

## ASSOCIATION:

An Essay Analytic and Experimental  
Mary Whiton Calkins (1896)

Classics in the History of Psychology

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## PREFATORY NOTE.

The tables and most of the text of Part II. of this mono graph are reprinted from the PSYCHOLOGICAL REVIEW Of January, 1896. The additions, of which some are quotations from an article in the REVIEW Of January, 1895, include comments and statements of detail, so that the record in its present form is the only complete report of the experiments described. Some of the conclusions reached by the analysis attempted in Part I. were formulated in a paper printed in the Philosophical Review of June, 1892, but the present discussion is an independent one.

The writer takes this occasion to acknowledge gratefully the inspiration and direction in psychological study, received from her teachers and friends, Professors Hugo Münsterberg and William James, of Harvard University, and Professor Edmund C. Sanford, of Clark University.

WELLESLEY COLLEGE, January, 1896.

## PART I. THE NATURE OF ASSOCIATION.

### I. PRELIMINARY ANALYSIS.

#### a. Provisional Definition.

Association may be provisionally defined as the observable connection between successive objects or partial objects of consciousness, of which the second is not an object of perception. The expression 'object of consciousness' is proposed as an equivalent for that most useful term of the Germans, *Vorstellung*. It is used in order to avoid the inadequacy of the statement, 'association is of things, not thoughts,'[1] which is open to misrepresentation as a theory of extra-mental connection, and which, besides, leaves out of account the cases in which sense qualities, not concrete things, are the associated terms; like the expression 'association of ideas' it also ignores the possibility clearly shown by experiments in free association,[2] that the factors of an associative series may be emotions or motor impulses. The condition that the second object of consciousness shall be representation, not percept, excludes from association not only the sequence of one percept upon another, or the intrusion of a presentation upon a train of thought, but also that combination of several present sense qualities into an object which Wundt[3] calls fusion (*Verschmelzung*) and incorrectly enumerates under the head of association.

This definition may stand as the starting point of discussion because it assumes no more than everybody grants, so that every [p. 2] other definition merely supplements without supplanting it. As a matter of fact, writers of the two schools-the Spiritualist and the Associationist-which hold a different theory of association, often define it in exactly these terms. So Wundt says: "Association is the connection of one object of consciousness with a preceding memory-image or sense

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impression."<sup>[4]</sup> And, on the other side, Hobbes may be supposed to have this meaning, when he says of the 'consequence or train of thoughts,'<sup>[5]</sup> that "when a man thinketh on anything whatsoever his next thought after is not altogether so casual as it seems to be;" Hume embodies this view, in describing association<sup>[6]</sup> as 'a connection between the different thoughts and ideas of the mind;' and James Mill expressly repudiates the more dynamic theory in the words:<sup>[7]</sup> "In successive order of ideas that which precedes is sometimes called the suggesting, that which succeeds the suggested idea; not that any power is supposed to reside in the antecedent over the consequent; [the words]<sup>[8]</sup> mean only antecedent and consequent with the additional idea that such order is not casual but to a degree permanent."

#### b. The Associationist and the Spiritualist theory of association.

But from this safe and simple recognition of association as the observable connection of facts of consciousness, the Associationists pass swiftly to the unwarrantable assertion that association is the complete explanation, and the adequate philosophy of psychic phenomena. "Every mental affection and operation," Priestley says,<sup>[9]</sup> "are but different modes or cases of the association of ideas." Here association is evidently something more than phenomenal, and turns out to be a force, or power, belonging to the facts of consciousness, or ideas, by virtue of which they associate each other. So Hume<sup>[10]</sup> calls association a 'gentle force' as well as 'a principle of connection.' Hartley [p. 3] says:<sup>[11]</sup> "Any sensations, A, B, C, by being associated with one another a sufficient number of times, get such a power over the corresponding ideas, a, b and c, etc., that any one of the sensations, A when impressed alone shall be able to excite in the mind b, c, etc., the Ideas of the Rest." Spencer repeats in slightly varying form the statement,<sup>[12]</sup> "each feeling as it arises associates itself instantly not with its class only, but with its sub-class."

The underlying dogma of this conception of association as a force or function of ideas, is a theory of ideas which makes of them single, psychic entities or realities, soul-things, as it were, each with an independent existence of its own, each possessing a mysterious force, called association, by which to summon others to its side. In this view, indeed, as Lehmann says, ideas become "glatte Atome, mit Haken angestaltet so dass sie sich einander einheften können."

Now the relative independence of mental phenomena is a necessary hypothesis of psychological investigation, for psychical facts must be studied as if ultimate, must be abstracted from all implications of a deeper reality and must be correlated with definable physical and physiological facts. Such independent ideas, are, however, mere abstractions, corresponding with no reality directly known, but inferred for purposes of scientific or metaphysical utility. And the Associationist theory, since it gains all its persuasiveness by just this assumption, that we are immediately aware of independent 'ideas,' is obviously a metaphysical hypothesis masquerading as a description of phenomena.

The simple definition of association is abandoned also, by writers quite antagonistic to Associationist doctrine. Their conception, too, is a dynamic one; they describe association as a 'process,'<sup>[13]</sup> an 'activity,'<sup>[14]</sup> 'eine unterstützende Funktion,'<sup>[15]</sup> 'eine zusammenfassende, vereinende Thätigkeit.'<sup>[16]</sup> This doctrine [p. 4] of association as process is opposed, as we have seen, to the teaching of the English school, in that it conceives of association as a function of a self, rather than as a sort of psychic energy inherent in primarily unrelated elements. Höffding, to be sure, with his definition of association as 'comprehending, unifying activity,' purports to oppose not merely the atomistic conception, but also the spiritualistic tendency to distinguish between association and a higher activity. He ends, however, by identifying, almost explicitly, association and thought, concluding that there is 'no reason to assume a thought capacity entirely distinct from the association capacity.'<sup>[17]</sup> Virtually, therefore, so far from opposing the spiritualist theory he adopts it, pointing out, with admirable insight, that it has no room for any real distinction of thought from association.

But to the ordinary consciousness, association means something other than thought or unifying activity. The bare observation that objects of consciousness are connected is not a consciousness of a process which connects them. Therefore simplicity, at least, and conformity with the admitted phenomena are gained by rejecting altogether expressions with such dynamical, and therefore either realistic or else idealistic, implications as 'process,' 'force' or 'activity.'

The objection to this spiritualist interpretation of the nature of association is by no means a denial of

the totality underlying the manifold facts of consciousness, or a rejection of the doctrine of the unity of self-consciousness. On the other hand, such a totality and such a continuous self seem to the writer to be an inevitable presupposition of psychic phenomena of every kind. But the identification of this unity with association is a manifestation of an unhappy passion for simplicity at all hazards. In the rigid resolve not to multiply realities *praeter necessitatem*, Occam's razor has cut too deeply, and real distinctions have been ruthlessly pruned away. The term association has been wrested from its present use as description of a perfectly obvious, even if psychologically inexplicable, relation of conscious elements, and has been freighted with a weight of epistemological truth which it cannot carry. What we mean [p. 5] by association is just a certain observable connection between contents of consciousness. When we begin to reflect upon the implications of this connection then indeed we find ourselves driven to the presupposition of this 'higher unity' of the self, but the reflection leads us at once from the matter-of-fact plane of psychology, into the domain of metaphysics. Höffding, though he usually treats the subject, as has been said, from the spiritualistic standpoint, in one interesting passage correctly formulates the relation of association to the activity of the self: 'Die Einheit des Bewusstseins,' he says, '[ist][8] gerade eine Voraussetzung aller Association.'

This examination of the two theories, which propose in place of the simple description of association a deeper analysis of its nature, has therefore verified the provisional definition by showing in the one case an unwarrantable metaphysical assumption, and in the other a needless confusion of the philosophical with the scientific point of view.

## II. DETAILED ANALYSIS OF ASSOCIATION.

### a. Assumed identity of the associated objects with connected past objects of consciousness.

Granting, then, that association is an observable connection between contents of consciousness, the question rises whether this connection may not be more closely described. One does in fact, account for any given case of association by referring to the connection in actual past experience of certain objects of consciousness with which the associated objects are assumed to be respectively identical. If, for instance, a vivid image of a temple in Olympia follows upon the glimpse, to-day, of a friend's face in a crowd, I explain this as due to the fact that I once saw her standing at the eastern porch of the Heraion. One recognizes at once that this is no chance relation, but rather an essential feature of admitted cases of association. A presentation-sequence of percept upon percept, or of percept upon image, does not at all require us to assume this parallel sequence in the past: a steam whistle may interrupt my reverie [p. 6] without requiring me to suppose that the same interruption ever before occurred, or I may have a first experience of out-of-door roses in winter; but an object of imagination can not be associated with another, unless in my immediate, perceptual experience, such a sequence has before occurred. It is true that this is not in any ultimate sense an explanation of association; the concurrence of past objects of consciousness -- the percept of friend and of temple, for instance -- does not necessarily involve a present connection of percept and image; but unquestionably the nature of associated connection is described by this reference to the connection in experience of these past objects.

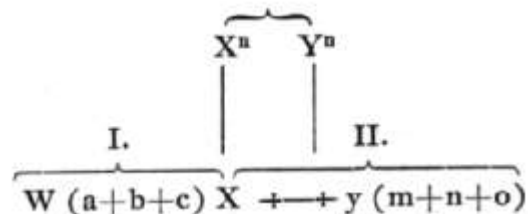
It is not, however, evident without further investigation, that this description applies to every sort of association; indeed, at first sight it seems to leave one class of cases out of account. To test its adequacy, therefore, a preliminary classification is necessary, and the most obvious, every-day distinction is that between similarity association, better named intrinsic, and contiguity, or extrinsic, [18] association. Certain objects or events which are associated are connected in what we call their essential or inner nature, others are externally or accidentally related. Between 'love' and the 'star to every wandering bark' there is a more intimate relation than between the star and the sky; between Daniel Deronda and Michael Angelo's David there is a subtler connection than that between the words and the paper on which they are written, or than that between the marble and the chisel. Now the external sort of association is evidently described and explained as fully as possible by the reference to the past, related objects of experience. The connection between a present, psychic phenomenon ( $X$  or  $x$ ) and that which follows it ( $y$ ) -- for instance, between the sight of a volume of Wundt's *Philosophische Studien* and the image of the library shelf on which it belongs, is simply the relation implied in the fact that these objects of consciousness are 'the same' as former ones,  $X_n$  and  $Y_n$ , which were successive or coexistent. That is, in this supposed case, the association implies that I had seen the *Studien* on the shelf. [p. 7]

The relation may be symbolized thus:

$$\begin{array}{c} X_n \quad Y_n \\ | \quad | \\ X \leftrightarrow y \end{array}$$

Here the small letter represents an image, the capitals stand for percept or image, and the indexes refer to past time.

But suppose instead, that Höffding's article at which the volume lies open reminds me of the figure of St. George in Raphael's picture. Now I have certainly had no simultaneous or immediately successive experience of the book and the painting, so that at first blush this seems to be a case of association which cannot be described by an assumed identity of the connected terms with past objects of consciousness occurring together. This case, therefore, must be carefully analyzed. The connection between the sight of the psychological essay and the following image of the pictured warrior is, evidently, the polemic attitude of both. But this observed hostility is an element of the earlier object of consciousness persisting in the later. None of the other qualities of the printed article -- its material, its form, its technical statements -- have any connection whatever with the picture; the element of hostility in the essay is not associated with anything in the picture, for it is itself one of the factors of the picture; in fine, the only association involved is that between the element 'hostility,' on the one hand, common both to essay and to picture, and on the other the remaining qualities of the picture, its material, color and form. Compared with the other instance, the characteristic feature of this one is readily seen to be the narrow starting point of the association. There, the connection was between the sight of a concrete thing, a book, and an image of its environment; here, the first of the associated terms is a single, highly abstract quality; and the connection is between this quality (hostility, X) and the sum of the remaining qualities which make up the complex object of consciousness, a picture ( $y=m+n+o$ ). Or, to illustrate by a concreter example: If a pair of new shoes reminds me of a hand organ, the association is not between shoes and hand organ as total complex objects, but between the inexorable squeak, common to both instruments of torture, and the other [p. 8] qualities of the hand organ. In symbolic terms once more, the object of consciousness WX is followed by Xy; the formula in full is somewhat as follows:



Here the Roman numerals, I. and II., represent the present total objects of consciousness, that is, in this case (if we ignore the environment to which attention is not directed),[19] the shoes and the hand organ. X is one quality (the squeak) of the percept I., while the other qualities, color, shape, texture (a, b, c), which have no part in the association, are grouped together and represented by the letter W. But the perceived quality X, the squeak, is also a part of the second complex object of consciousness (II., the hand organ), that is, X is connected with the imagined qualities of the hand organ, the shape, color, surface, (m, n, o, grouped together under y). This intrinsic association really then consists in the connection of one quality with a group of qualities, and it proves to be perfectly parallel with extrinsic association, and describable by reference to connected past elements of objects of consciousness. I account for the fact that squeaky shoes remind me of a hand organ by the fact that I have had previous experience of a hand organ, that is of the connection of squeakiness with the remaining qualities of the hand organ; in other words, the X<sub>n</sub> and the Y<sub>n</sub> with which the X and the y are assumed to be identical have coexisted before in my experience.

