject of genetic theory of knowledge. This we may do by explaining first the sense in which the matter constitutes logic, and second, the sense in which it is experimental.

The treatment of the operations of thinking, that is, of the discursive or reasoning faculty generally, under the term Logic, is so conventional and established, that further defence of it is not necessary.[2] It is only the nature of the method adopted — the method called 'genetic' — involving as it does, a peculiar point of view, that distinguishes the present treatment. That method consists in tracing out the movement of the function of cognition — in this case, the logical mode of it as such — in its great typical movements or 'progressions,' with the attempt to determine the 'how,' 'why,' and 'whereunto' of each stage in the advance. Thinking is thus considered in the light of an *effective function*, working upon the objects of cognition, having adequate motives for its passage from one stage to another, and pursuing its characteristic method in achieving each successive stage. It is this general conception of a logic that is genetic[3] that justifies the isolation of the function of thinking for special treatment.

[1] Being the 'Introduction' to the second volume of the writer's work on 'Genetic Logic' entitled *Thought and Things*. It may be taken to supplement the 'Introduction' to the first volume of the work, on 'Functional Logic' (Sonnenschein and Macmillans, 1906), referred to in this paper as Vol. I.

[2] See the account of 'Formal Logic' in Vol. I., Chap. I., § 2.

[3] See the detailed exposition of the field and scope of Genetic Logic, Vol. I., Chap. I.

In adopting the term *experimental* logic, a certain general result of the treatment itself is anticipated. That result is, in brief, as follows. The logical operations as such, considered as the essential method of advance or progress in the mode of thought, *proceed by experimentation*, or to use the more special term employed in the first volume of this work, by a process of 'schematism.' This consists essentially in the *experimental* erection of an object already made-up in consciousness, and its treatment as having a meaning or value which *it has not yet been found to have*, with the expectation and intent that in the result it may be found to have it. It is, in the logical mode, an intentional and conscious use of a method established and found fruitful in the pre-logical stages of psychic assimilation and handling of objective contents, as has been shown in another place.[1] The results of what may be called the 'progression of experimentation' as a method may be summarized for our present purposes under a separate heading.

§ 2. The Progression of the Experimental Mode.

The development of cognition, in its essential progress, is always one of increasing determinateness in the two great moments that enter into its objective meanings. These two moments are the *content* and the *control*. The content is what it is because *it is determined and controlled to be that* and no other object. Besides its determination as having this or that make-up, consistency, subsistence, it is controlled as capable of being referred to one or other of those spheres or classes which be-

[1] Vol. I., Chap. V., § 6; Chap. VI., § 4; Chap. VIII., §§ 6–8. It will be seen from the division given in the table in Chap. I., § 6 of that volume, that the larger topic of 'functional logic' includes what is here called experimental logic; for it is the *function* of knowledge in the mode called 'logical' that is now to be taken up. Both on account of its special characters, however, and also on account of its traditional monopolizing of the term logic, it is worthy of detailed treatment and also of a special name. To those, we may add, who do not admit that experimental processes exhaust the procedure of the mode of thinking, we have only to say — let the scope then of 'experimental logic' be restricted to those operations which are and are shown to be experimental. There will then be left over for another discipline — formal, deductive, rational or whatever it be called — the problems which such non-experimental processes present. To such thinkers the problems of this volume will be found to be among those of the discussions sometimes known as 'empirical logic.'

come, for consciousness, existences, substances, and realities. The process of contextuation of content might go on *ad libitum* by the mere presence together of items, images, fancies, etc.; but it would be meaningless. If, however, meanings are to arise whereby such contexts have reference to the spheres in which in some sense *they hold good*, then different controls must also be derived and developed in our theory.

Now it is on the side of such reference, such control, such assignment of possible and present combinations of contents to their spheres of fulfilment that a method of selecting, testing, exerting or acknowledging control is necessary; and this we find, as the result of our detailed examination of cognitive process, to be one of experimentation. The main stages of its determination — its progressive modes, so to speak, as worked out in the earlier volume — are as follows.

(1) The 'semblant' or make-believe use of an object having merely inner character as image of fancy, whereby it is treated for playful or other personal purposes *as having further meaning or reference*. The object thus becomes a 'scheme,' a *schema*, charged with the further meaning which it, in its own right, has not as yet been found to have.

(2) The erection of such schemata in an *experimental* way under the urgency of a desired or intended fulfilment. There results either fulfilment or non-fulfilment, and either is a marked accretion to the original meaning so erected. Thus by the experimentation both the determination and the control are essentially advanced. In the pre-logical modes, consciousness has no other way — barring possibly certain brutal intrusions upon it [1] — of advancing or effectively selecting its meanings.

(3) The most important instance of this before the rise of reflection is that which issues in 'generalization.' By the use of a schema as a meaning adequate to embrace many instances, and hence *experimentally taken to mean them*, it is discovered what cases may properly in the particular instance be meant. The individuation of objects as general, particular, singular and universal — as is shown in the earlier discussion — is secured by this process of schematism.

[1] To these, however, it must still accommodate itself, by 'trial-and error' processes which are in type experimental.

(4) The transition to the logical mode as one of reflection, is accomplished again by an act of essential experimentation. The contexts which are still ambiguous in their meanings as general and particular, under whatever control, are all alike erected as schemata within the larger control they have in common — that of the inner life or experience. From this point of view, that of experience under a control functioningas judgment, the contents may severally get *whatever further assignments the schematism of this mode may secure.* The entire context of experience — idea, hypothesis, imagination — becomes available for experimental treatment in the problematic forms of judgment which embody variations in *belief.* The schematism of the logical mode becomes the method of determining belief; and the entire development of logical meanings may be treated from the point of view of ascertaining the forms in which the relative determinateness or indeterminateness of belief takes form in presupposition, postulation, implication or other mode of acknowledgment or assurance.

