FROM THE UNIVERSITY OF CALIFORNIA PSY-
CHOLOGICAL LABORATORY.

COMMUNICATED BY G. M. STRATTON.

VII. THE EFFECT OF VERBAL SUGGESTION UPON THE
ESTIMATION OF LINEAR MAGNITUDES.

BY JOSEPH E. BRAND.†

Late Assistant in the California Psychological Laboratory.

The purpose of this investigation was to find how far, and in what direction, the visual estimation of a linear magnitude could be affected by suggestion of certain possible errors in such estimation, the subject knowing that the suggestions were purely arbitrary, *i. e.*, that they had no reference to any foreseen tendency to err in either direction.

The general method of the investigation was to show the subject for a brief time two small objects at a predetermined distance apart, and to let him subsequently place two similar objects so as to include between them an interval which he judged to be equal to that between the first two. The suggestions were introduced by showing to the subject along with the standard interval certain printed mottoes containing the random suggestions of possible errors in the reproduction of the interval; *e. g.*, 'Don't make too long,' 'Make Short,' etc. Then from the results of his reproductions the attempt was made to determine whether or not the suggestion had produced any effect.

Three different forms of apparatus were employed, but as the differences were chiefly mechanical, and the principle of operation identical in all, the description of the second form will suffice.

Two low, dead-black screens were built up on a table. The screen nearer the subject was high enough so that when seated his horizontal line of sight passed just over it. In the farther screen there were just above this line two long horizontal slots,

† Deceased.

the lower one being 2.2 cm. in width, and the upper one 1 cm. in width, having behind them backgrounds of the same blackness as the screens. Through the lower slot and against this background were exposed the printed slips bearing the mottoes, resting on a wooden ledge fastened to the back of the screen just below the edge of the slot. On a similar ledge behind the upper slot were exposed two white pegs .8 cm. in diameter and long enough to have their ends hidden by the screen. These pegs could be moved along the ledge, and hence adjusted for various intervals between them. On the near side of the nearer screen and just below the top, was a ledge on which the subject moved little pegs similar to those just described, and thus reproduced his estimation of the standard interval.

Over the front of the farther screen was made to slide a movable screen having a single horizontal slot through which either of the two slots in the stationary screen could be exposed, but not both together. Thus the subject saw either the motto in the lower slot, or else the standard distance marked off by the two white pegs appearing as rectangles $1 \times .8$ cm. in the upper slot, or else both slots were altogether hidden. The distance from the subject's eye to the nearer screen was 40 cm., and from the nearer screen to the farther was 80 cm.

The mode of operating the apparatus was sufficiently simple. The proper motto being in the lower slot, and the pegs having been properly spaced in the upper, and both slots being hidden by the movable screen, the operator, after due warning to the subject, raised the screen one notch and exposed the motto for two seconds; then raised it a second notch and exposed the standard interval for two seconds; then dropped it one notch and left the motto again exposed. The subject immediately so placed his pegs on the ledge as to mark off his estimate of the space interval, and the operator recorded the length so marked, reading it from a scale hidden from the subject's vision by a narrow strip of black paper projecting above the ledge.

I. FIRST SET OF EXPERIMENTS.

In this first work only two subjects were engaged and a variety of suggestion mottoes were used, viz., '*Make short enough,*

'*Make long enough*,' '*Don't make too long*,' '*Don't make too short*,' '*Make short*,' '*Make long*,' a nonsense motto '*Zwp fjvic bgzx asye*,' and a meaningless sentence '*Life is real where*.' These mottoes were printed in black capitals 1.2 cm. high on white cardboard.

In groups *A*, *B* and *C* four standard lengths for estimation were used, 16, 22, 28 and 34 cm. In group *D* standards of 24, 26, 30 and 32 cm. for subject C. and 12, 14, 18 and 20 cm. for subject Y. Long standards were used for subject C. in this group because from examination of results in the preceding groups it seemed that the long standards would give more definite results; and since standards for this subject were changed, it was thought advisable to change standards for the other subject also. Thus any possible difficulty from too long use of the same standards was obviated. The four standards employed in any group were given in succession with each motto, in an order determined by lot, the order of succession of the mottoes being changed for each day. A 'nonsense motto' was used in order that the tests without suggestion might be under conditions as like as possible to the others, except for the suggestion itself.