Not only is this a possible explanation of such cases of association, but it is the only consistent one. This is shown by consideration of the alternatives. According to the ordinary view, the earlier concrete object of consciousness is associated as a whole with a later concrete object. But this is impossible here, for most of the elements of the earlier object, in this case the shoes, have nothing to do with the later object, the hand organ, and in themselves would never have suggested it. [p. 9]

More plausibly, it is urged that the connecting element is slightly different in the two objects associated. That is, squeakiness in the boots is different from squeakiness in the hand organ, and the association is between these two. But, unless one can disprove the ordinary conception of similarity as presence of identical elements, the supposition that there are two sorts of squeakiness indicates simply that these have a common element which is then the first term of the association, so that boots and hand organ have a more subtle connection than we have supposed. In this way Höffding's chief argument against the theory of persisting elements may be met. He calls attention to the fact that sensations, which are recognized, he says, as unanalyzable units of consciousness are nevertheless similar and so suggest each other. "Yellow and orange", he says, "have no common element and yet recall each other." [20] But it is incorrect to assert that any given sensations are absolutely ultimate. The existence of such unanalyzable elements is a convenient postulate of psychological science, but the name sensation is given to certain merely unanalyzed partial contents of our consciousness, and nothing forbids the assumption of unnamed elements even more simple than some of these.

Höffding objects, in the second place, to the theory of persistence of elements, that it renews the old realistic abstraction fallacy. The thinness common to the leaf on the tree and the leaf of paper is no identical element of the two, because thinness in and for itself does not exist. [21] This objection, however, clearly reveals Höffding's misunderstanding of the theory; the element, or elements, forming the first term of such an association are not regarded as 'independent middle terms,' or as qualities existing in and for themselves. For purposes of discussion only, they are treated as if they possessed this fictitious [p. 10] and abstract sort of independence, but they actually exist only as emphasized portions of complex contents of consciousness. Such 'implicate' elements, which are all that the theory demands cannot possibly be denied by Höffding without an odd inconsistency with his own doctrine of immediate recognition. [22] The consideration of these objections demonstrates the validity of the parallel treatment of internal and external association, and verifies the complete definition of association which may now be formulated somewhat as follows: Association is the connection between objects or elements of consciousness (of which the second is not perceptual), assumed to be respectively identical with preceding objects, or elements, of consciousness which have stood to each other in a relation of simultaneity or of succession.

The relation may be symbolically expressed by the proportion  $X:y :: X_n:Y_n$ . The 'persisting element' and the suggested elements are not necessarily cognitive sense qualities, but may be emotional or motor. Musical associations, for instance, are almost invariably either through persisting emotions or through self-perpetuating rhythmic activities, and many of the most striking abnormal associations in cases of colored hearing are clearly emotional. On the other hand, many instances of what Baldwin calls 'sensori-motor association or assimilation' are through the presence of the motor elements involved in attention.

#### b. The implication of assumed identity.

The fact that associated objects of consciousness are 'assumed to be identical' with past objects has offered a tempting chance for metaphysical discussion, and the opportunity has been promptly embraced. Associationists, of course, have found no difficulty with this apparent identity of present with past. The early writers content themselves for the most part with explanations which are no more than metaphorical descriptions. The 'recurring' experience is called a 'miniature vibration' [23] and a 'copy.' [24] So far there is little advance [p. 11] upon Plato and Aristotle who spoke of the stamp (*shma tupon*) [25] upon the mind of that which has passed out of consciousness. But the later and more consistent Associationists, especially the Herbartians, recognize the need of explanation. The identity of present with past object of consciousness is for them an actual and complete identity. To-day's idea, which seems like yesterday's, is the same idea reëmerging from the ocean of temporary unconsciousness. So Spencer speaks of the 'revivability of feelings' [26] exactly as Wahle talks of the 'Auftauchen der Vorstellungen' [27] and Herbart says, "so soon as the object of consciousness P is unhindered, it lifts itself up into consciousness." [28]

The rejection of the Associationist philosophy, that is the denial of the independent existence of ideas, of course requires the abandonment of this crude doctrine of their revivability, since no state of consciousness, regarded as a single event in time, ever reappears. Nevertheless the actually assumed identity, the observed sameness, requires explanation, and spiritualists in psychology have usually reconciled the entire impotence of states of consciousness once vanished to reinstate

themselves and the evident presence, on the other hand, of an identical element in experience, by means of a distinction between 'universal' and 'particular' or between 'form' and 'content'. The identity is predicated of the universal forms of consciousness, while the momentary sensations are allowed to be perishable. But all this is a mere repetition, in stately, yet rather unmeaning phraseology, of the old paradox. Truth to tell, there is no recourse here save in the recognition of that 'inexpugnable assumption'[29] of the permanent self beneath the changing phenomena. One can never have the same states of consciousness, in successive hours or moments, but one may be conscious in the same way at different times, and in that sense only the succeeding[sic] objects of one's consciousness may be called 'the same.' [p. 12] For this reason, because the connected objects must be defined as in some sense identical with the preceding ones, the fact of association, though in itself an observed, objective connection, has, as has been said already, for its presupposition the existence of a self in some sense continuous, whose methods of activity may recur.

This entire discussion of the implication of the identity assumed in association is nevertheless an intrusion of metaphysics upon science. Psychology is the study of the immediate facts of consciousness and the simply psychological standpoint, which avowedly is not an ultimate one, requires the bare acceptance of the predicates 'same' and 'identical' as facts of consciousness, without a further attempt to probe their meaning.

It should be added that the assertion of an assumed identity of associated contents with past objects of consciousness must not be supposed to imply that the individual subject in every case recognizes the associated objects as identical with certain preceding ones. Everyday observation and experimental studies, like those of Dr. Scripture,[30] include repeated instances of association in which the associator has completely forgotten his former experience of the associated objects. In these cases, however, the subject does not even realize the existence of the association which appears to him as a chance sequence; and the observer recognizes it as association only when he discovers the continuity of the 'identical' past objects.

#### c. Discussion of association 'by similarity' and 'by contiguity.'

Up to this point, the expressions association 'by contiguity' and 'by similarity' have been used, as synonyms for 'extrinsic' and 'intrinsic' association, to characterize broadly a common distinction which however has been shown, strictly speaking, to lie outside the limits of association. Since nevertheless not even a slight innovation of psychological doctrine can claim support, unless accompanied by a serious consideration of the traditional view which it replaces, the ordinary classification must next be more carefully studied. The statement, 'association is by contiguity' or 'by similarity' clearly indicates that [p. 13] the contiguity or the similarity is supposed to be itself the agent of the association. But this is evidently impossible. In any case of similarity, that, for instance, in which the first vivid streak of light on the eastern horizon is followed in the poet's mind by the image of a 'blade of gold flashed on the horizon's rim,' the similar objects are the perceived light and the imaged blade, and this imaged blade evidently cannot be similar to the flashing light until it comes into existence, but it does not exist until the poet thinks of it, and yet by the time he thinks of it, it is already associated with the percept of the light. The similarity so far from explaining the association requires and involves the sequence, and so the association. As Dr. James says[31]: "The similarity of two things does not exist till both things are there -- it is meaningless to talk of it as an agent of production of anything. It is a relation which the mind perceives after the fact."

It is even more apparent that the contiguity of the associated objects themselves does not explain their association. The opposite view derives some of its force from the unwarranted assumption that the contiguity in question is spatial, a view which easily leaps to the error of supposing that the association is of extra-mental things. But association is of objects of consciousness, and their contiguity is evidently what Rabier calls 'contiguïté de la conscience' and Ward names 'continuity.' Now this continuity of the associated objects does not precede association, but is involved in it. The contiguity is not there until the second object of consciousness actually has followed upon the first, but now -- and not till now -- the connection between first and second is there too. As Bradley says, "If they are contiguous, then they must both be there, and how can one call in the other?"

It is perfectly clear, therefore, that neither the contiguity nor the similarity can be regarded, after the manner of the old, [p. 14] naive realism, as agents of the association. But the possibility remains that the expressions may have a descriptive value, and that, dropping the old preposition, we may

legitimately speak of the 'association of the similar' and 'of the contiguous.' Regarding first the associated objects themselves, it certainly is true that they are contiguous in the sense already explained of 'continuous.' But this continuity is true not only of all kinds of association, but even of the sequence in consciousness of percept upon percept; it cannot therefore be a peculiarity of trains of association. On the other hand, the similarity of associated objects seems to be a significant mark of the association. To recur to our old examples, the squeaky shoes are like the hand organ, love is like 'the star to every wandering bark' and one copy of a book is like another. But even if we admit the preëminence of similarity among the relations observed between associated terms, it has no right to an exclusive place. Things may remind us of their opposites as well as of their similars, as when 'imperial Rome' recalls to Hilda her native village. Causes may recall effects or wholes bring parts to mind. The old multiplicity of so-called laws, indeed, seems truer to the facts than this partiality for a single one. As Dr. James says,[32] "If perceived relations among objects are to be treated as grounds for their appearance before the mind, similarity has of course no right to an exclusive, or even to a predominant place."

Moreover the analysis of associations of the similar, which are really synonymous with what we have called internal associations, would show us, as before, that the association is not strictly speaking between the whole, concrete, 'similar' objects, but between elements common to both, and the combination of remaining elements of the second object of association. Therefore, though two so-called objects of association are certainly often similar, similarity is surely not a distinguishing principle of association.

Finally, then, we may inquire whether similarity and contiguity should be predicated, not of the objects of association, but of past objects of experience with which these are assumed to be identical. It at once appears that such identical objects of [p. 15] past experience are not even necessarily assumed in the case of so-called similarity association. Shelley need never even have seen a sky-lark before the moment when he conceived its likeness to the 'high-born maiden,' 'the glow worm golden' and the 'rose embowered.' On the other hand, the continuity of past objects of consciousness with which the associated objects are assumed to be identical has been found already to be the common assumption of every instance of association.

In terms of traditional psychology, 'association by contiguity' is therefore the only actual form of association, and means 'association explained by the continuity of past objects of consciousness with which the associated contents are assumed to be identical.' But the universality of this sort of association seems to excuse it from the requirement of a particular name; and the ambiguity of the expression makes it desirable to reject 'association by contiguity' along with 'association by similarity,' which has been abandoned for more vital reasons, both because it is not the only observed relation between associated phenomena and because it really reduces itself to 'association by contiguity.' Neither principle is in any sense a causative explanation of association.

### III. THE CLASSIFICATION OF CASES OF ASSOCIATION,

#### a. Total, partial and focalized association.

The analysis of extreme cases of external (so-called contiguity) and internal (or similarity) association has shown that the fundamental principle is the same in both cases and that both reduce themselves to the suggested law of association, which is merely a generalized statement of the continuity in earlier experience of elements or objects corresponding with the associated ones.

In the course of this analysis, however, it has appeared that the provisional distinction of cases of association, as 'external' and 'internal,' is inadequate. For the supposed objects of internal association have turned out to be, strictly speaking, not associated at all, and the association, in these cases, has been observed to lie between an element common to two objects [p. 16] and a group of qualities in the second one. Yet the old distinction is one which we unquestionably do recognize; in some sense, therefore, it must be retained, only its place may be shifted and its boundaries newly surveyed.