In other words, as of cognition generally, so here; there is the established and there is the not-yet-established, the content and the intent, the fact used as anticipatory schema of richer fulfilment. The method whereby consciousness, by using a meaning experimentally, establishes and advances it, holds for thinking also.

If this be the exclusive method, or even the principal method, whereby thinking does its work, then it is quite proper to call this department of genetic logic 'experimental.' The further questions as to the limits of experimentation and the possible advancement of meanings by some other process or by no process at all — these may in turn be solved by the inquiry itself, or, if left over, made subject of separate disciplines.

It will, therefore, serve the interest of clearness, if we define experimental logic as that enquiry which, pursuing genetic and functional methods, *investigates thinking with a view to tracing the derivation, development, and embodiments of belief.*[1]

[1] These three words indicate the problems 'why,' 'how,' and 'what' of the logical mode, although in the treatment which follows the topics are taken up rather with reference to divisions current in the literature. 'How' belief

§ 3. The Two Types of Schematism.

Speaking still on the general topic of experimentation, we may say that there are two contrasted ways in which a content may be made schematic and so be used experimentally. These illustrate respectively the methods of advance of the two great sorts of meaning, 'recognitive' and 'selective'—or meaning established by recognition and held up as true, and meaning selected by and for appreciation and held up as, in some immediate sense, good or 'fit.'[1]

It is evident that these two types of meaning result from and appeal to different motives. The items of established fact are taken as just what they are, and used for the discovery of further items of fact. Only so far as the content is stripped of selective and personal meaning, of all interpretation beyond its bare outline as a context of knowledge, only so far is it available for the schematism whose motive is theoretical. The schema of this sort is instrumental to the development of knowledge as such, of a representative and convertible system of cognitions; in short, to the development of what is to be acknowledged as true. This may be called 'scientific' or theoretical schematism. On the other hand, the furtherance of special personal purposes and interests requires a schematism of its own sort. This consists in the selective use of a context as 'fit' to fulfil a purpose or end and thus 'good' for that purpose or end. The items chosen are *appreciated* as 'good' or 'fit,' and the further advance is in the confirmation and development of this sort of appreciable fitness. The development of selective meanings in the pre-logical modes is by this sort of schematic

embodies itself in judgments is taken up in one chapter, and in 'common' judgments in another; 'why' it is thus embodied is the question of 'schematism' in two chapters. The question 'What?' suggests the topic of the organization of logical meanings in a system, which is also treated in considerable detail; and the limitations of thinking, together with the new problems set by the logical function itself, are given full consideration.

The correlation might be pointed out between the scheme of results summarized in this Introduction and those worked out from the objective point of view in the writer's paper on 'Selective Thinking' (printed as Chap. XVII. in the work *Development and Evolution*).

[1] See the theory of 'Meaning' worked out in Vol. I., Chap. 7.

or experimental use of contents.[1] In the logical mode it may be called 'selective' or 'appreciative' schematism.

The further treatment of these two sorts of experimental use of contents is to follow; they are mentioned in this Introduction in order to point out that with the rise of judgment as characteristic control in reflection, all appreciations as such are made truths, all selective meanings are made theoretical meanings — *so far as they are made subject-matter of reflection.* Experimental logic, therefore, after it has found it to be the fate of appreciations to be thus taken up in judgments of experience or fact, has no longer anything to do with them as appreciations; for it then deals with such meanings from the point of view of judgments of truth motived by theoretical interest.

The further development of these appreciative meanings goes on, it is true, in its own right; but experimental logic, as theory of reflective or logical procedure, loses its claim upon them. There is indeed the special need of inquiring in detail as to the function whereby the items of selective schematism arise and are found eligible or 'fit'; this is to be discussed in the treatment of the hyper-logical modes. The operations of the constructive imagination, in its selection of materials with reference to what may be called purposive or normative ideals, is to be distinguished from that other sort of schematic use of a context whose aim is to extend its comprehension in the domain of fact or truth. It is the latter with which the developments of our text heretofore have had mainly to do, and to which this volume is to be exclusively devoted.

The preservation of this distinction is subject, however, to a complication which we may as well point out now, especially as it enables us to introduce a scheme of definite terminology that will later on stand us in good stead. It is the complication that, while disclaiming any motive of a personal or purposive sort in its theoretical schematism and experimentation, yet reflective process is itself motived by its own interest. The interest and purpose to know and to know only what is resolutely true to fact, requires a certain restriction of the scope and function of the mental life to that more direct field of psychic vision we

[1] See Vol. I., Chap. VIII., § 9.

call the 'theoretical.' This results in a fulfilment, a renewed appreciation, of its own type. We will find, therefore, that the separation of the two modes of rendering the meanings of knowledge is not final; nor are they exclusive *inter se* as to content. Not only do appreciated experiences become when judged theoretical; but judged contents are appreciated as fulfilling the ideal set up by theoretical interest. A logical solution of a problem meets the demand for logical validity and so fulfils the interest of its theoretical pursuit.

