

## B. ASSOCIATION. (II.)

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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 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.
    1. *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 massed records of the first part of the study were published in this REVIEW, volume I, pages 476 to 483. The figures of this earlier summary are incorporated with those of the later experiments in this paper, and the account of the methods used and of certain of the conclusions reached is here in part repeated to secure completeness. All the results 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.

EXPERIMENTAL INVESTIGATION OF 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 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. 1. Successive Arrangement. Visual Series.*

The method already described<sup>1</sup> was retained throughout, except that the time was kept, in the second half of the experiments, 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. A color was shown during four seconds, against a white background, followed by a numeral, also exposed four seconds. Each series consisted of 7, 10 or 12 such pairs of quickly succeeding color and numeral, each presentation lasting only four

<sup>1</sup>PSYCHOLOGICAL REVIEW, I., p. 477.

seconds and each pair of stimuli separated from the next by an interval of eight seconds; at the close a test series was shown, made up of the colors only, in changed order, and the subjects wrote down whatever numeral, if any, was suggested by each color. The experimenter was hidden from view throughout.

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, 213. Vividness.*

First Series: Vivid, 4. Second Series, 5.

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.

*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.

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.

The later experiments, in the first place, fully corroborated the results already published. Thus the general likelihood of the recall of numerals in series of this character, leaving out of consideration all the emphasized numerals, was 26.1% in the long, 35.1% in the short series.<sup>1</sup> No new series were intro-

<sup>1</sup>Cf. for per cents. of earlier results (26.4% and 35.3%) PSYCHOLOGICAL REVIEW I., p. 479.

duced with only two occurrences of the repeated numeral, since the per cent. of recall in these cases<sup>1</sup> had been so little above the normal; but the likelihood of associating the numeral three times repeated with a color was 63.7%, while the normal or unaccentuated numeral appeared in only 24.9% of the cases.<sup>2</sup> In 19.2% of all the test series, 'both' the frequent and the normal were remembered. This is easily explained when the normal comes late in the series, for the recurrence of the color, already repeated, draws attention to the following numeral, even when that is not accentuated. To eliminate this influence of position, the place of the normal in the series was constantly changed from beginning to middle and end. The table of individual records is given only for the one-fourth (or 3 of 12) 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. As before, the column headed 'Half' includes cases in which one digit only was recalled, and these are estimated in calculating the per cents., as half correct.

TABLE I. 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%)	

<sup>1</sup>cf. PSYCHOLOGICAL REVIEW, IV., p. 475<sup>2</sup>Cf. for per cents. of earlier results (63.4% and 23.3%), PSYCHOLOGICAL REVIEW, I., p. 149.

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.

TABLE II. 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, in close likeness to the results of the former experiments,<sup>1</sup> the vividly-associated numerals are remembered in about one-half (52.2%)<sup>1</sup> of the series, while the normal associations with the same colors are only one-fifth (20.8%)<sup>1</sup> of the entire number. The lessened strength of these sorts of vividness, as compared with that of the three repetitions, is shown by the 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.

The individual records in the experiments on recency<sup>2</sup> offer only one variation from the type, again in the case of J. P.

<sup>1</sup> Cf. for earlier results (48% and 20.8%) *op. cit.*, page 481.

<sup>2</sup> Cf. for earlier results (53.7% and 22.2%) *op. cit.*, page 480.

The last numeral is recalled in 53.7%<sup>1</sup> of the possible cases; the other numeral associated with the same color, only in 25.7%.<sup>1</sup>

TABLE III. 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 particular purpose, 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, 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.

<sup>1</sup> Cf. for earlier results (53.7% and 22.2%) *op. cit.*, page 480.

TABLE IV. 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 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 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,<sup>1</sup> 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 associa-

<sup>1</sup> Cf. the work of Dr. W. G. Smith on memory.



tion 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.

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 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 to 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., with those of the successive series, are added in parenthesis.

TABLE V. SIMULTANEOUS COMBINATION.

Nature of Series.	Number of Series.	Both.		Normal only.		Emphasized.	
		Sim. No.	Suc. %	Sim. No.	Suc. %	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 to 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 VI. 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%)

TABLE VII. 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 it also.

TABLE VIII. 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	1 (3 ")	17	7 (40 ")
	150	57	2 (38 ")	1	4 (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 IX. 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 X. 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, as in the other series, in the larger number of cases in which 'both' are remembered, when the normal comes after the vivid combination.

TABLE XI. 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 XII. 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:

XIII. 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 "

## II. COMPARATIVE SERIES.

In showing that frequency, vividness, primacy and recency 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 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 XIV. 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 XV. 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 54.9% (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.

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 XVI. 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	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	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 XVII. FREQUENCY AND VIVIDNESS.

## INFLUENCE OF POSITION IN SERIES.

Position of Vivid.	Number of Series.	Both		Vivid.		Freq. Sec.	
		Full. Half.	%	Full. Half.	%	Full. Half.	%
Early.	68	25	(36.7%)	7	1 (11 %)	20	9 (36%)
Midway.	72	42	(58.3 "	5	1 (7.6 "	12	5 (20 "
Late.	60	24	(40 "	4	2 (8.3 "	12	13 (30.8 "
Total,	200	91	(45.5 "	16	4 (9 "	44	27 (28.7 "

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

TABLE XVIII. 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 XIX. 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 XX. 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%)

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 observed 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:

In these experiments 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 of 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 associative process, 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.

None of our generalized totals, it must be added, are proof against the caprice of the individual, who may have his own favorite type of association which resists opposition. So 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.