The principle of the revised classification may best be gained by considering other instances of association which lie midway between those cases in which the starting point is a single accentuated element, and those whose first term is a whole, concrete thing. Between these extremes there is a whole series of gradations. The Höfding article might remind me, for instance,



of one of Weissman's papers on the 'Acquired Character' distinction; here the starting point would be a combination of the many common qualities of polemical, scientific monographs.[33] Or the shoes might recall the sabots of a little Breton peasant, and here again the first term of the association would include a complex of qualities, not a single element. Yet both these would be recognized as examples of internal (or similarity) association; and even the connection between this copy and another of the volume of the Philosophische Studien or between this pair, and another, of shoes is an internal, not an external, relation, and thus quite different from the case of external association in which the book recalls the shelf on which it belongs.

Our distinction is really, therefore, between cases in which the first term of the association -- the X -- is a particular, concrete thing, and those in which this first term is any element or combination of elements, cognitive, emotional or impulsive. It will be readily allowed that the distinction may be made in most cases: the association between book and shelf, between perceived thing and imagined environment, corresponds with what is called external association; the association between shrillness and other [p. 17] qualities corresponds with what we have known as internal association.

When, however, one book reminds me of another, the association is an internal one (of so-called similarity), yet the first term seems to be a concrete thing, and if this is so, the distinction just drawn is not perfectly parallel with the ordinary one. As a matter of fact however, in such a case as this, the association is not between two concrete things--in this case between two copies of a book--but between the sum of the elements common to the perceived and to the imagined book, and the sum of the qualities, however few, which distinguish the imagined from the perceived book. If a red book remind me of a blue one, otherwise exactly like it, the first term of the association is the sum of the qualities of the books except the color, and the second term is the blueness of the second book. The distinction between the succeeding objects of consciousness may be indefinitely less than a pronounced contrast of color, but always there is some difference between this thing and another, however similar, and the point of difference forms the second term of the association.

The most significant system of classification distinguishes, therefore, between concrete association of things, and the association of elements or qualities. In the first case, the earlier term of the association possesses the completeness and the relative isolation which constitute the concreteness of a comparatively permanent combination of qualities; in the second case the starting point of the association lacks concreteness and forms a part, larger or smaller, of some including total. The various possibilities are enumerated in the following summary:

#### Classification of Cases of Association.

##### I. Total or Concrete association of concrete objects of consciousness.

a. Without appreciable persistence.

b. With persistence.

##### II. Partial association of elements of consciousness.

Always with persistence.

##### a. Successive association. [p. 18]

1. Multiple association (in which the starting point of the association is a large group of persisting elements).

2. Focalized association (in which the starting point is a single element or a small group).

##### b. Simultaneous association (assimilation).[34]

The terms 'total,' 'partial' and 'focalized' are those proposed by Dr. James, but are used with somewhat altered meaning. 'Total Association' is an especially misleading expression, retained in default of a better one; it is not to be interpreted as if it required that the entire object of consciousness of a given moment be associated with a following one, for it covers instances in

which the first term of the association is very narrow, for instance a single word. The essential feature of these cases is that the first term be concrete and complete in itself, a single word or object or event, which can be treated independently of accompanying contents of consciousness. The extreme forms -- concrete and focalized association -- are obviously characteristic of opposing types of intellect -- of the literal and prosaic, which proceeds by the sober path of recollection or of concrete induction from one thing to another, so that the life of the imagination is a close transcript of the life of experience, and on the other hand, of the penetrative and creative mind, which so singles out the remote and subtle elements and qualities of its gross contents that they then become the centres of ever widening circles of revery or of thought.

The persistence of the earlier term is a significant accompaniment of many forms of association. The prominence of change in the mental life has often been emphasized at the expense of this opposite but equally fundamental factor. In all cases of partial association, the second term is a group of elements or a single one requiring, for concretion into a total object of consciousness, the persistence of the first term.

In an earlier discussion of the subject,[35] the writer made the presence or absence of persistence the basis of the differentiation [p. 19] of the two chief types of association, which were named respectively 'persistent' and 'desistent.' Wundt[36] suggests a classification in the main like this, except that he calls the persistence itself similarity association (Gleichheitsassociation) which is manifestly incorrect. Several considerations have led to the rejection of this principle of division. The term 'desistent' is objectionable because of the implication that the earlier of the associated objects entirely disappears before the occurrence of the second.[37] Certainly this often seems to happen, but it is probable that the earlier object, though unattended to, fades gradually away and persists, for at least an unappreciable moment, with the later one. The chief objection, however, to the classification of association as 'desistent' and 'persistent,' is the frequent triviality of the distinction. What essential difference is there between the 'persistent' association of the verbal image 'tariff reform' after the sound of the word 'tariff' in place of the 'desistent' image 'reform?' Or what basis of division lies in the fact that at sight of a rose I think of the friend who gave it to me with or without the rose in her hand? Evidently the significant distinction is the quantitative one. All the instances just enumerated are of concrete, total association, and are therefore to be opposed to connections of the subtler, more intensive kind.

#### b. Simultaneous association.

The ordinary distinction between simultaneous and successive association is unessential, for successive association which is 'observable connection' requires the 'simultaneous' presence of the associated terms, which, however, have succeeded each other in consciousness; while so-called simultaneous association is usually the familiar case of the observable persistence in consciousness of an earlier object of association with a later one. Wundt, who has a peculiarly elaborate theory of simultaneous association, distinguishes three forms, fusion (Verschmelzung), assimilation and complication. [p. 20]

Fusion is defined[38] as the connection of like or disparate sensations, making up a total percept: so one may perceive a rose, and in one and the same moment see it, smell it and touch its velvety petals. But the second term of an association is never an object of perception, so that these cases of fusion or connection of merely perceived qualities can never be cases of association. Wundt himself leaves them out of account in the essay in the *Philosophische Studien*. [39]

By assimilation, Wundt means the connection of *Vorstellungselemente* -- that is of separable parts less elemental than sensations-within a single object of consciousness. All these must be of the same sense-order, and Wundt remarks that one is usually impression, and the rest images;[40] if associated they certainly are not all impressions. Wundt's examples are chiefly from the field of illusions -- instances of reading words omitted by the printer, or of 'seeing' the rough blotches of theatre scenes as genuine landscapes. In these, the so-called simultaneous association is the connection between the actual sense impression and the imaged qualities belonging to a total percept, for instance, between the green daubs as seen, and the imaged qualities necessary to complete the percept 'forest.' Now such 'simultaneous association' certainly is not present in immediate perception, for there can be no association of parts within a total object, without a recognition of the existence of such parts; and the essence of perception is just this, that it ignores parts and grasps wholes. As Dr. Ward says,[41] "though the percept is complex, it is but a single

whole, and the act of perception is single too." But the existence of these parts within the percept may later be reflected on, and then their observed connection may be called a case of simultaneous association. The sort of reflection here involved is, however, of a relatively rare and artificial [p. 21] sort; and Wundt's whole discussion gains its force by his constant incorrect assumption that assimilation is involved in mere perception.[42]

Complication, finally, is defined as the connection between sense impressions and images of a different sense order. For example, the sight of an apple at a distance may be followed by an image of its taste, or the sound of an electric car bell may suggest a visual image of the car. In these cases there is usually a separation in time: the visual image of the apple distinctly precedes the gustatory, the bell is heard before the car is imaged. Here we have a case of successive association, involving the observed persistence of the earlier percept, for instance, the clang, with the following image. Wundt remarks this frequent relation in the words:[43] "In der That \* \* \* geschieht [es][8] wahrscheinlich sehr häufig dass die simultane Association einer gewissen Zeitdauer und zeitliche Folge zu ihrer Entstehung bedarf."

There certainly may be, therefore, within total objects of consciousness, a connection of imaged, or of perceptual with imaged elements which may be called simultaneous association, since its explanation is, of course, an 'assumed identity' with former elements which were continuous in actual experience. The simpler term 'assimilation' seems, however, to describe this situation equally well, and association has accordingly been used throughout this discussion to cover only cases of the successive kind.

#### c. So-called voluntary association.

Another ordinary distinction is that between involuntary or passive and voluntary or active association. Aristotle's picturesque [p. 22] expression *qhreusiV* or the parallel terms of Hobbes, 'seeking' and 'hunting,' adequately characterize this strenuous stage of consciousness, in which we eagerly pursue the baffling solution of our problem and explore the recesses of memory for fleeting face or name.

But that which distinguishes this so-called voluntary association is evidently no characteristic of association itself. It is rather a complex of image, emotion and volition; the possession of a partial or a general image, the realization of its incompleteness, the desire to complete it and the successive emphasis of one part after another of this vague image of present consciousness in the hope that it may associate the unknown. Our rules of practice in the selection of the first term, as it were, for the desired association, are the so-called secondary laws of association; we accentuate the objects of our consciousness which we know to have been frequently, or recently, or impressively connected with the desired image; or we dwell upon a combination of these particularly suggestive elements. The discussion of these secondary laws is postponed to the later division of this paper.[44]

What is called voluntary association is therefore a very complex mode of consciousness of whose content association is but one factor. To speak of voluntary association is, indeed, to return to the old error of conceiving association as an operation, whereas it is really an observed content; voluntary imagination or recollection, or simply thought, are the proper names for this form of consciousness.

### IV. A MODERN FORM OF 'ASSOCIATION BY SIMILARITY.'

#### a. The sequence upon a percept of images like itself is not association.

Some modern psychologists believe that they find lurking among the phenomena of consciousness, still another kind of association. It is usually regarded as a sort of 'association by similarity,' and Bain and Spencer try to make the new sort more [p. 23] plausible by illustrating it through many examples of the old, but Höffding,[45] with greater insight, recognizes and does not confuse the two varieties of so-called association by similarity.

The new kind of association ordinarily appears as a refutation of the attempted reduction of 'association by similarity' to 'association by contiguity.' Admitting that what is commonly called internal association is the connection of elements, rather than of objects, it is urged that there is a process of association still more elementary which is presupposed by every observed connection.

This process is nothing less than the sequence upon a given present percept or image, X or x, of repeated images, x1, x2, x3, x4, like itself; and such a succession of images like itself is necessary, it is asserted, before the appearance of the different image, the y, of ordinary external association. My percept 'Mary' is, and must be, followed by a succession of images 'Mary,' before it can be followed by the image 'lamb;' I must recognize the Sistine Madonna before she can remind me of the portrait of Raphael, and this recognition is through a mental procession of images, standing for previous percepts of the picture.

The first comment on this entire construction is that, true or false, it is utterly misnamed when it is called Association. The fact of 'being reminded' has not the faintest resemblance to the fact of 'observing an association.' The reappearance of what we call an 'image of the same' -- even a ghostly procession of such images, always growing fainter -- is quite different from the observed connection of different contents. Such a process in which the purported similarity amounts to identity truly is as Dr. Ward says, 'more fundamental than association by contiguity, but then it is not a process of Association.' Even Höffding often questions the propriety of the expression 'association by similarity' in this use of it. "If one sufficiently extend the conception of similarity association to include immediate recognition, \* \* \*" he says in one passage[46], with the evident inference [p. 24] that the procedure is a doubtful one. On the other hand he indicates his satisfaction with the term 'assimilation,' which is sometimes used by Wundt in this sense.

The critic of association theories would be justified, therefore, in refusing to consider further this spurious sort of association between presentation and representations of the same, on the mere ground that such a phenomenon is not in any sense a variety of association. But the process in question has played so prominent a part in discussions, and does, in the later forms of the theory, oppose itself so strongly to what is really association, that the consideration of its significance and validity is hardly to be omitted.

The immediate question is, therefore, does this process, really exist? Is it requisite to the association of a percept X, with an image, y, that the percept should have been followed immediately by one or more images, x, x --, exactly corresponding with it, in fact identical except in time. Is the complete formula of an association  $X \rightarrow x_n \leftrightarrow y$ , instead of  $X \leftrightarrow y$ ?

b. The Associationist argument for this so-called 'association.'