There is, therefore, when we reach the logical mode, need of careful distinction of the various sorts of 'interest' that motive these great progressions of meaning. Accepting the distinction already advanced between the psychic and psychological points of view,[1] we may recognize 'practical,' 'pragmatic,' 'pragmatelic,' and 'theoretical' interests. 'Practical' interest is that which motives the mass of contents of cognition and action [2] as fused together in their early flow and development. The interest of the child in his tea-spoon is practical. It is an interest in which the factors of knowledge and action have not yet been isolated. 'Pragmatic' interest is the practical interest considered from the objective and psychological point of view. For example, with my knowledge of the child's processes, I may describe his interest as having consequences, bearings and motives which he himself does not apprehend. My account of his interest makes it a pragmatic interest. The dualism of the factors of knowledge arises, however, in later modes in consciousness, and the relative opposition between recognitive and selective meanings appears. This is consummated in the segregation of the interests that clearly motive knowledge over against the contexts acknowledged and judged. So there arise 'theoretical' interest on the one side—interest in maintaining and furthering the context of knowledge [3]—and over

[1] Vol. I., Chap. 7, § 3.

[2] Action in the large sense, as including fulfilments, consequences, etc., in what is called 'practical life.'

[3] From the objective point of view this is the 'logical' interest. It may be named with reference to its psychic end, 'noötelic.' Interests of the type that motive objects of the 'semblant' sort are 'autotelic' in the play-mode (see Vol. I., Chap. VI., § 5), and — drawing still upon the Greek — 'syn-telic' in the Æsthetic mode (to be discussed in Vol. III.).

against it 'pragmatelic' interest, which terminates upon the system of satisfactions, fulfilments, appreciations, as such. These fulfilments are now isolated, set up as psychic meanings, and made *ends* of pursuit.

The two points just made may be stated in terms of interest. The objects of pragmatelic interest, *appreciated as fulfilling*, are, when judged to be objective experiences, placed in a context of recognitive and common meanings, and are thus made objects of theoretical interest. On the other hand, the items of knowledge in a measure reduced to a context of theoretical interest, are thereby made pragmatelic, since the fulfilment of the theoretical interest is a real fulfilment and satisfaction, although its ideal involves the denial of the interest in fulfilments as such.

We shall find, therefore, in the sequel, that the whole field of meanings of appreciation will also bear interpretation as a field of theoretical truths, and that the whole field of theoretical knowledges may be interpreted as meanings of fulfilment and appreciation. In short, the entire body of psychic objects may be both true and good in appropriate senses at the same time. That is, putting it somewhat differently, a self-consciousness cannot be aware of its own satisfactions without also judging them as objects of experience; and such a consciousness cannot judge or acknowledge its experience, without also appreciating it as being good for what it is.[1]

[1] But this, of course, is anticipatory (of Vol. III.). The approaches to such a point of view may be found in the chapters 'Origin v. Nature,' *Devel. and Evolution* (Chap. XIII.), and 'The Cosmic and the Moral,' *Fragments in Philos. and Science* (V.). In this latter chapter, published originally in the *International Journal of Ethics* (October, 1895), it is contended that the 'ends' of ethical pursuit — the contents of the 'ought' — are, as they are attained, added to the context of theoretical truth (the contents of the 'is').

DISCUSSION.

CERTAIN CHARACTERISTICS OF EXPERIENCE.

Recent philosophical discussions have made extensive use of the term experience. This is practically true of the new empiricism which styles itself pragmatism and of absolute idealism as set forth by Royce. These discussions have made it apparent that this term, like many others of its kind, has no finally settled meaning, and that it can thus be pressed into service as the starting point of lines of thought which in the end are widely separated.

That any ultimate agreement as to what experience really signifies can be reached is perhaps too much to be hoped, yet any attempt to clear up some of the obscurities which attach to the present use of the term need not offer a plea of justification. I venture, therefore, to suggest in the following pages some of those marks of experience which seem most important in the present state of philosophic uncertainty.

I. There are some points of common agreement in regard to the nature of experience, and I believe it can be stated without serious fear of contradiction that *experience must be taken as the ultimate essence of the universe*. It is neither derived from, nor conditioned by, anything else. Both pragmatist and absolute idealist have clearly recognized this truth. To have done this is a great gain, but the value of the position has been materially lessened by the interpretation of the meaning of experience which these two schools of thought have arrived at. Both have found in experience something that goes beyond human consciousness. The pragmatist, if we are to follow James, seems to find his starting point in an infra-human and infra-conscious experience, the absolutist seeks the goal of reality in a super-human experience. In the speculations of James 'pure experience' has come to designate the primitive reality from which related human experience has sprung, while on the other hand Royce and Bradley have passed beyond human experienee and have arrived at the experience of an absolute thinker, who because of his very absoluteness is completely transcendent. The absolute idealist enquires whither thought is tending, while the pragmatist enquires whence it came,

but neither has arrived at anything actual. Both found their speculations on consciousness, consciousness as we know it, human consciousness, with all its limitations and imperfections. There is no way of transcending this individual consciousness unless we take the deadly leap. Absolute idealism leaps forward, pragmatism backward; absolute idealism carries thought to its completion and its negation, while pragmatism traces it back to its original chaos whence it came. In a world of infinite possibilities of experience we cannot arrive at the completion the absolutist posits, neither in a world of finite relations can we trace thought back to its pure immanency before these relations were evolved.