Tables I. and II. give in detail the results of this investigation. Instead of finding the average lengths reproduced with different mottoes it was deemed simpler to interpret the data by aggregation. The number tabulated under a given motto for a given day is therefore the sum of all the judgments taken that day for that motto. As remarked above, the series in both tables are arranged in four groups, which differ amongst themselves in regard to the mottoes and standards used, and also in that a month's interval elapsed between the work of group *C* and that of group *D*. For convenience in examining the tables, totals are given under each group for such columns as it is desirable to compare. As all the mottoes are not used on all the days, only such days are included in forming the totals as make the totals in the same horizontal line properly comparable.

An examination of these tables leads to some interesting conclusions. First, we find by comparison of daily totals and general totals, that the suggestion produces a definite, though slight, effect. The results for '*Make short enough*' are in both

TABLE I.

BASED ON 650 JUDGMENTS; SUBJECT, MISS C.

	1	2	3	4	5	6	7	8	9	10	11
	Day of Group.	No of Judgments Each Motto	Standard (Sum)	Nonsense Motto	"Life is Real Where."	"Make Short Enough."	"Don't Make Too Long."	"Make Long Enough."	"Don't Make Too Short."	"Make Short"	"Make Long."
Group A (Eight different standards, 11-30 cm. long, were used in this group).	1 2 3 4 5 6	9 8 10 10 10 15	189 167 202 202 202 320	199 179 221.5 218 — 343.6	— — — — — —	— — 227 224.5 220 —	212.7 — 225 214 221.5 341.5	— 180.7 223.5 220 216 —	— — 224 223 221 342.9	— — — — — —	— — — — — —
Sum of days 3, 4, 5	3	30	606	—	—	671.5	660.5	659.5	668	—	—
3, 4, 5, 6...	4	45	926	—	—	—	1,002	—	1,010.9	—	—
3, 4, 6...	5	35	724	783.1	—	—	780.5	—	789.9	—	—
Group B (Standards, 16, 22, 28, 34 cm.)...	1 2 3 4	11 16 24 24	248 322 588 660	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —	259.2 302.5 584 650.7	258.3 305.2 597.6 680.3
Sum.....		75	1,818	—	—	—	—	—	—	1,796.4	1,841.4
Group C (Standards, 16, 22, 28, 34 cm.)...	1 2 3	8 9 9	200 210 204	216.6 196.2 200.5	205 202.1 198.2	— — —	210.2 196.3 194.3	— — —	211.7 205.4 202.1	— — —	— — —
Sum		26	614	613.3	605.3	—	600.8	—	619.2	—	—
Group D (Standards, 24, 26, 30, 32 cm.)...	1 2 3 4	6 10 7 6	170 276 206 162	— 279.1 209 165.6	— 279.1 211.6 157.3	— — — —	183.2 284.6 221.7 165.2	— — — —	175.3 280.5 213.6 156.2	172 279 203.3 164.5	185.5 279.6 212.5 170
S. of days 1, 2, 3, 4	1	29	814	—	—	—	854.7	—	825.6	818.8	847.6
2, 3, 4...	2	23	644	653.7	648	—	671.5	—	650.3	646.8	662.1
Total, C & D (except day 1).....		49	1,258	1,267	1,253.3	—	1,272.3	—	1,269.5	—	—
Total, A (except days 1, 2) C & D		100	2,354	—	—	—	2,457.5	—	2,455.7	—	—
Total, B & D.....		104	2,632	—	—	—	—	—	—	2,615.2	2,689

cases greater than those for 'Make long enough'; the results for 'Make long' are greater than those for 'Make short' for subject C., and also greater for subject Y. in group D, although less in group B for this subject. Similarly, results for 'Don't make too long' are pretty uniformly greater than those for 'Don't make too short' for subject Y., and also for subject C. in group D, but not for this observer in groups A and C.

TABLE II.

BASED ON 598 JUDGMENTS; SUBJECT, MR. Y.