The English psychologists offer an argument for this process, which is really a corollary of their well known theory. They admit that the present percept, X, by virtue of its perceptual nature, is something relatively new in consciousness; therefore, they insist, X cannot by itself suggest the image y of a past experience. So the image x, which has to do with the past, must appear before y, also a phenomenon of the past, can come to consciousness. "My present sensation," Stuart Mill says[47] "could not remind me of those former sensations unlike itself, unless by first reminding me of the sensation like itself which really did coexist with them." In the same fashion, Spencer writes, [48] "the primary association is between each feeling and the class, order \* \* \* \* and variety of preceding feelings like itself \* \* \* \*. The act of recognition and the act of association are two aspects of the same act. And the implication is that besides this law there is no other." [p. 25]

But this is only the old Associationist fallacy. A present image is treated as identical with a past percept, whereas it is a new fact of consciousness. So the image of my Paris Baedeker is supposed to suggest my percept five years ago of the Sainte Chapelle, which the mere sight of my Baedeker could not, it is believed, associate. Of course this explanation is a tissue of impossibilities. In the first place, the supposed image of the Baedeker would be as much an affair of the present as the sight of it; the present image was not in existence at the time of that past percept, and is therefore no more able than the present percept, to explain the association; and, on the other hand, the past percept cannot reappear. "Ein gewesener Zustand," as Lehmann says, "kommt niemals wieder auf." In the second place, there is no earthly need of this impossible, present-past percept to explain the association, for the suggested object, the richly lighted church interior, is no past percept but is itself a present image. In symbolic terms then the Associationist construction may be pronounced incorrect, both because x is not Xn and because y not Yn is associated. Nevertheless the Associationist theory will continue persistently to ignore the distinction between present and past, and its 'ideas,' however deeply buried, will always 'bob up serenely,' to paraphrase Herbart's own word auftauchen, whenever they are wanted.

c. Höffding's theory of this so-called 'association' (or 'assimilation').

This theory of assimilation finds its completest and most technical expression in Höffding's discussion. His starting point is the existence of immediate recognition, that is, recognition of objects, scenes or simple sense experiences, without any representation to ourselves of the attendant circumstances. He claims that this bare familiarity without detailed recollection can only be explained by an assimilation to the given presentation of like representations, that is, by a sequence of the  $x_1, x_2, \dots, x_n$  upon the  $X$ .

1. The possibility of immediate recognition.

At this point, therefore, our problem is the validity of the concept of immediate recognition. Is there really any [p. 26] 'immediate recognition'? Do we recall things without any representation to ourselves of attendant circumstances (Nebenvorstellungen), which distinguished the former experience from the present? Höffding's examples[49] are the instant recognition of an unaccustomed and unnamed, yet familiar, tint in the sky, of a foreign word, which we are nevertheless unable to translate, of some unnamed and unlocated organic sensation. In all these cases, he says, we know nothing about the former setting of the experience; we know neither the time nor the circumstances of its former occurrence; we do not know even the name. The objects are, nevertheless, 'familiar,' though introspection shows 'no faintest trace of other representations, awakened by the recognized phenomenon.' [50] Lehmann's experimental observations corroborate the possibility of such familiarity. In a series of experiments on the recognition of odors[51], these appeared familiar in seven per cent. of the cases, though the subjects were unable to name them or in any way to connect them with other experiences.

Höffding concludes that this fact of being recognized is an immediate and distinguishing quality of the object, Bekanntheitsqualität, as simple and as indescribable as the difference 'between pain and pleasure or between yellow and blue.' Immediate recognition, as thus understood, is momentary and simple; it flashes upon a mind unprepared for it, and it is distinguished from mediate recognition just in that it does not involve association. This absence of association is the important point. In mediate recognition the sight of an object is followed by the memory of that object in the different environment of the past. The elements which make up this different environment are the attendant images (Nebenvorstellungen), which are associated with the percept of the object; these are the condition and the mark of mediate recognition, and must be proved to be entirely lacking in any case of immediate recognition.

The existence of immediate recognition is therefore disputed by those who believe that these Nebenvorstellungen must always be present, in however faint and fleeting a fashion, in every [p. 27] case of recognition. The accuracy of Höffding's self-observation is questioned; for instance it is urged[52] that an educated man 'not color-blind' could not recognize a tint, however unusual, without some consciousness of a more or less appropriate name. On this ground, Wundt and James deny rigorously the possibility of immediate recognition. "There certainly always is," Dr. James says[53], "[a][8] 'fringe of tendency' toward the arousal of extrinsic association." "Weder glaube ich," Wundt writes[54], "dass diese [Bekanntheits][8] Qualität jemals ohne mitwirkende Vorstellungen vorkommt." It must be admitted, however, as Höffding, in his reply to Lehmann[55], does not fail to observe, that Wundt abandons this position and definitely contradicts himself by the theory, advanced in volume VII., of the Philosophische Studien, that every association is really made up of two processes[56], a combination of like elements and a later association of previously continuous elements. Even Dr. James seems to allow by two or three unguarded phrases[57], which Höffding triumphantly extracts, the occasional possibility within 'a couple of minutes interval' from the presentation of 'recognition of the immediate sort.' This must, in fact, be admitted as a possibility, however sceptical one is about particular instances. Undoubtedly most supposed cases of immediate recognition have really involved a recollection of a name or a faint background of imagery, yet familiarity, without real recollection, does not seem to be a priori impossible, and has experimental evidence on its side.

2. The relation of this so-called association to immediate recognition.

Granting the fact of immediate recognition, its bearing on the theory in question must next be discussed. Höffding [p. 28] insists that immediate recognition is explained only by such an assimilation of images to percept.[58] His theory, however, undergoes much modification as it

proceeds, and includes physiological as well as psychological considerations. The fact to be explained is the immediate recognition, and its physiological condition, according to Höfdding, is the neural habit which results from repetition (Uebung), that is, the cerebral 'disposition' to activity, the facility or readiness of neural response to stimulation. The hypothesis of cerebral habit is greatly emphasized in Höfdding's later paper,[59] where he says: "Ich wende also das einfache Gesetz der Uebung an." This physiological explanation of immediate recognition will at once be admitted. It is, in fact, a commonplace of psychological theory that familiarity depends on the physiological facility which results from repetition; nobody doubts this assertion and it can be fitted to any theory. The characteristic part of the Höfdding theory is, however, the hypothesis that the psychological correlate of physiological habit, the factor of consciousness which explains the immediate recognition, is the occurrence, along with the recognized percept (X) of a number of images (x1, x2 ---) corresponding with it. The color is familiar because I have not only the percept of it, but a series of images of former percepts (always without any distinguishing marks of the former occurrences). These images explain, or rather they are, the Bekanntheitsqualität. "In order that A may excite the ideas of B, C, D, with which it usually arises simultaneously in consciousness, it must first establish its identity. Thus A must give rise to a, and only then will a bring with it b, c and d." [60] The modification of the theory by which the similar ideas or images are treated as merely possible will be later considered, but the expression 'images' is retained throughout. In varying ways, Höfdding argues the plausibility of this view, by insisting that it involves no more than is admitted by those who deny 'assimilation,' and assume the presence of association in all cases of recognition. The neural predisposition, [p. 29] he says [61], which is required for the sequence of image y upon percept X, is even more likely to bring about the appearance of image x after X. No argument, however, can establish a psychological hypothesis in the total lack of confirming experience. The addition made by the feeling of familiarity to a given percept, whatever it may be, certainly is not a series of images corresponding with the percept. The present image of the color we are this moment seeing, the image of the sound which is still sounding in our ears, the image of the present odor or taste-this is a baseless and a needless construction.

The theory of assimilation, in this form, has not even the merit of corresponding accurately with what has been admitted as a physiological explanation of familiarity-that is, with neural habit. For, as Lehmann has shown [62], it obliges us to suppose that the physiological equivalent of an image is nothing more than the ease (Leichtigkeit) of nervous discharge in an accustomed way. This, however, is incredible. For the neural accompaniment of image, no less than of percept, includes a certain definitely localized brain process; the mere increase of nervous plasticity cannot possibly, speaking physiologically, entirely account for an image. But just this would be demanded by the theory under consideration, for the only difference between the physiological condition accompanying bare perception, and that which accompanies immediate recognition, is the greater ease of nervous response in the latter case.

This is the objection which Dr. James urges [63] against this theory: "To say that the process A can only reach [the process b] [8] by the help of a weaker process a, is like saying that we need a candle to see the sun by. A replaces a, does all that a does and more, and there is no intelligible meaning, to my mind, in saying that the weaker process coexists with the stronger." The last clause of the passage just quoted makes the assumption that the brain process accompanying an [p. 30] image differs from that accompanying a percept only in its lessened force. The argument, therefore, claims more than is necessary to the refutation of Höfdding's theory. It urges that the bodily process accompanying the percept includes every element of the image process in greater intensity, so that no separate physiological correlate, belonging to the image only, can remain. To refute this assimilation theory, however, it is only necessary to show that image and percept process are so nearly the same that the physiological correlate which distinguishes the image (neural ease, according to the theory) is not, by itself, sufficient to account for the image.

Dr. James's supposition of the entire identity (except in degree), of the image and the percept process is, in fact, open to question. Dr. Ward opposes it warmly, and proposes a theory of the 'distinction of the seats' of perception and imagination, basing it chiefly on arguments drawn from cases of cerebral disturbance, in which "visual memory images are for the most part retained, so that old scenes can be recalled and familiar objects or persons accurately described, and yet the recognition of them is no longer possible." [64] The points at issue are less significant than they appear, The 'distinction of seats' which Ward proposes is no 'wide separation' but a mere difference of cortical layer. And he defends merely the fact of immediate recognition (which, however, he calls assimilation), and does not uphold Höfdding's proposed explanation, that is the theory of 'implicate

association by similarity' or association by a percept, of images like itself.

Höfding's answer to his critics involves, according to the fiercest of them, Lehmann, a restatement of the theory as it appeared in the *Psychology*, with a complete shifting of its position. Already, in the *Psychology*, [66] Höfding had called the assimilated images implicate (gebundene) and fused (verschmolzen), but nevertheless had treated them as possessing a certain faint and subordinate reality of their own. For instance, the assertion, "the reawakened state fuses immediately with the [p. 31] given sensation, and does not stand out beside it as a free and independent representation" [67] clearly suggests that the representation has a certain life of its own; otherwise in what sense would it be 'reawakened;' and what would there be to 'fuse ?' In the *Vierteljahrschrift*, however, and even more definitely in the latest paper of all, that of the *Philosophische Studien*, Höfding seems to rob these 'implicate images' or 'ideas' of all the actuality they had retained. Under this treatment they become mere possibilities, abstractions of thought, "Elemente die wir jedes für sich zu denken vermögen; theoretisch gedachte Faktoren." Bekanntheitsqualität is defined as a Vorstellungspotentialität.

Now this view undoubtedly avoids the difficulties of the theory of assimilation of images, but it does so by making the whole theory superfluous and by forfeiting all claim to the name similarity association. If the 'associated' images are not actual they should not be invoked at all; it is meaningless to say that they are present only in the sense that under other circumstances images [68] would be present. In other words the conception of 'possible images' has no significance except for metaphysics and for physiology. In this latter sense, as an abbreviated statement of the existence of neural activity without the corresponding accompaniment in consciousness, Höfding practically uses the term. More and more the explanation of familiarity is given in terms of physiology. It is a 'disposition;' it forms, with the sense stimulus, the condition of immediate recognition; it is that which would under other circumstances make a free representation possible. ("Beim unmittelbaren Wiedererkennen [wirkt][8] dasselbe was unter anderen Verhältnissen eine freie Repräsentation a möglich machen würde.")

The possibility of immediate recognition has been granted, and the probability that its physiological accompaniment is a certain neural habit. The hypothesis that such immediate recognition is through the association or assimilation of 'similar' ideas or images has been denied. If it is necessary to suggest [p. 32] a psychological correlate in place of this one, an equivalent in consciousness for physiological ease or Leichtigkeit, one may follow Lehmann [69] and Wundt [70], and apparently James [71], in describing this as a certain emotional element (Gefühlston), a quality of ease or warmth, a certain Lustgefühl; or it may be defined, as by Baldwin, to be "readiness or ease \* \* \* in the motor sensations of adjustment;" or finally, it may be no further definable than by the expression 'consciousness of identity.' It remains true, as has been noticed already, that recognition is usually of the mediate sort, involving the association of some environing circumstances, some reaction upon the object or some shade of feeling which does not recur in the present.