II. In opposition to both these views I venture to suggest that *experience has a complete identity with finite consciousness*. The two terms should be taken as interchangeable. There is no consciousness that is not experience and no experience that is not conscious. If we make experience wider than consciousness then we shall be obliged to think of an experience which is prior to consciousness. Such an experience, however, could never be known, and must forever remain a pure abstraction, a veritable Ding-an-sich for human beings. James thinks of pure experience as the original stuff from which everything is derived. Known and knower are parts of pure experience and develop from it. Yet he also describes this same pure experience as the original flux of life before reflection has categorized it. "Only new-born babes and persons in a semi-coma from sleep, dreams, illness or blows can have an experience pure in the literal sense of a *that* which may not yet be defined as a *what*." Here pure experience is made identical, apparently, with mere sensation or feeling. It is a subconscious affair — but the subconscious is still conscious. I emphasize this apparent contradiction to show how difficult it is to escape the assumption that experience must be conscious in order to be experience. Consciousness cannot be a function of experience, then, as James would have us believe. He himself cannot carry this doctrine to its legitimate conclusion, but is forced to find in pure experience rudimentary consciousness.

While we must be on our guard to avoid this error of an infra-conscious experience, we must be equally careful to recognize that there can be no consciousness (at least as far as we can know it) that is not itself experience. In other words there can be no pure consciousness which can ever be gotten at.

Experience implies a content, and consciousness must possess, even in its lowest forms, a noetic element in order to be conceived as con-

sciousness. Mere immediate consciousness, a pure feeling without differentiation or direction, if it exists cannot be known. Only objects are known and for an experience to be an element in a subsequent and wider experience it must contain objective elements.

III. Further it must be insisted that *experience is always the subject and never the object. What we actually know are objects experienced and not experience as such.* From this it can be seen that the assertion of Spinoza that we not only know, but know that we know, is impossible. Thought is buried in its object and not turned on itself in the moment of knowing. Consciousness is that which conditions all objects but which cannot be conditioned by itself. The experience of the moment is always immediate, directly given, pure actuality, while things experienced are always mediate. Immediate knowledge is a contradiction in terms.

Further we can no more know past experience as such than we can know present experience. What we know are objects of past experience and not the past experience itself as subject. When we introspect and examine a state of consciousness which has past, we cannot do this by bringing up the consciousness as such but by again experiencing the objects of the past state. If a contentless experience could exist, therefore, it could not be known. Between it and the present there would be an absolute break, a gulf that could not be bridged.

No purely immanent state of consciousness could be recalled in memory, for memory is composed of images. We at once are convinced on introspection that as the content of an experience grows less exact the experience itself tends to slip out of consciousness. There has been much talk of late about the truth of feeling, but this is to my mind a manifest absurdity, if by feeling is implied pure affective immanence without content or direction. Truth means relation of one part of experience to another, and if there are no parts to relate there can be no truth.

Perhaps the meaning of the above point of view may be better shown by a concrete illustration. As I am writing these words, I see the lamp before me. It is the focal element in a complex noetic state. I shut my eyes and try to analyze this state as a past experience. What I really arrive at in my introspection is not the subjective state of consciousness, but the experienced objects of my past state. The objects of my introspective state are, as far as I am able to recall the past moment of consciousness, the same, as were the objects of my direct visual and motor experience a moment before. They are somewhat less permanent and vivid and definite than they were in the original

state. However, in this introspective analysis I have nothing given that was not present in the direct perception and I in no way arrive at my past experience as such in distinction from the objects of my past experience.

Consciousness reveals to us various classes of objects. First of all there are the objects given to us through the direct sensory experience. This is the stuff from which all experience as such is supposed to take its rise, yet it cannot constitute experience itself, because as mere sensation it cannot be known, but only as sensation interpreted or objectified. It is this interpretation or objectification that gives the reality to objects of experience, and it is this same tendency which gives various classes of objects in experience and leads to the separation of the world into mind and matter, *res cogitantes* and *res extensæ*. Objects are always in the last analysis partly sensory and partly ideational. This is clearly true of all objects perceived and imagined. Of objects of reason this is not quite as evident, since the symbol of the objective reality has come to take the place of the concrete sensory experience. This symbol itself, however, is sensory and stands in the last analysis for the original sensory experience. The relationships between objects, which from a large part of our conscious life, are themselves not detached nor separated from the objects, but inhere in them and are experienced in these objects just as much as any aspect of the objects such as color, or form, or hardness or odor. Relations are not superimposed on the objects but arise in the objects — they are not detached ideas. Further our experience of bodily states, which give rise to the feelings and emotions and, in muscular adjustments, to the experience of will, are clearly also sensory in their character and attach themselves to objects in the world outside the body. It is erroneous to suppose that these subjective states are experienced as purely subjective and contentless. An emotion has locality and externality both in the world outside the body and in the body itself. Indeed there can be no affective state that does not take a concrete and objective form, nor can there be a state of will that does not have an objective point of attachment. It is often held, apparently, that these states exist as pure and immediate, that they can be arrived at directly. Introspection shows that this is not a true analysis of the experience. All our experience whether sensorial, imaginary, rational, affective or voluntary, is the experience of something objective.

It happens, however, that among these various objects there are some elements which seem more permanent and abiding, more general and universal, and these are taken to belong to the material world,

while others are regarded as individual, peculiar, variable and are looked upon as mental. There is no object that cannot be looked at from these two standpoints and as the emphasis is given to one or to the other of these aspects the object is regarded as mental or as material. Thus arose the ancient distinction between primary and secondary qualities of matter, which, however, is only a relative distinction and never one that can be made absolute.

Psychology has to do with objects in so far as they exhibit mental constituents and relations, but it has no objects that belong entirely to itself. It has nothing absolutely peculiar, and does not consider consciousness as such apart from objects, as is often held to be the case. The gravest confusions have arisen when the mental world has been made identical with experience (consciousness) as such. We are told, for example, that the mind knows only ideas, the reason for this assertion being that the mind cannot know something outside of consciousness — which is a self-evident assertion. Ideas, however, strictly speaking are simply aspects of objects and cannot be detached from these objects and be known in their purity.