	1	2	3	4	5	6	7	8	9	10	11
	Day of Group.	No. of Judgments Each Motto.	Standard (Sum).	Nonsense Motto.	"Life is Real Where"	"Make Short Enough."	"Don't Make Too Long."	"Make Long Enough"	"Don't Make Too Short."	"Make Short."	"Make Long."
Group A (Eight standards 11-30 cm. long).	1	9	189	176		—	176.5	179.7	—		
	2	10	202	188		197	188	192.5	190.5		
	3	10	202	186.5		191	190	194.5	186.5		
	4	15	320	297.6		289	293.8	—	289.2		
Sum of days, 2, 3, 4		35	724	672.1		—	671.8	—	666.2		
2, 3...		20	404	374.5		388	378	387	377		
Group B (Standards 16, 22, 28, 34).....	1	21	534							503.3	487.8
	2	22	538							499.9	491
	3	19	514							499.8	500.9
	4	20	524							487.2	488.5
Sum.....		82	2,110							1,990.2	1,968.2
Group C (Standards 16, 22, 28, 34).....	1	11	320	283.9	276.8		285.1		287.8		
	2	11	278	252.5	248.8		258.5		255.6		
	3	9	198	176.5	178.1		175.1		172.2		
Sum.....		31	796	712.9	703.7		718.7		715.6		
Group D (Standards 12, 14, 18, 20).....	1	6	98	94.7	91.7		92		94.3	92.2	92.8
	2	6	90	86.6	86.3		89.8		88.1	85.6	92.4
	3	6	102	94.9	94.3		94.3		91	91.4	95
Sum.....		18	290	276.2	272.3		276.1		273.4	269.2	280.2
Total, C and D....		49	1,086	989.1	976		994.8		989	—	—
Total, A (except day 1) C, D.....		84	1,810	—	—		1,666.6		1,655.2	—	—
Total, B and D....		100	2,400	—	—		—		—	2,259.4	2,248.4

Since group *B* followed group *A* and group *C* followed group *B* without gap, but a month elapsed between groups *C* and *D*, and since the difference in the presumable effects of the same mottoes occurs only between group *D* and the other groups, we must conclude that the uniformity is too great to admit of an explanation except by potency of the suggestion from the mottoes.

Second, this suggestion-effect varies both according to the individual to whom the suggestion is made, and also according to circumstances. The disagreements just referred to as existing between group *D* and the preceding groups is evidence upon the

latter of these points. The data within these groups are reasonably self-consistent, showing that on almost every separate day the same effect was produced, but that during the month's interval the subject had gotten over into a condition such that the difference between the effects produced upon him by two opposing formal suggestions was of opposite sign to what it was earlier.

Third, the mere words 'long' and 'short,' regardless of their content, seem to affect the estimation under certain circumstances. This is illustrated by Table III., which gives the sums for the mottoes containing the word 'short' and the sums for those containing the word 'long' from group *D* of both tables.

TABLE III.

Subject.	No. of Judgments.	Standard.	Mottoes Containing the Word	
			"Long."	"Short."
C.	58	1628	1702.3	1644.4
Y.	36	580	556.3	542.6

From this table it will be seen that the total for mottoes containing the word 'short' is less in both cases than that for mottoes containing the word 'long.' Similar totals from group *A* give exactly opposite results for Table I., and neutral results for Table II. (*i. e.*, in the latter case the totals are about equal).

Now these results, taken as they are merely from the group totals, may either be the result of chance, or they may be due to the existence of a different attitude towards positive and negative suggestions, causing the subject at any given time to incline to act in accordance with one and in opposition to the other; or they may be due to a tendency to be influenced by the mere words 'short' and 'long,' as said above. The likelihood of this latter explanation led to the group of experiments which follow under section 2.

Fourth, a motto which has interest for a subject seems to give greater lengths in the reproduction than an uninteresting one. The nonsense mottoes in group *A* (except for a single day for subject Y.) give smaller totals than do the other mottoes, which in this part of the experiment were not yet so familiar as

to lack interest; while in groups *C* and *D* the motto 'Life is real where,' which the subjects declared was much more empty and uninteresting than the 'nonsense' motto, and hence should be taken as the criterion in these groups, gives smaller totals than the averages for the suggestion mottoes, as show in Table IV.

TABLE IV.

Subject.	Mottoes with content.	Mottoes without content.
	(Average of columns 7 and 9 of groups <i>C</i> <i>D</i> , omitting row 1 of <i>D</i> , Table I.)	(Total of column 5 of same days)
C. (Table I.)	1270.8	1253.3
Y. (Table II.)	991.9	976.0

The indication of this comparison is of course very unsatisfactory, but seems at least to warrant a special investigation on this point.