The result of the whole discussion is, therefore, first, to show that a sequence of like images upon a percept is not a form of association; second, to indicate that such a process does not occur at all, either to explain association, as the English psychologists assert, or to explain immediate recognition, as Höfding holds. [73]

## V. THE PHYSIOLOGICAL EXPLANATION OF ASSOCIATION.

The present discussion is merely an introspective analysis of the full psychological meaning and assumption of association, not an attempted formulation of its causes. Psychologically, indeed, association is further inexplicable, but a suggestive physiological explanation may be discovered by the observation and the inference of characteristic bodily accompaniments. These are, of course, the varied forms of neural and muscular habit, the spread of bodily stimulations through paths already worn. [p. 33]

The quantitative distinctions between total, multiple and focalized association, and the difference between association with and without persistence, are easily stated in cerebral terms. The most significant advance of what may be called psychological physiology is, however, the application of the concept of habit not only to cerebral connections, but to connections between sensory and motor processes, or between motor processes alone. This principle, which has been particularly emphasized and developed by Münsterberg and by Baldwin, opens up rich fields of physiological

explanation and of vivified psychological analysis. Not merely association, but perception, illusion, recognition and conception are susceptible of this sort of explanation. In so far, also, as these motor reactions are elements of conscious contents they are direct material of psychology; not the least value of the theories of 'dynamogenesis' is their accentuation of the constancy in our consciousness of these 'feelings of bodily behavior.' In cases of multiple, partial association, when an image follows upon a percept nearly like it, as in the puzzling instances when a thing thing [sic] reminds one of 'itself' in a similar environment, the second and differentiating term of the association may be an imaged bodily reaction; and often when the link between associated objects seems undiscoverable it may be found in the form of an unmarked motor adjustment.

This observation of bodily reactions and the study of physiological correlates should never, however, be mistaken for a psychological analysis of the nature of association, though the confusion does actually occur in the midst of the most brilliant and most effective psychological writing. "So far as association stands for a cause" Dr. James says,[74] "it is between processes of the brain," "These reactions," in the words of Dr. Baldwin,[75] "are reduced to orderly habitual discharges; this is association by assimilation." Both writers frequently formulate the correct view of the physiological connection as 'basis' or 'foundation' or 'organic side' of association, but the tendency to make the two synonymous is also noticeable. So Wundt's [p. 34] theory of assimilation translated into physiological terms is a satisfactory one, but is untrue, as has been shown, to the facts of consciousness. So far, indeed, as the combination of sensory stimulations, or of motor effects, or of sensory with motor processes, is not known to the subject, it simply is no case of association at all, but is rather the physiological correlate of association.

#### Footnotes

[1] Cf. James, Principles of Psychology I., p. 554.

[2] Cf. Scripture, Vorstellung und Gefühl. Philos. Stud., 1890.

[3] Grundzüge der physiologischen Psychologie 4te Aufl. II., p. 437.

[4] op.cit., II, p. 453. "Die Association ist [der][8] Zusammenhang einer Vorstellung mit einem vorausgegangenen Erinnerungsbild oder Sinneseindruck."

[5] Leviathan, Part I., c. 3.

[6] Essay, Section III.

[7] Analysis of the Phenomena of Human Mind, ed. by J. S. Mill, p. 81.

[8] Classics Editor's note: These words are Calkins' insertion.

[9] In Essay II. of Introduction to Priestley's edition of Hartley.

[10] Treatise, Sect. IV.

[11] Observations on Man, Sect. II., Prop. X.

[12] Principles of Psychology, I. p. 254.

[13] Murray, Psychology, p. 75 (cf. Dewey, Psychology, and Höffding, Vierteljahrsschrift für Wissenschaftliche Philosophie, XIV., p. 204).

[14] Dewey, Psychology, p. 92.

[15] Wundt, op. cit., II., p. 457.

[16] Höffding, op. cit., p. 190.

[17] Höffding, op. cit., XIV.



[18] Wundt's terms, op. cit. II., p. 455.

[19] The braces mark the union of qualities into concrete wholes; the indexes mark the past objects of consciousness, with which the associated terms are parallel.

[20] Op. cit. XIV., p. 161. "Gelb und Orange, oder die verschiedenen Nuancen des Roth haben kein gemeinschaftliches Element und doch erinnern sie an einander."

[21] op. cit., p 168. "Zwischen diesen beiden Vorstellungen sollte also eine Vorstellung der Dünne, aber, wohl zu merken weder von der Dünne des Pflanzenplattes noch von der des Papiers, sondern von der Dünne an und für sich liegen? Man kann diese Auffassung nicht vertheidigen, ohne die alte Abstractions theorie zu erneuern, welche die gemeinschaftlichen Elemente unserer Vorstellungen genügen lässt um neue, selbständige Vorstellungen zu bilden."

[22] Cf. page 27 seq.

[23] Hartley. Observations on Man, II, Prop. IX.

[24] Hartley, op. cit. II, Prop. VIII; and Hume, Treatise I, i, and Inquiry II; and James Mill, Analysis I.

[25] Cf. Plato, Theaitaitos, 194, 195; and Aristotle, De Memoria, Bek. 95, 25.

[26] Principles of Psychology, I. c. 5, et alt.

[27] Vierteljahrschr. f. wiss. Phil., IX., p. 85. Cf, the statement (ib., p. 405), 'eine Vorstellung [besteht] [8] aus alte Elemente.'

[28] Psychologie als Wissenschaft I., 3, 4. "Auf einmal verschwindet für [Vorstellung][8] P alles Hinderniss, so richtet sich P. ins Bewusstsein auf."

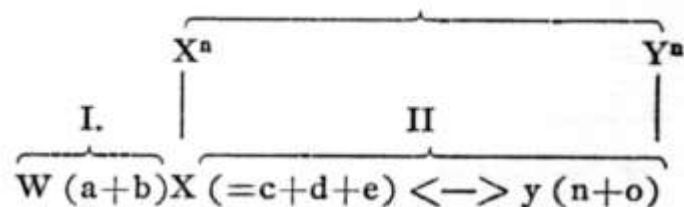
[29] Ward Enc. Brit., Vol. XX., p. 39.

[30] Cf. Scripture. Über den associativen Verlauf, p. 90 seq.

[31] Op. cit., I. p. 591. Cf. Bradley, Principles of logic, p. 294: "Similarity is a relation, which, strictly speaking does not exist until both terms are before the mind." Cf. Rabier, Psychologie: "S'il n'y a pas moyen de percevoir une ressemblance entre un état de conscience et un autre qui n'existe pas dans la pensée, comment la perception pourra-t-elle susciter ce second état dans la pensée."

[32] Op. cit. p. 59'

[33] The formula here is:



indicating that X, the common factor, includes several elements, the material qualities of magazine articles, scientific character, etc.

[34] Cf. page 19. In the body of this paper 'association' is treated as synonymous with successive association. The division is made here in order to indicate the proper place of < simultaneous association' if it be included.

[35] Philosophical Review, July, 1892.

[36] Philosophische Studien, VII., p. 341.

[37] This criticism was made by a reviewer in the Zeitschrift der Psychologie und Physiologie der Sinnesorgane.

[38] Grundzüge, II., p. 437.

[39] Philos. Stud., VII.

[40] Op. cit. II., pp. 439-448.. Wundt, however, sometimes uses assimilation, as Ward does, in the sense of Höffding's implicate association by similarity, to indicate that the presentation of a given object is followed by images of the same. The validity of this theory will be discussed later. Cf. Philos. Stud. VII., pp. 340 and 341. "[Ein Eindruck][8] wird eine Erinnerung nur immer insoweit erwecken können als er ihm gleich ist."

[41] Enc. Brit. XX., p. 57.

[42] Baldwin makes the same assertion (cf. Mental Development in the Child and The Race, p. 311 et alt.): "All perception is accordingly a case of assimilation." But assimilation is here used of a physiological combination of 'sensory processes' and 'motor reactions' and therefore does not refer to psychological association at all.

[43] Philos. Stud. VII., p. 334. The immediately following sentence seems to suggest that, similarly, successive association may be the result of simultaneous. ("Andererseits ist es nicht ausgeschlossen dass bei einer successiven Association die verbundenen Vorstellungen an sich gleichzeitig in das Bewusstsein treten, dass sie aber nur successiv appercipirt werden.") But the so-called case of simultaneous association is here very evidently a complex percept.

[44] Cf. Part II.

[45] Op. cit. XIV., p. 49 seq.; Psychology, Eng. Tr. p. 151.

[46] Vierteljahrschr. f. Wiss. Phil. XIV, p. 190. "Will man den Begriff der Aenlichkeits-association so weit ausdehnen dass er auch das unmittelbare Wiedererkennen umfasst."

[47] Note to James Mill's Analysis. Cf. Bain, Senses and Intellect, p. 458.

[48] Principles of Psychology, I. 270.

[49] Vierteljahrschr. f. wiss. Phil. XIII., 425.

[50] Op. cit. XIII., p. 428. "Nicht die geringste Spur von anderen Vorstellungen die durch die erkannte Erscheinung enweckt wurden."

[51] Philosophische Studien VII., p. 190.

[52] Lehmann. Wiedererkennen. Philos. Stud., VII., p. 180.

[53] Op. cit. I., p. 674. Note.

[54] Philos. Stud., VII., p. 352; cf. pp. 360, 361.

[55] Philos. Stud., VIII., p. 93.

[56] Philos. Stud., VII. p. 343. "aus einer unmittelbaren Verbindung gleicher Elemente verschiedener Vorstellungen, und aus einer daran mittelbar sich anschliessenden Verbindung solcher Bestandtheile die in früheren Vorstellungen mit jenen gleichen Elementen in äusserlichen Berührung gewesen waren."

[57] Op. cit. I., p. 675. Note.

[58] Vierteljahrschrift. wiss. Phil., XIII., p. 431, seq.

[59] Philos. Studien, VIII., p. 87, seq.

[60] Psychology (Engl. ed.), p. 157.

[61] Vierteljahrschr. f. wiss. Phil., XIV., p. 42. "Es scheint eine unvermeidliche Folgerung \* \* \* dass die Disposition zur Vorstellung a in weit höherem Grade erregt werden müsse wenn A selbst eintritt, als die Disposition zu b erregt wird, weil das von B verschiedene A eintritt."

[62] Philos. Stud., VII., p. 181.

[63] op. cit., I., p. 592, et. alt.

[64] Mind, October, 1894.

[65] Philos. Stud., VII., 173. [Classics Editor's note: This note corresponds to no index in Calkins' text. It was probably supposed to have been in reference to "Höffding's answer to his critics," described in the last paragraph of p. 30]

[66] Engl. Tr., pp. 121-123 and 157.

[67] Psychology, p. 123.

[68] Cf. the next quotation; and the statement that immediate recognition is an 'untrennbares Ganze.'

[69] Philos. Stud., VII., p. 191.

[70] Philos. Stud., VII., p. 345 ('Erkennungsgefühl').

[71] Op. cit., I., p. 675. Note.

[72] Op. cit., p. 318. [Classics Editor's note: This note corresponds to no index in Calkins' text.]

[73] Since this paper was sent to the press I have read Ueber das Grundprincip der Association (Berlin, 1895), by Arthur Allin, Ph.D., and two articles by the same author in the American Journal of Psychology, Vol. VII., 2. Dr. Allin presents in greater detail and with admirable clearness the theory of association, as related to immediate recognition and to assimilation, which I have here defended.

[74] Op. cit., I., p. 554.

[75] Op. cit., p. 310. Italics mine [i.e., Calkins].

## PART II.

### EXPERIMENTAL INVESTIGATION OF CONDITIONS OF ASSOCIATIVE SUGGESTIBILITY.

Experimental investigation may best supplement the purely introspective study of the nature of association by describing in relatively concrete terms the probable direction of trains of associated images. To this end there is necessary such a consideration of the so-called suggestibility of objects of consciousness as shall answer the question: what one of the numberless images which might conceivably follow upon the present percept or image will actually be associated with it?

Ordinary self-observation has long recognized that the readily associated objects are the 'interesting' ones, and has further enumerated frequency, recency, vividness or impressiveness, and primacy (the earliest position in a definite series of events) as the factors of interest, and therefore the conditions of association. A given object, then, is likely to be suggested by one with which it was frequently, recently or vividly connected, and by one with which it stood at the beginning of a series.