Many tangles of epistemology may be traced, I believe, to this confusion of consciousness as subject and the mental world as object. The two aspects of objects have been violently separated and then the attempt is made to bridge the gulf by various theories of knowledge, none of which is adequate to accomplish its purpose. The trend of all such assumptions is toward subjective idealism or absolute idealism and away from the healthful realism which gives vitality to our thinking.

IV. As a matter of fact *all experience is realistic, but experience itself is not real.* This may seem a contradiction, but a closer examination will reveal the truth of the statement. As to the first part of the proposition, its truth lies in the fact that to have any experience means to have an object, ultimately an object with a sensory basis, an object which has a degree of permanence, stability and universality, and hence a reality.

There is no question of going outside of the experience to a trans-experiential reality, a manifest impossibility, but of giving to the object in experience this quality of reality. Indeed, to have an experience, to be conscious, means nothing more nor less than to objectify, to have a content, to give a permanence. There is no experience, never mind how rudimentary and incomplete, which is not of this nature — if one should exist it could not be known. All experience must therefore be realistic.

Yet experience as such, being the immanence of pure being, can

be called neither real nor true. These terms apply only to objects of experience in their relations and connections. Experience simply *is*, the ultimate fact of the universe, which, because of its ultimate nature, cannot be in itself described nor known.

Some recent discussions in regard to the nature of feeling hint at an experience that is purely immanent. Dr. Washburn, for example, speaks of feelings that are "absolutely unanalyzable and unlocalizable." Among these she gives feelings of relation and of pleasure-pain. Neither of these experiences, I would insist, ever occurs without attaching itself to some object, either within or without the body and cannot be known except as objective. Indeed, Dr. Washburn should hold that they possess this objective characteristic, since she considers them as motor attitudes, the feelings of relation as of a vestigial nature, and pleasure-pain "as representing the most fundamental of all primitive motor attitudes."[1]

In the sense in which I am using the term there can be no state that is entirely mental and subjective, as some writers would hold. I cannot, therefore, believe, as Professor Stratton affirms,[2] that imagination, for example, is purely mental.

It is as clearly objective in certain of its aspects as is perception, and is to be treated from the same realistic standpoint. The objects which it contains are not any less real nor true than those given in sensory experience. It is an error to consider imagination thus peculiarly subjective and unreal.

It may seem that the foregoing analysis had done away with consciousness as such and has left merely objects of experience, since experience expresses itself objectively and cannot exist without its objects. Although this relation between experience and its objects is one that cannot be dissolved, experience is not its objects, — it is, however, capable of description and analysis only through its objects. As the ultimate it cannot be known, but still it must *be*. To say that it is nothing is both true and false, — true in the sense that it is not an object among objects, false in the sense that it has no being. It cannot be imagined, for imagination exists only in terms of objects of consciousness; no more can it be perceived, because perception rests on imagination and sensation. It cannot be rationally deduced, for reason employs symbols (themselves objects and standing for objects).

Yet, on the other hand, experience is the final solvent of all things.

[1] See *Journal of Philosophy, Psychology, and Scientific Methods*, February 1, 1906.

[2] See PSYCHOLOGICAL BULLETIN, January 15, 1906.

The reality of any content of experience may be doubted, but the being of the experience is the final fact which cannot be brought into question. Such a doctrine as this may perhaps be designated as mystical, but if it is mystical I believe it is necessarily so. The seeming mysticism which it contains results from the impossibility of giving an objective account of the immediate fact of being, and does not arise from an attempt to transcend the immediate and to reach a supra- or infra-experiential reality. It is not due to an attempt to know the unknowable. It rests in the fact that we cannot put into objective terms that which forever must remain subject.

Experience should not be looked on as merely a logical fact, made necessary as an antithesis to the object experienced. It is more than formal, it is actual. It has been recognized at various times by various names, but it is always, whether recognized or not, present in some form. It has been termed, for example, the 'soul,' the 'synthetic unity of apperception,' the 'pure ego.' Attempts of recent date have been made to banish it, or its equivalent, consciousness, from psychology. James has styled consciousness "the faint rumor left behind by the disappearing 'soul' upon the air of philosophy," but though thus condemned to live a spook-like existence, it still refuses to pass completely. Like the ghost of Banquo it reappears when the least desired to put to confusion the philosophic feast the pragmatist would spread. It will not down, but claims its place at the table of experience.

V. Another mark of experience is that *it comes always with a tinge of personality, but is not itself identical with personality.* Personality is an object of consciousness. As has been previously stated, we know no consciousness that has not this characteristic of personal warmth. This peculiarity of all human experience joins together objects experienced in certain groups and does not permit the free interchange of these with objects of other groups. Whether this grouping is ever transcended or not cannot be experienced. We seem to have evidence from mental pathology of one set of experiences passing over and uniting with another set in cases of dual and multiple personality. However, multiple personality may be legitimately inferred but never experienced. The experience is always that of grouped objects tinged with the coloring of our personality. What is true of multiple personality is likewise true of the infra-conscious. As soon as objects inferred to exist in the infra-conscious become known, they have become stamped with the mark of personality.