2. SECOND SET OF EXPERIMENTS.

The apparent effect of the mere words 'long' and 'short' in the first set of experiments led to the second set, in which the mottoes used were only three in number, viz.: 'long,' 'short,' and 'XXXX.' The apparatus differed from that described above only in the substitution, for the pegs, of white paper squares on a black screen, one square of the pair being on a strip of black paper running in grooves behind a slot in the screen, so that the adjustments, *i. e.*, the various distances of separation of the squares, were obtained by simply sliding the strip along. Three standard distances were used, viz.: 17, 18 and 19 cm., being given in such order that each was preceded by each of the others about an equal number of times, and each of the three used an equal number of times on the same day. Each of the mottoes was given an equal number of times with each of the standards, in order determined by lot. The letters of the mottoes were so spaced as to cover the same extent in every case and so exclude the possibility of a difference due to mere space contrast or assimilation.

Four subjects were employed, and the results were not very uniform, two of the subjects showing no decided tendency towards anything resembling a constant effect, while the other

two subjects, showed a clear general constancy of considerable difference throughout. The results for these two are given in Tables V. and VI.

TABLE V.
SUBJECT K.

Date.	Standard.	Times Used.	Sum for Standard.	Sum for "Long."	Sum for "Short."	Sum for "XXXX."
Sept. 18.	17	3	51	47.8	48.4	48.3
	18	3	54	53.6	52.4	53.9
	19	3	57	54.8	56.2	58.0
			162	156.2	157.0	160.2
Sept. 24.	17	5	85	79.9	79.2	81.5
	18	5	90	84.4	84.3	85.1
	19	5	95	93.5	95.5	94.3
			270	257.8	259.0	260.9
Sept. 25.	17	6	102	94.6	98.6	98.3
	18	6	108	104.9	104.4	103.0
	19	6	114	107.5	113.6	111.7
			324	307.0	316.6	313.0
Sept. 26.	17	6	102	92.7	96.8	95.1
	18	6	108	106.6	107.2	105.0
	19	6	114	110.4	112.1	112.9
			324	309.7	316.1	313.0
Oct. 2.	17	6	102	94.1	95.5	92.7
	18	6	108	101.8	104.5	103.8
	19	6	114	111.4	114.8	113.7
			324	307.3	314.8	310.2
Oct. 4.	17	4	68	58.1	62.3	60.6
	18	4	72	67.2	65.7	68.6
	19	4	76	72.7	73.4	73.2
			216	198.0	201.4	202.4
Grand Total.		90	1620	1536.0	1564.9	1559.7

By examining Tables V. and VI. it will be seen that for Subject K. the figures for the motto 'short' are with two exceptions greater than the figures for the motto 'long,' and for subject M. the reverse is true, again with two exceptions. In the daily totals, however, there are no exceptions. In spite of the fact that the other two subjects gave neutral results, the hypothesis that the words 'long' and 'short' of themselves are capable of influencing the estimation of distances seems well

TABLE VI.

SUBJECT M.

Date.	Standard.	Times Used.	Sum for Standard.	Sum for "Long"	Sum for "Short."	Sum for "XXXX."
Sept. 5.	18	6	108	108.3	103.2	108.8
	19	6	114	123.2	117.0	116.8
			222	231.5	220.2	225.6
Sept. 6.	17	7	119	118.2	113.0	118.5
	18	5	90	92.8	91.3	86.1
			209	211.0	204.3	204.6
Sept. 11.	18	8	144	144.6	140.5	141.7
	19	6	114	116.0	117.8	112.1
			258	260.6	258.3	253.8
Sept. 13.	17	8	136	139.8	134.6	137.8
	18	8	144	148.3	145.5	146.6
			280	288.1	280.1	284.4
Oct. 7.	17	7	119	117.3	116.0	119.0
	19	7	133	130.2	134.3	134.7
			252	247.5	250.3	253.7
Oct. 11.	17	7	119	121.0	115.0	117.4
	19	7	133	136.7	132.5	138.0
			252	257.7	247.5	255.4
Oct. 14.	17	1	17	17.1	16.0	17.0
	18	3	54	50.3	48.9	52.9
	19	4	76	76.2	72.7	75.1
			147	143.6	137.6	145.0
Grand Total.		90	1620	1640.0	1598.3	1622.5

grounded, for in view of the discussion of the first group of experiments we might expect that the suggestion effect would be contrary in certain different subjects, and lacking in others. Thus the influence of purely formal and arbitrary suggestion seems even more clearly evidenced by this second group of experiments than by the first.