Logically prior to the discussion of suggestibility is the study of the suggestiveness of objects of

consciousness, that is, the consideration of the question: what part of the present total content of consciousness will be associated with a following image? The suggesting object may, of course, be of varied extent. In the rare cases of 'total redintegration,' practically the entire present content is connected, as a whole, with what follows. Far more often, some one accentuated part of the total object of consciousness is the starting point of the association; and this emphasis of attention is once more upon the 'interesting' part of the entire content, that is upon some vivid, recent or repeated object, or upon one which has had the early place in a series. Finally, neither the total content of consciousness, nor a single accentuated portion of that total, but a [p. 36] group of these single factors or objects of consciousness may form the starting point of the association.

These distinctions may be summarized, somewhat as follows :

I. Contents of consciousness are 'suggestive.'

a. As totals (Total Redintegration.)

b. As complex.

I. Groups of objects are suggestive (through 'constellation.')

2. Single portions are suggestive, through their interest, due to

(a) Repetition (Frequency.)

(b) Vividness.

(c) Recency.

(d) Primacy.

II. Objects of consciousness are 'suggestible,' through their interest, due to

a. Frequency of connection.

b. Vividness " "

c. Recency " "

d. Primacy " "

The experimental investigation whose results are here reported concerned itself with the conditions of suggestibility.

The relative significance of frequency, recency, primacy and vividness, was studied in about 2,200 experiments. This number does not include the introductory experiments undertaken in order to select satisfactory methods nor the practice experiments of each subject. There were 17 subjects, no one of whom assisted in more than 275 nor in less than 40 experiments; and the average number was 130 for each subject. Most of the visual experiments were repeated with 40 members of the writer's Wellesley College class, with an average of 12 experiments each. The results coincide very closely with those of the more extended study in the Harvard laboratory; they are not included except in one or two instances which will be noticed. All the subjects were entirely or comparatively ignorant of the aims and the problems of the investigation, which was not discussed until the conclusion of the work. The results [p. 37] were twice set down, once in the books kept for the individual subjects, and again in the books which contained the grouped records of the different sorts of experiment. These experimental ledger pages have been balanced, and all the figures given in the tables represent the concurring results of both forms of record. Constant notes were kept of subjective experiences, but have not been reported, for none of them tended to modify the conclusions drawn from the experiments themselves except where the occurrence of natural associations made it necessary to reject entirely the results of particular experiments.

The experiments were of two main types, visual and auditory; the visual experiments are divided

again into the successive and the simultaneous; finally, all the experiments may be classed, with reference to their purpose, as simple or comparative.

## I. SIMPLE SERIES.

### a. I. Successive Arrangement. Visual Series.

The method of the visual experiments was as follows: the subjects, of whom two to eight were present at one time, sat before a white screen large enough to shield the conductor of the experiment. Through an opening, 10 cm. square, a color was shown for four seconds, followed immediately by a numeral, usually black on a white ground, for the same time. After a pause of about eight seconds, during which the subject looked steadily at the white background, another color was shown, succeeded at once by a second numeral, each exposed for four seconds. The pause of eight seconds followed, and the series of 7, 10 or 12 pairs of quickly succeeding color and numeral was continued in the same way. At the close a series was shown of the same colors in altered order, and the subject was asked, as each color appeared, to write down the suggested numerals if any such occurred. The pause between the combination-series, in which colors and numerals appeared together, and the test-series, in which the colors only were shown, was eight seconds in the case of the short series and four to six seconds in the case of the longer. Color and numeral were placed together in their position behind the opening [p. 38] of the screen, the numeral at first concealed by the color, which was then slipped out. There was thus a merely momentary pause between the appearance of color and of numeral. During the eight-second pauses the opening was filled by a white ground, 1/2 cm. behind the screen. The subject thus saw nothing in the opening except this white ground, or the color, which filled the whole square, or the printed numeral; the movements of the experimenter were entirely concealed. The time was at first kept by following the ticks of a watch suspended close to the experimenter's ear; but in the last 1,200 tests by listening to the beats of a metronome, which rung a bell every four seconds; the metronome was enclosed in a sound-proof box, so that the subjects were not disturbed by the beats, which reached the experimenter through a rubber tube. All the series were carefully placed in order beforehand.

In the first group of experiments, some one color appeared several times in each series, once in an unimportant position with any chance numeral, but also once or more in some emphasized connection-either repeatedly with the same numeral (a 'frequent' combination), or at the very beginning or very end of a series (cases of 'primacy' and of 'recency'), or with a numeral of unusual size or color (an instance of 'vividness').

The following are representative series:

Visual series 89. Frequency (3: 12).

I. (Combination Series.) Green, 47; brown, 73; violet, 61 (f); light grey, 58; violet, 61 (f); orange, 84; blue, 12; violet, 61 (f); medium grey, 39; violet, 26 (n); light green, 78; strawberry, 52.

II. (Test Series.) Blue, light grey, strawberry, green, violet (f), orange, brown, medium grey, light green.

Visual Series, 213. Vividness.

I. Brown, 34; peacock, 65; orange, 51; green, 792 (v); blue, 19; violet, 48; green, 27 (n); grey, 36; strawberry, 87 ; dark red, 54.

II. Blue, grey, dark red, brown, green (v), orange, strawberry, grey, peacock. [p. 39]

Visual Series, 127. Recency.

I. Peacock, 46; blue, 38 (n); brown, 51; grey, 74; yellow, 29; blue, 52 (r).

II. Grey, blue (r), peacock, yellow, strawberry, brown.

Visual Series, 69b. Primacy.

I. Light red, 48 (p); strawberry, 13; violet, 60; grey, 82; orange, 29; light red, 31 (n); yellow, 53; green, 94; light violet, 17; blue, 69.

II. Green, gray, light red (p), light violet, strawberry, orange, violet, yellow, blue.

The problem of the experiment is the discovery of the proportion of cases in which the accentuated color, e.g., green (as in series 213, above), suggests the numeral -- here 792 -- with which it was emphatically combined, instead of suggesting the other numeral with which also it was shown.

To gain a basis of comparison about 1,300 series of all types, and from the records of all the subjects, have been considered as a mere memory test, leaving out of account, for the time being, the emphasized combinations which they contain. About one-fourth of the ordinary combinations in the longer series (10 to 12 pairs), and one-third in the shorter series (7 pairs) are remembered. This is shown in

TABLE I. CORRECT ASSOCIATIONS.

Series.	Number of Series.	Possible Correct Associations.	Actual Correct Associations.		
			Full.	Half.	%
Long	867	7672	1728	558	26.1
Short	444	2144	674	170	35.2

In this calculation, and in all similar ones, all cases were excluded in which any accidental association already existed between color (or syllable) and numeral. If the color was thus naturally associated with the emphasized or the contrasted numeral, the whole series was excluded; otherwise, as in the cases included under this table, merely the combination thus connected was set aside.

The tabulated results of the experiments on frequency as a condition of association are as follows: [p. 40]

TABLE II. FREQUENCY, VISUAL.

	Number of Series.	Both			Normal Only.			Frequent Only.		
		Full.	Half.	%	Full.	Half.	%	Full.	Half.	%
Freq. 3 : 12.....	200	37	3	19.2	7	9	5.7	83	12	44.5
Freq. 2 : 12.....	143	16	7	13.6	8	16	11.2	29	3	21.3

The table shows the number of those cases in which both numerals were recalled, then the number of cases in which the color suggested only the numeral with which it had been but once associated, and in the last group the number of times in which that numeral was recalled with which the color had been twice or three times combined. Under the heading 'Half' are given those cases in which one digit of the numeral was recalled, and in estimating per cents. these cases are rated as half correct. The comparison of the 'frequent' with the unemphasized, that is the 'normal,' shows that, with repetitions amounting to one in four, the repeated numeral is associated in 63.7% of the possible cases (44.5+19.2%), the normal in only 24.9% (5.7+19.2%). When only one numeral is suggested, the 'frequent' appears more than seven times as often as the once combined numeral.

The comparison of both these per cents. with that representing the likelihood of recall for such long series (Table I.) leads to the same conclusion. The frequency combined numeral is associated more than twice as often (63.7% instead of 26.1%), while the unemphasized numeral is associated slightly less often, than the average (24.9% instead of 26.1%). This latter comparison, which, however, needs substantiation by a greater number of experiments, suggests the negative result of habit, since the effect of habitual combination with a given stimulus is seen to be a small decrease of the likelihood of ordinary connection with the same stimulus. In the case of subjects with retentive memories-observe, for instance, the record which follows, of Sh. -- 'both' numerals are likely to be recalled, the normal as well as the frequent. This is easily explained when the normal comes late in the series for the occurrence of a color already accentuated by repetition may direct the attention to

the following numeral even when that is not emphasized. This [p. 41] fact makes the general lowering of the percentage of recall of the normal in the 'frequent' series the more striking.

It must be added that in the case of the frequent and the vivid series this influence of position was eliminated by constantly changing the place of the unemphasized pair of stimuli; thus, in the 'vivid' series the normal and the vivid combination alternated between the early middle and the late middle parts of the series; and in the 'frequent' series the normal was placed successively in the early, the early middle, the late middle or the late part of the series. From the results it appears that the normal combination is slightly more likely to be forgotten if placed in the early part of the series, but this does not alter the general tendency.

It is noticeable, also, that the influence of repetition is much lowered when the 'frequent' combination appears twice only instead of three times. The second line of Table II. gives the results; the 'frequent' numeral is recalled in 34.9% of the series (21.3+13.6%) which is only 8.8% more than the ordinary average of associations without repetition, and 28.8% less than the proportion of three times repeated associations. The table of individual records is therefore given only for the one-fourth frequency series; it shows that the results are not due to any misleading massing of the figures, for the preponderance of 'frequency' associations appears for each subject. [p. 42]

TABLE III. FREQUENCY (3:12), VISUAL.

Names.	Number of Series.	Both.		Normal only.		Frequent only.	
		Full.	Half.	Full.	Half.	Full.	Half.
B.	20	4	1			5	2
C.	24	3	1	2	3	9	1
Ha.	13	2			2	6	
Ns.	5					3	
Pt.	22	3		1		14	1
Shp.	6	2				2	1
St.	17	2		1	1	12	
Lg.	11	3				5	1
Mc.	6					3	
N.	11	3			1	2	
E.P.	6			1	2	2	
J.P.	12	1				2	2
R.	12	3		1		5	1
Sh.	12	8				3	
Si.	11		1	1		3	1
So.	12	3				8	
Total,	200	37	3(19.2%)	7	9(5.7%)	84	10(44.5%)

The greatest difficulty of these experiments was unquestionably in the study of vividness as a condition of suggestibility. The category is a vague and elusive one, seeming to include all those forms of the interesting which cannot be referred to the repetition, the recency or the primacy of the experience. In the main, therefore, the 'vivid' is either the 'unusual,' or it is the object of instinctive, and therefore of psychologically inexplicable, interest.

The following summary distinguishes the different devices used to make the combinations 'vivid.' Since the color was always repeated, this result could only be secured by varying the numeral, which was accordingly either black, of two digits, but much smaller than the other numerals (B2S); or black, of usual size, but of three digits (B3); or of usual size and of two digits, but red (R2); or, finally, of usual size but of three digits and red (R3). About 200 records obtained from experiments at Wellesley are added to the table. [p. 43]

TABLE IV. VIVIDNESS, VISUAL.

Nature of Vividness.	Number of Series.	Both.			Normal Alone.			Vivid Alone.		
		Full.	Half.	%	Full.	Half.	%	Full.	Half.	%
B <sub>3</sub>	147	9	6	8.2	11	2	8.2	63	4	44.2
B <sub>2</sub>	102	7	2	7.8	12	6	14.7	21	3	22.1
R <sub>3</sub>	132	11	5	14.7	11	0	8.3	39	18	36.3
R <sub>2</sub>	159	18	6	13.2	12	4	8.8	53	21	39.9

The comparison of these different sorts of impressiveness shows an interesting preponderance of associating three place black numerals (52.4%) over associating black numerals of only two digits (29.9%). Since the latter were visually very striking, because so small, this difference is very likely due to the fact that the numerals of three places, introducing, if pronounced, the word 'hundred,' are helped by the articulatory memory. Only the Harvard records are used in the following table of individual results.

TABLE V. VIVIDNESS, VISUAL.