By way of summary it may be added that experience is the final being of the universe and the only purely immanent actuality that

exists. It is itself not known, but only described in terms of its objects with which, however, it cannot be identified. This experience is always given in a finite, personal way and is equivalent to human consciousness, being nothing more nor less. It is not, however, to be confused with the mental aspect of objects, which is the subject matter of psychology, and is not to be put in antithesis with the material world which is merely an aspect of objects of experience on an equal footing with the mental aspect. Experience embraces both the material and the mental and the existence of one can no more be doubted than that of the other. On this basis all difficulty of relating the mental and the material disappears, together with many problems of epistemology and the contentions of idealism and realism. Indeed, experience is clearly and always realistic in the sense that reality attaches to all objects of experience, which by the very fact of objectification are given a permanence, stability and universality. And here the value of this point of view is seen, since it does away with old time useless contentions and gives back to the philosopher and psychologist the common-sense view of reality which physical science and practical thinking have never for a moment abandoned. It opens the way for a sane discussion of parallelism and the complex questions which arise in the problem of the relations between mind and body; it banishes that spectre of philosophic thought, subjective idealism and leaves psychology free to go about its business like any other science.

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[1] The MS. of this article was received July 6, 1906. — Ed.

CATEGORIES OF THE SELF.

In a former paper,[1] I suggested that, of the two distinct uses or meanings now indicated indifferently by the terms ego and self, the term ego be restricted to one, viz.: the individual who is or may be self-conscious, who can think in terms of 'I'; and that the term *self* be applied to the other meaning, viz.: that content of consciousness in which an individual recognizes himself. Using the term self in this narrower sense, in this paper I would distinguish and name some six distinct 'selves,' *i. e.*, distinct contents, in each of which the conscious individual recognizes himself.

Among other writers James, Baldwin, Stout and Bradley have enumerated each two or more such 'selves.' In the case of James and Stout their accounts suggest in their form of expression a completeness which I think they do not possess. Indeed it seems to me no writer has approached adequacy in this matter, none has done justice to the complexity of our conception of self, or defined with sufficient care the several 'selves,' or properly emphasized the gulf that lies between one self and another.

The problems of the self and the not-self are now less prominent than they have been. Their importance to metaphysics, however, and particularly to ethics is permanent. It is the ethical significance of 'self' that I have most in mind; and partly for that reason I approach the matter from the side of self-feeling. I hope, too, thereby to make my statements concrete and more readily verifiable.

A few words with regard to the nature of self-feeling, Dewey[2] says: "Feeling is always a feeling of self; of the hinderance or furtherance of self-development,[3] through activity." We need, however, the word self-feeling to distinguish those feelings which have for their object self in antithesis to the not-self. James uses the term self-feeling in this latter sense. Such feelings are: pride, humility, shame, self-love, self-pity, etc. The sefeelings are not 'aroused by' self, as James says, but rather, as Hume maintains, are aroused by certain things or qualities which, through instinct or habit, direct those feel-

[1] THE PSYCHOLOGICAL BULLETIN, Sept. 15, 1906.

[2] *Psychology*, p. 281.

[3] The reflexive pronoun self, in such words as self-development, of course need not refer to the self as I have defined that substantive.

ings toward self. Through such instructive or habitual direction of feelings on the one hand the several contents of self are built up; on the other hand those contents of self reciprocally modify self-feeling.

Of the self feelings I select the general class of self-appreciation. Hume [1] describes pride and humility as simple and *uniform* impressions, and he uses pride, apparently, in the general sense of self-appreciation. I would show that for each of the 'selves' I now proceed to describe, self-appreciation takes a different form. These forms, are, I think, easily recognizable, and aid us to realize the distinctions between the several selves.

It is often said, and said with great assurance, that, in pride, our own excellence counts for nothing unless we excel others. The statement is, I think, true only for pride that has for its object the self which I shall call the *historical self*. The historical self is an agent working in a world of agents; it is I as others may know me, as I see myself in a mirror, the living body, speaking, thinking, acting on others, feeling and responding in its own way to the acts of others. Were we to ask the average American what he means by himself, he would probably reply, in effect, that it is this living, active body, which remembers, wills, forecasts; whom others see (though not of course *as self*), love, honor, fear, despise; which triumphs over others and submits to them. Appreciation of this self means little, if anything, except in terms of comparison with the others, the not-self. Better here means better than others. The emotion of self-appreciation or pride, where this self is concerned, is, it seems to me, always properly called *vanity*.

But a man may recognize and appreciate himself as an activity pouring forth 'in ready and abundant measure, beating down all resistance, and making use of obstacles only to overcome them.' [2] Such self-appreciation Job ascribes to the horse: "He paweth in the valley, and rejoiceth in his strength. He mocketh at fear. He swalloweth the ground in fierceness and rage; neither believeth he that it is the sound of the trumpet." This feeling of our superior energy we may call *exaltation* or glory. This self is the inner activity of apperception (Wundt), the sense of inner adjustment (James), in antithesis to the world of means and of obstacles through which and against which my energy, activity or will is or is not realized. I call it the *will-self*. Self-appreciation here means superiority or inferiority of self to the not-self, but the not-self is not other people. Exaltation

[1] *Treatise*, Bk. II., Part 1, Sec. 2.

[2] Dewey, *Psychology*, p. 265.

does not require comparison with other people. It may arise through a sense of the superiority of self to a certain mathematical problem, due to my successful solution of it. If, however, I do compare my success with that of others, I find that the will-self no longer occupies the field; now the self is the historical self, of which the will is regarded as a *possession*, an inner energy, finding its expression in my acts. The emotion is no longer exaltation but vanity, when I attribute superiority to the will I (the historical self) *possess*.