Names.	Number of Series.	Both.			Normal Only.			Vivid Only.		
		Full.	Half.	%	Full.	Half.	%	Full.	Half.	%
B.	33				1			13	6	
C.	8				2	1		4		
Ha.	39	4			2			16	3	
Mi.	42	3			9	1		12	7	
Ns.	47	6	1		1			17	2	
Lg.	10	2			1			6	1	
Lh.	35	5	1					7	8	
Mc.	43	11			5	2		10	6	
N.	9					1		1	1	
E.P.	29	4						12	7	
J.P.	10				2			1	2	
R.	11	3						4	1	
Sh.	9	3						1	2	
Si.	10	1			1	1		3	1	
So.	11	1	1		1			6		
Total,	346	43	3 (12.8%)		25	6 (8%)		113	47 (39.4%)	

Thus the vividly-associated numerals are remembered in about one-half (52.2%) of the series, while the normal associations with the same colors are only one-fifth (20.8%) of the entire number. The lessened strength of these sorts of vividness, as compared with that of the three repetitions, is shown by the [p. 44] greater number of cases in which neither numeral is remembered. J.P., however, is the only one of the subjects whose records, only 10 in number, show no influence at all of vividness.

In the attempt to fix a rate of associative recency, series were used varying in length from 4 to 7 pairs. Only the series of 7 pairs proved suitable to the purpose, for in the shorter ones both numerals were usually recalled so that a comparison became impossible. The 'recent' color, which appeared last, of course, in the combination series was placed second, not first, in the test-series, in order that no after-image of the numeral might remain. The individual records which are grouped in the following table offer only one variation from the type, again in the case of J.P. They show that the last numeral is recalled in 53.7% of the possible cases; the other numeral associated with the same color, only in 25.7%.



TABLE VI. RECENCY, VISUAL.

Names.	Number of Series.	Both.		Normal Only.		Recent Only.	
		Full.	Half.	Full.	Half.	Full.	Half.
Hy.	4	1				1	1
Lg.	9	2				3	
Lh.	19	3				11	1
Mc.	27	6		1	1	8	3
Nr.	9			1		3	2
E.P.	18	2		3		9	1
J.P.	18	2	1	4	1	3	1
R.	17	2		2		8	1
Sh.	12	4		1		4	3
Si.	15			3	1	3	
So.	17	2		1	3	8	2
Mi.	6			1		1	1
B.	10	1		1	1	2	1
Ha.	9			2		3	1
Ns.	10	2			1	4	
Total,	200	27	1 (13.7%)	20	8 (12%)	71	18 (40%)

The influence of recency has been studied also in the series which were arranged without this immediate end in view, by recording all cases in which the last numeral was correctly associated with the color on which it had followed. In these cases the likelihood of recall does not surpass that of the average numeral, [p. 45] though the 'recent' color was shown third in the second half-series: the recall of the recent numeral occurred only in 26.4% of 276 series. The swiftly decreasing influence of recency, well-known from such experiments as those of Ebbinghaus on memory, is thus clearly indicated: even the intervention of only two colors between the last combination of color and numeral and the reappearance of the color was sufficient to annihilate the effect of the recency.

Finally, the suggestibility of a numeral which had already appeared at the very beginning of a series was compared with that of another numeral combined with the same color midway in the series.

TABLE VII. PRIMACY, VISUAL.

Names.	Number of Series.	Both.		Normal Only.		Primacy Only.	
		Full.	Half.	Full.	Half.	Full.	Half.
Hy.	8			1		2	
Lg.	14			1			
Lh.	20	2		8	3	2	1
Mc.	19	2		2	3	6	2
Mi.	2			1	1		
N.	18	1		2		6	2
E.P.	20	4		3	3	2	1
J.P.	21			3	1	5	
R.	22	1		3	1	12	1
Sh.	17	3		2	3	6	2
Si.	17	2		1	2	4	1
So.	22	3	2	4	1	3	2
Total,	200	18	2 (9.5%)	31	18 (20%)	48	12 (27%)

The table shows very clearly that with long series, primacy is a significant factor only in individual cases. Thus, its influence is very marked on R.'s associations, and may be observed in the records of Mc. and Sh. Lh. on the other hand associates the later numeral, that is the 'normal,' much more often, and with four of the other subjects the normal has a slight advantage. A record of cases was also kept in which the first of the series was remembered, without special competition with any other numeral, but the proportion was barely the average one in the long series; in the short series on the other hand the first numeral was associated in more than two-fifths of [p. 46] the cases -- in 43%, that is 8% more often than the average numeral and only 8% less often than the recent.

The ineffectiveness of primacy in the long series seems at first sight to contradict the testimony of common experience and of experiment,[1] for, in committing long series to memory, the learner is certainly very apt to remember the first presentation. This difference, however, is easily explained: in memorizing, the subject sets himself to learn the series as a whole, and he may not only accentuate the first presentation, but recur to it while learning the rest of the series; moreover, when he repeats the series, or records it in writing, he almost invariably gives first the earliest presentation. In the association experiment, on the contrary, the first presentation was always repeated toward the middle of the test-series, thus multiplying the chances that the combination would be crowded out of the memory.

## 2. Simultaneous Arrangement. Visual Series.

These general results have been amplified, and at the same time verified, by introducing series in which the connected color and numeral were simultaneously shown. This method might have been used more often, since the simultaneous combination of stimuli is perhaps more common in ordinary experience than the successive; but the experiments of the successive type, in which the combination of color and numeral is emphasized by the long pause between each pair, were employed as affording a close comparison between the visual and the auditory series. So far, however, as these subjects are concerned, the results of the simultaneous series are so closely parallel with those of the successive ones that no characteristic differences appear. Color and numeral were shown side by side in an opening 10x4 cm., by slipping them into double passe-partout frames, made for the purpose. Each frame held a color and a numeral separated by a narrow band of white. The intervals of exposure were six seconds, and in a few series four seconds; the pauses were usually six seconds, occasionally four seconds. In each of the three most important simple forms of the experiment, 50 [p. 47] tests were made. The average of recall, leaving out of account the emphasized numerals, was 25.4% for the 100 long series and 30% for the 50 short series, thus falling, as has been said, slightly below the average of recall in the successive series. Moreover the percentage of emphasized numerals which were associated was slightly greater than in the successive series, because of the larger number of cases in which both numerals were recalled. This result, however, may be due to the greater degree of practice when these simultaneous tests were made.

The number of experiments is so small that the individual records are not given, but they are closely parallel with those of the successive series. In the table which follows, the figures for the 'half correct, which are small, are combined with those of the fully correct, and the corresponding per cents. of the successive series are added in parenthesis.

TABLE VIII. SIMULTANEOUS COMBINATION.

Nature of Series.	Number of Series.	Both.		Normal only.			Emphasized.		
		Sim. No.	Suc. %	Sim. No.	Suc. %	Emphasized. %	Sim. No.	Suc. %	
Freq.	50	11	22% (19%)	1½	3%	(5.7%)	24	48% (44.5%)	
Viv.	50	15	30% (12.8%)	4½	9%	(8%)	19	38% (39.4%)	
Rec.	50	10	21% (13.7%)	5½	11%	(12%)	19	38% (40.7%)	

### b. Auditory Series.

All the varieties of experiment which have so far been described, except those in primacy, were repeated with nonsense syllables and numerals, as the association-elements, both pronounced to the subjects. These series were arranged in pairs of a nonsense syllable and a numeral each, with four seconds allowed to the pronunciation of each pair, and four seconds interval both between the pairs and between the two parts of the series. One series will serve as illustration of all.

Series 335b. Vivid, Auditory.

I. Zet, 24; Kip, 62; Tox, 96; Wez, 319 (v); Vit, 38; Lup, 45; Nuk, 29; Wez, 73 (n); Vab, 57; Muv, 41.

II. Vit, Kip, Muv, Zet, Wez, Nuk, Lup, Vab, Tox.

The results of the experiments are generally parallel with [p. 48] those of the visual tests, with certain suggestive variations which will be noticed later. The general average of recall, disregarding the accentuated pairs is shown in

TABLE IX. CORRECT ASSOCIATIONS, AUDITORY.

Series.	Number of Series.	Possible Correct Associations.	Actual Correct Associations.		
			Full.	Half.	%
Long.	254	2405	498	22	(25.3%)
Short.	100	581	118	39	(23.6%)

The 'frequent' numeral is recalled twice as often as the unemphasized (in 80% as against 40% of the possible cases) as appears from

TABLE X. FREQUENCY (3:12) AUDITORY.

Names.	Number of Series.	Both.		Normal only.		Frequent only.	
		Full.	Half, %	Full.	Half, %	Full.	Half, %
Hy.	5	1				1	
Lg.	14	8		1		3	1
Lh.	12	3			1	5	2
Mc.	15	9				4	2
Nr.	14		1		1	7	2
E.P.	14	5	1			5	2
J.P.	14	9				2	3
R.	15	4				7	3
Sh.	17	8			1	6	2
Si.	14	8				3	3
So.	16	2			1	9	3
Total,	150	57	2 (38%)	1	4 (2%)	52	23 (42%)

The position of the normal in the series was carefully varied, as in the visual experiments. The following table shows, however, that whatever the position of the normal, associations with the repeated numeral are much in excess, though they decrease where the normal is midway in the series so that the repetition affects is also.

TABLE XI. FREQUENCY, AUDITORY.

Position of Normal.	Number of Series.	Both.		Normal Only.		Frequent Only.	
		Full.	Half. %	Full.	Half. %	Full.	Half. %
Early.	42	11	(26%)			25	3 (63%)
Middle.	57	26	(45.6%)	3	(2.6%)	10	13 (28.9%)
Late.	51	20	(41%)	1	(3%)	17	7 (40%)
	150	57	(38%)	1	(2%)	52	23 (42%)

Two methods of making a numeral impressive were employed. Sometimes, as in the example given, a numeral of three digits was used. At other times the emphasized numeral was read in a very loud tone. The next summary shows that both methods were effective, but that the voice-stress was a little more impressive.

TABLE XII. VIVID, AUDITORY.

Nature of Vivid.	Number of Series.	Both.		Normal Only.		Frequent Only.	
		Full.	Half. %	Full.	Half. %	Full.	Half. %
Digits.	97	14	3 (15.9%)	4	9 (9.7%)	26	29 (41.7%)
Loud.	103	22	1 (21.8%)	6	6 (8.7%)	31	7 (33.4%)
Total,	200	36	4 (19%)	10	15 (8.7%)	57	36 (37.5%)

The individual records show greater variation from the type than the reports of frequency-association .

TABLE XIII. VIVID, AUDITORY.

Names.	Number of Series.	Both.		Normal only.		Vivid only.	
		Full.	Half. %	Full.	Half. %	Full.	Half. %
Hy.	4	-	-			1	
Lg.	19	2			2	6	4
Lh.	14	2	2		1	6	2
Mc.	22	5	1	1	2	10	2
Nr.	10				1		3
E.P.	12	2		1		7	2
J.P.	23	8	1	1		4	5
R.	26	3		4	5	7	4
Sh.	23	7			1	6	8
Si.	20	3		3	1	2	3
So.	27	4			2	8	3
Total,	200	36	4 (19%)	10	15 (8.7%)	57	36 (37.5%)

The influence of the position of the normal shows itself, in the other series, in the larger number of cases in which 'both' are remembered, when the normal comes after the vivid combination.

TABLE XIV. VIVID, AUDITORY.

Position of Normal.	Number of Series.	Both.		Normal only		Vivid only.	
		Full.	Half. %	Full.	Half. %	Full.	Half. %
Early.	108	13	(12%)	7	4 (8%)	40	22 (46%)
Late.	92	23	4 (27%)	3	11 (9%)	17	14 (26%)
Total,	200	36	4 (19%)	10	15 (8.7%)	57	36 (37.5%)

The records of the recency experiments show the very striking effect of auditory recency. There are no individual variations from the general type, and the number of cases in which the normal is remembered does not rise above one-eighth. In about half the records the 'recent' is wholly or partially remembered in every case.

TABLE XV. RECENCY, AUDITORY.

Names.	Number of Series.	Both.		%	Normal Only.		Recent Only.		
		Full.	Half.		Full.	Half.	Full.	Half.	%
Hy.	5						5		
Lg.	9	1					8		
Lh.	6						5	1	
Mc.	9	3					4	1	
N.	8						4	3	
E. P.	10						9	1	
J. P.	10	2			1		4	2	
R.	11	1			1		7	1	
Sh.	10	1					5	1	
Si.	11	2			1	1	5	2	
So.	11						10	1	
Total,	100	10		(10%)	2	2	(3%)	66	13 (72.5%)

Auditory experiments to determine the effectiveness of primacy were undertaken, but were soon discontinued because they showed from the beginning the insignificance of this factor in long series. In the short auditory series, however, as in the visual, the first position proved very important: the first numeral was associated in 38.4% of the possible cases, that is, in 14% more than the average number.

The general relations of the auditory to the visual series appear in the next table in which only per cents. are given:

XVI. COMPARISON OF VISUAL AND AUDITORY ASSOCIATIONS.

Type of Series.	Correct Ass.	Both.	Normal.	F, V or R.	Total F, V or R.	Total Normal.
F. Vis.	26%	19%	6 %	44.5%	63.5%	25 %
F. Aud.	25 "	38 "	2 "	42 "	80 "	40 "
Viv. Vis.	26 "	13 "	8 "	39.4 "	52 "	21 "
Viv. Aud.	25 "	19 "	8.7 "	37.5 "	56.5 "	27.7 "
Rec. Vis.	33 "	14 "	12 "	40 "	54 "	26 "
Rec. Aud.	23 "	10 "	3 "	72.5 "	82.5 "	13 "

[p. 51]

These figures may seem to contradict Dr. Münsterberg's conclusion[2], from his memory experiments, that "when isolated the visual memory surpasses by far the aural." But the comparison of visual and aural memory in these association-experiments is, in the first place, an unfair one, since the suggesting stimuli differ so much in the two types of experiment, consisting in the one case of colors, in the other of syllables. Furthermore, the figures themselves (in the column of 'Correct Associations') show that the memory for ordinary combinations is rather stronger in the visual series. The suggestiveness, not the reproduction, seems to be increased in the auditory series, and this is very likely a case of the well-known associativeness of language. The preponderance, already noticed, of recency associations is also, perhaps, peculiar to verbal suggestions. At the very least, the auditory experiments corroborate the results of the visual by reproducing these in another sense-material.

## II. COMPARATIVE SERIES.

In showing that frequency, vividness, primacy and recentness are conditions of association these experiments have so far, of course, merely substantiated ordinary observation. The real purpose of the investigation is attained only by a comparison of these factors. Already it has appeared that the per cent. of correct 'frequency' associations is slightly the largest, and that recency is the principle of the combination in the next greatest number of cases. In order, however, to carry out the comparison under like conditions, these principles of combination were compared within the same series. To this end, long 'successive' series were arranged in which the significance of frequency was contrasted with that of vividness by showing a color three times with the same two-digit numeral (f) and once with a three-digit numeral (v) ; others, in which the color three times shown with a numeral (f) appeared also at the first of the series with another numeral (p). Short 'successive' series were formed in which the last color (r) had appeared once before [p. 52] with a three-digit numeral (v), or at the very beginning of the series (p), or twice before with a repeated numeral (f).

In the following summary of results of the comparison of frequency and primacy, half the records are those of Wellesley subjects. The individual records are not given because they are few in number and show no variation. The experiments were not continued further because their result was so unmistakable, verifying the conclusion already reached by the study of primacy alone, that this is evidently an unimportant feature of long series.

TABLE XVII. FREQUENCY AND PRIMACY.

Number of Series.	Both.			Prim. Only			Freq. Only		
	Full.	Half.	%	Full.	Half.	%	Full.	Half.	%
80	15	2	20%	3	2	5%	44	3	56.8%

The comparison of frequency with vividness shows far less inequality, and yet there is a definite excess of correct associations with frequency. In half the cases where there was any association at all, both the frequent and the vivid numeral were recalled. The records are these:

TABLE XVIII. FREQUENCY AND VIVIDNESS.

Names.	Number of Series.	Both.		Vivid		Frequent.		%.
		Full.	Half.	Full.	Half.	Full.	Half.	
Hy.	7					2	2	
Lg.	13	8					2	
Lh.	23	15		1		3	4	
Mc.	26	12		3		6	4	
Na.	17	2		1	1	8	2	
E. P.	20	16			1	2	1	
J. P.	18	4		7		3	1	
R.	23	13		1		2	6	
Sh.	16	11			1	3		
Si.	14	4		3		6		
So.	23	6			1	9	5	
Total,	200	91	(45.5%)	16	4 (9%)	44	27 (28.7%)	

This shows a total of 74.2% (28.7+45.5) of associations with the numeral frequently combined with the color presented, and 54.5% (9+45.5) of associations with the numeral vividly combined. Frequency, however, is not invariably the more determining factor: the records of E.P., Lh., and Sh. show only a small difference between 'frequent' and 'vivid' associations, while J.P. has more with the vividly combined numeral. [p. 53]

The greater significance of frequency of combination was brought out more strongly by lengthening and filling the interval between the half-series. After the pairs of colors and numerals had been shown to the subjects, short anecdotes or news-items, of about one hundred and fifty words, were rapidly read aloud. The test series, of colors only, was then shown and the subjects tried as usual to

associate the numerals. The table shows that the per cent. of association was a little lowered, but that the per cent. of frequency associations is greater than after the unfilled interlude. The frequently combined numerals seem to be more tenaciously associated. This method might with advantage have been extended to the other experiments.

TABLE XIX. FREQUENCY AND VIVIDNESS.

INFLUENCE OF FILLED INTERLUDE.

Inter- lude.	No. of Series.	Both.			Viv. Only.			Freq. Only.		
		Full.	Half.	%	Full.	Half.	%	Full.	Half.	%
Unfilled.	89	49	(55.7%)		7	1	(8.4%)	16	10	(23.6%)
Filled.	111	42	(37.8%)		9	3	(9.4%)	28	17	(32.8%)
Total,	200	91	(45.5%)		16	4	(9.4%)	44	27	(28.7%)

The influence of position in the series does not alter the general relation of frequent and vivid associations, though the greatest number of 'frequent associations only' does occur where the vivid numeral is nearest the beginning of the first half-series and so at a relative disadvantage. The greatest likelihood of remembering 'both' occurs when the vivid is near the middle of the series so that it is influenced by the repetition and itself influences the remaining repetitions. All this appears in the following table:

TABLE XX. FREQUENCY AND VIVIDNESS.

INFLUENCE OF POSITION IN SERIES.

Position of Vivid.	Number of Series.	Both			Vivid.			Freq. Only.		
		Full.	Half.	%	Full.	Half.	%	Full.	Half.	%
Early.	68	25	(36.7%)		7	1	(11.1%)	20	9	(36.7%)
Midway.	72	42	(58.3%)		5	1	(7.6%)	12	5	(20.8%)
Late.	60	24	(40.0%)		4	2	(8.3%)	12	13	(30.8%)
Total,	200	91	(45.5%)		16	4	(9.4%)	44	27	(28.7%)

[p. 54]

The results of the comparison of recency with the other conditions of suggestibility is made in the three following tables:

TABLE XXI. RECENCY AND VIVIDNESS.

Name.	Number of Series.	Both.		%	Vivid Only.		%	Rec. Only.		%
		Full.	Half.		Full.	Half.		Full.	Half.	
Hy.	5	1								
Lg.	9	6			1					
Lh.	26	6			5	7		2	3	
Mc.	22	4			7	4		2		
Mi.	10	2			2			2	1	
Nh.	10	3			4			1		
E.P.	24	13			4	1		3	1	
J.P.	17	3	1		2	1		1		
R.	17	8	1		2	3			1	
Sh.	11	6			3	2				
Si.	9							2		
So.	17	2			1	1		6	3	
B.	6				2	1				
Ha.	8	3			1	2				
Ns.	9	2			2	1		3		
Total,	200	59	2	(30%)	36	23	(23.7%)	22	9	(13.2%)

TABLE XXII. RECENCY AND FREQUENCY.

Name.	Number of Series.	Both.		%	Frequent Only.		%	Recent Only.		%
		Full.	Half.		Full.	Half.		Full.	Half.	
B.	6					2				
Ha.	8	2			3	2		1		
Lg.	9	6						1		
Lh.	11	2			1	2		2	1	
Mc.	17	7			5	2			1	
Mi.	10	6			3			1		
Nr.	3	1	1					1		
Ns.	9	3			2	2		1		
E.P.	8	3			1	2		2		
J.P.	7	3			1			1	1	
R.	10	7	2					1		
Sh.	10	6			2			1		
Si.	7				2			2	1	
So.	10	4			2	1		3		
Total,	125	50	3	(41.2%)	22	13	(22.8%)	17	4	(15.2%)



TABLE XXIII. RECENCY AND PRIMACY.

Name.	Number of Series.	Both.		%	Primacy Only.		Recent Only.		%
		Full.	Half.		Full.	Half.	Full.	Half.	
Ha.	4	1					1	1	
Lg.	13	6			1	1	3		
Lh.	4	2			1				
Mc.	8	2			1	1	1	2	
Mi.	4	1					3		
Na.	8	1			2	1	1		
Ns.	3	1			1				
E.P	3	2							
J.P.	4						2	1	
R.	13	4				4	2	1	
Sh.	12	2	1		1	3	3	1	
Si.	10						3	1	
So.	14	3			3	1	6		
Total,	100	25	1(25.5%)		10	11(15.5%)	25	7(28.5%)	

[p. 55]

The discussion of these results will be facilitated by comparing the per cents. of the total number of the recent and of the contrasted associations in the different cases:

	RECENT ASSOC. %	CONTRASTED ASSOC. %
Rec. and Viv.	43.2%	(V) 53.7%
Rec. and Freq.	56.2 "	(F) 64 "
Rec. and Prim.	54 "	(P) 41 "

It appears that in this direct competition recency yields both to frequency and to vividness as a condition of suggestibility. The vivid numeral seems even to suppress the recent, for in the recent-vivid series the recent is recalled 10% less often than in the series where the recent is compared with an ordinary numeral (See Table VI.). On the other hand, the effect of recency is as usual, to raise the likelihood of the recall of the contrasted numeral, but not to the level of the frequent associations.

The associations with the first numeral of the series are decidedly less than those with the recent, though far more numerous than in the longer series. Individual differences, however, are to be noticed here, and would doubtless appear more strongly in a larger number of experiments; they may also be observe in a few records of the other short series, as in that of So., who has few vivid, and many recent, associations.

From this mass of figures a few conclusions emerge into prominence. Some of these have been already formulated, but the more important ones may be briefly stated again. [p. 56]

No one of these generalizations, it should be remarked, is proof against the caprice of the individual, who may have his own favorite type of association which resists opposition. Thus the preference of one of our subjects-So.-for the recent may be traced through almost all the series, often in contradiction of the general result.

Frequency has been the most constant condition of suggestibility. The proportion of the frequent as compared with the normal associations is one-tenth greater than that of the vivid or of the recent. When directly compared with the vivid and the recent the proportion is still greater, though the number of associations with the contrasted numeral is larger than that of the associations with an ordinary one, because of the tendency of the repetition to accentuate the compared factor.

This significance of frequency is rather surprising. For though everybody recognizes the importance of repetition in forming associations, we are yet more accustomed to 'account for' these by referring to recent or to impressive combinations. The possibility that the prominence of frequency in our results is not fairly representative of ordinary trains of association is strengthened by the fact that it is contrasted with forms of vividness which are only two or three of many, and which do not approach the impressiveness, for instance, of richly emotional experiences. But this does not affect the importance of frequency as a corrective influence. Granted a sufficient number of repetitions, it seems possible to supplement, if not actually to supplant, associations which have been formed through impressive or through recent experiences. Moreover, the trustworthiness of the ordinary observation, which relegates frequency to a comparatively unimportant place among the factors of suggestibility, may be seriously questioned: I have found many cases, during experiments in free association in which the subject, asked to explain the association, does not always mention repetition, even when it has obviously occurred, but seems, as it were, to take it for granted. The prominence of frequency is of course of grave importance, for it means the possibility of exercising some control over the life of the imagination and of definitely combating harmful or troublesome associations.

#### Footnotes

[1] Cf. Dr. W. G. Smith, *Psychological Review*, III., p. 30.

[2] *Psychological Review*, I., p. 37.

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