By considering another phase of self-appreciation we may discover two other 'selves.' James[1] says that our self-feeling 'depends entirely on what we *back* ourselves to be and do,' 'on the ratio of our actualities to our supposed potentialities.' Self-esteem, he maintains, varies directly as our success and inversely as our pretensions. But is this always true? If in 'good faith' one gives up all pretensions to be a gentleman or a philosopher, or whatever it is that one has striven and partly failed to be or do, is one's self-esteem increased? Yes and no! It depends on what 'self' one has in mind. There is an 'ideal' or 'pretension' self, and also a '*realization*' self. If I think in terms of the former I identify myself with what I *stand for*, with my ideals and pretensions, and all the opposing ideals, the pretensions I reject or abandon, are the not-self, I cannot recognize myself in them. There is a self-esteem which regards simply the ideals, not the success, we may well call it, I think, *self-respect*. James cites the Stoic as one whose self-esteem rises through abandoning pretensions that could not be assured of success. This is but one side of the shield. The Stoic's great *self-respect* rested not on his success in his few pretensions, but in his acceptance of *pretensions* which to the Stoic himself seemed to link man with God through a common nature. Christian renunciation is surely *not* so much what James would have it, a renunciation of ideals, but far more it is the rejection of the whole self of success, of *works*, of '*claims of wages*,' and the adoption of the self of ideals, of infinite ideals, through which the highest self-respect is attained. For this self of pretensions self-esteem varies directly, not inversely as the pretensions.

If I do adopt, however, the category of the *realization self*, and identify myself, as I may, with so much of my ideals as I have achieved, then forthwith ideals are to me *mere* ideals, not actual, and not the self. Self is actual. And here James's equation seems to be true. This form of self-appreciation, which I would call *exultation* or self-satisfaction, varies inversely as my pretensions, for self is

[1] *Principles of Psychology*, Vol. I., p. 310.

measured by its approach to those pretensions. The true opposite of exultation is the emotion of humility.

In terms of self-respect and of the ideal self the young Christian knight, for example, was the proudest of men. In terms of exultation, or self-satisfaction, and of the realization self he might well be most *humble*.

It seems to me we get an important basis, in terms of these categories of self, for distinguishing self-respect and the emotion of humility from less desirable forms of self-appreciation. Those who think, as Hume did, that pride is a 'uniform' impression, describe self-respect and humility as certain *degrees* of pride. Clearly this is not true. A man who has the greatest self-respect is likely to be most humble. Humility, *as an emotion*, is a function of the realization self and is the opposite of exultation.

These four 'selves' are those with which self-appreciation is most commonly connected. A fifth category of self is the bodily self. If a woman is proud of her beauty or a man of his strength, commonly the emotion has reference to the efficiency of the beauty or the strength in acting on or influencing other agents. The self-appreciated here is the historical, and the emotion is vanity. On the other hand the *bodily* self is learned probably without the medium of social relations, chiefly through pains, and through touch and temperature, and through its continual presence. It is passive, receptive; it is fed, warmed, pained; it grows, is sick. The not-self is that world whose pains are not ours, and the presence of any one part of which is not necessary. If self-appreciation is felt for this self it is perhaps delight in the sense of its warmth and sensuous life contrasted with the inertness of the not-self, the world I cannot directly feel. Probably this self-delight is, as a rule, morbid, except in the very young.

In such a double monster as Helen-Judith,[5] having common circulation, but a separate nervous system, and of course separate worlds of experience, the pair necessarily acts in unison, for the most part. Hence for most purposes the historical self, for either ego, would tend to include the other as part of the single agent. But the bodily self, for each ego, would be sharply limited by the fact that, beyond a certain point of the skin, touch, temperature and pain stimulations did not affect her, but the other, who was thus, in this connection, part of the not-self. In us the historical self tends to include our clothes; the bodily self is set over against the clothes which warm and chafe it. This difference of limits, however, should merely guide us in realiz-

[1] Ribot, *Diseases of Personality*, Chap. I., § 3.

ing the difference in meaning between these two categories of self, the bodily and the historical.

A sixth category of the self is the experience self. Stout calls this the inner self; James calls it the *me*, and the 'empirical ego.' He would place the bodily, social and spiritual selves within this *me*, as its constituents; whereas Stout calls the body the outer self, in antithesis to experience, the inner self. It seems to me the experience self is not inner; for what is it inside? The body which it experiences?

The experience self is my experience of objects in antithesis to the objects themselves; it has an order and connection which is not that of the objects. In this connection, my body is part of the not-self, the 'recognition which I get from my mates' is part of the not-self, and even the 'Self of Selves,' what James makes the core of our spiritual life, viz: 'the collection of these peculiar motions in the head or between the head and throat'[1] is an object, and is part of the not-self. Seldom, except as metaphysicians, do we identify ourselves with our experience; but modern as well as ancient thought has made men recognize that for some purposes, at least, man *is* feeling and thinking. When we stop to recall what at some distant day we were, or if we compare what now we are to what in old age we shall be, it is thought and feeling that we summon and compare with present thought and feeling; and in this individual experience of objects rather than in any object, we recognize ourselves, past, present and future. Indeed, when convinced that our experience rightly and fully mirrors the world, we feel a self-appreciation, a kind of assurance, which has for its object, not the historical self, which might be said to *have* the experience, but the experience itself, with which we identify ourselves, and of which we are proud.

I cannot add to my categories what James calls the self as thinker, or knower. This is distinct from all objects known; and it is not part of the experience, but is the present, passing, inchoate, judging thought, which herds, brands, adopts and inherits the past thoughts which the thought just dead bequeaths to it. These functions are, even according to James's account, hypothetical. And according to that account, again, this 'thinker' cannot be a content of consciousness in which the individual recognizes himself, for such recognition would make it the known, not the knower. This thinker, indeed, seems rather to be, for James, the individual which is or may be self-conscious, taking the place which in psychology the 'psychophysical organism' now tends to occupy, It is, then, an ego rather than a self, if it is either.

[1] *Principles*, Vol. I., p. 301.

With regard to each of the six categories of the self which I have here described, no one of them seems to be a subspecies or a part of another. Each with its corresponding not-self seems to me to make up a universe in which no other *self* has a place. The historical self, for example, is not to be found, I think, among the objects of which the experience self has knowledge, but rather comes to light only by a change of the system of thought, and the presence of another category of existence, with other kinds of self-feeling.

I realize how crude and unsatisfying my presentation is; but I hope that I may bring the attention of others to the very inadequate treatment that the 'self' now receives, particularly in reference to pride or self-appreciation. Psychology should be able to offer much more light than it does offer to aid in the correct description and evaluation of this important class of emotions.

There are some points that may occasion unnecessary misunderstanding, to which, therefore, I will briefly refer. First, I hasten to admit that within each *category* of self appear many *sub-species* of self; 'selves' that conflict or accord with each other, and 'selves' that go to build up for each individual one or other category. Within the historical self may appear both the athlete self rejoicing in applause, and the candidate self turned away by a teachers' committee. Within the will-self contend the 'aggressive' and the 'accommodating' self. Within the experience-self moods of gloom and joyous insights mingle; and so on.

The synthesis of these selves is no doubt just as important as the analysis; but of course the latter must precede. Preyer refers to the 'I' *concept* as the abstract conceptual unity of such selves as he mentions.[1] But such a concept is not a *self*, I should say, not a content of individual consciousness in which the individual recognizes himself, but rather a concept of the ego, an abstraction of the content common to all egos. The 'I' for each individual seems to have merely an analogical reference to the several categories of self, and to be a functional or practical, rather than a conceptual unity. That is, I *do* use the term 'I' rightly for all my categories of self; but why I do, is a matter to be explained by a careful analysis of the development of the *habit* of so doing, rather than by an analysis of what I always and everywhere mean by 'I.' Royce and Taylor, among recent writers on metaphysics, seem to assume that the self is fundamentally homogeneous, and that essentially it is the ideal self. I cannot understand the grounds on which this position is taken.[2]

[1] *The Development of the Intellect*, trans., p. 205.

[2] Taylor's *Elements of Metaphysics*, pp. 342, 350 *et al.*

Many difficulties arise in keeping clear the distinctions which I here attempt to establish. For example, in the experience self the *sense of* the body, the organic sensation, is recognized as a very important element of that self. This sense of the body, or experience of my body, is not the bodily self, it must be noted. In the bodily self I identify myself with the body, not with my experience of it. These are two very different ways of thinking.

What Baldwin calls the *socius*, 'the self of all the rich social relationships,'[1] seems to be, not a new category of self, but a new conception of the relation of the self to the not-self, which may apply in different ways to the ideal self, to the historical, the will, and to the bodily self — *a conception in which self and not-self stand together under a wider unity.* The unity of the ideal self and not-self seems to be logical merely: that of the historical self and not-self seems to be the unity of historical action; that of the will-self seems to be the unity of attitude; and that of the bodily self, the unity of natural or mechanical law. I regret I have not space to develop this point properly.

A very interesting and, I think, elucidating application of the principles of this paper may be made to certain cases of double consciousness. In the case of Leonie B., as narrated by Sidis, in his *Psychology of Suggestion*, p. 131 ff., Leonie is hypnotized and assumes a different name, Leontine. In this state she, Leontine, is told to remove her apron after the hypnotic state has ceased. This she does. She is then rehypnotized, and volunteers this statement: 'How stupid the other (Leonie) looked while I took off her apron!' Unfortunately these experiments are not so described that we are helped to understand the content of the subject's mind. The hands and arms with which Leontine took off Leonie's apron were the hands and arms under which that apron was tied! Leontine must so have thought of herself that one aspect of those hands and arms were knit up with herself, while another aspect was not so knit up. If Leontine thought of herself in terms of the bodily and will-self, to the exclusion of the historical self, one can see how the sense of touch and movement of hands and arms were recognized as parts of self, while the sight of herself was to her like another person. The old soldier, Father Lambert, who regarded his body as a machine, 'it,' not himself,[2] insisting that he himself had died at Austerlitz, apparently owing to the insensibility of his skin, had lost the natural, im-

[1] *Social and Ethical Interpretations*, p. 41.
[2] Stout, *Manual*, p. 531.

mediate connecting link between his visible and his kinæsthetic perception, which must be the usual means through which, to the visual and tactile image, which is one feature of the historical self, we associate the essential sense of its activity. To his enfeebled intellect, again, that insensibility would prevent the usual functional or practical identificatlon of the will-self, bodily self and historical self in the one 'I.' Hence he possessed an 'I,' in the form of the will and the bodily self, and doubtless, also, an *image* of the historical self lost since Austerlitz, associated with that 'I.' But he was incapable of associating any element of that 'I' with the perceptions which normally should now constitute in part the historical self. Even if this explanation is incorrect it seems that such cases confirm the general position that the self is homogenous, but that there is only an analogical relation between the several categories of self.[1]

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[1] The MS. of this article was received June 27, 1906.—ED.

EDITOR'S NOTE.

An article by Mrs. H. T. Woolley and Miss Kate Gordon, intended for this issue, has been omitted because of delay in the composition and correction of the necessary tables.