Number averaging behavior: A primacy effect

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In two experiments, Ss guessed averages of serially presented numbers. Guesses were made only at the end of a stimulus sequence. The results of both experiments showed strong primacy effects in the guesses; earlier information in the stimulus sequence was weighted more heavily than later information. The results for number averaging were comparable to results obtained for personality traits in previous research, suggesting that both tasks represent a more general problem of integration of serial information.

Since Asch's (1946) classic work on impression formation, several experiments have found a primacy effect when Ss are asked to evaluate a person described by serially presented trait adjectives (e.g., Anderson, 1965). In a typical experiment, the E reads several sets of six or eight adjectives to a S and obtains a numerical evaluation after each set. A more favorable evaluation is usually obtained when the adjectives are presented in a desirable-undesirable sequence than when presented in the reverse sequence.

The primacy effect has also been obtained with other classes of verbal stimuli, including food words (Anderson & Norman, 1964). Such results suggest that the personality impression task should be considered as an instance of the integration of serial information (Anderson, 1968a), rather than the study of personality impression formation per se. This broader conception directs attention toward the process of serial information processing and its determinants.

The research to date indicates that the primacy effect is obtained only under a special set of experimental conditions. Hendrick & Costantini (in press) concluded that a primacy effect may be generally expected only when one final evaluative response (called the "final mode" of response) is given to the stimulus set after it is presented. When other response requirements are imposed, either no effect or a recency effect is obtained. When evaluative responding was required after each trait word (Stewart, 1965), when recall of the stimuli was required (Anderson & Hubert, 1963), or when pronunciation of the stimuli by the Ss was required (Anderson, 1968b; Hendrick & Costantini, in press), recency effects were obtained.

All the studies discussed above, except Anderson & Norman (1964), used trait adjectives as stimuli. Anderson (1964) introduced a number-averaging task that modeled the trait impression paradigm. Two-digit numbers were read to Ss in serial order. Ss were required to guess the average of the numbers to that point as each number was presented. This "continuous mode" of response was analogous to the continuous mode used by Stewart (1965) to obtain evaluation ratings after each trait was presented. Anderson (1964) obtained a strong recency effect for the number stimuli with this mode of response, as did Stewart (1965) with the trait stimuli.

In the context of information integration, numbers have a distinct advantage as stimuli. In a sense, numbers have their own "built-in" scale values. This attribute offers the possibility that multivariate or analysis of variance methods may be used to determine conveniently weights for serial positions of stimulus sequences. Determination of weights will eventually become important to help choose between competing models of information integration.

The two experiments that are reported had more limited objectives. The first objective was to determine if a primacy effect would be obtained with a number-averaging task when a final mode of responding at the end of the sequence was used. Since primacy effects have always been obtained with trait stimuli when the final mode is used, a primacy effect was predicted for the number stimuli also. The second objective was to determine what effect, if any, variation in number size within stimulus sets had on the magnitude of the primacy (or recency) effect.

EXPERIMENT 1

The stimuli consisted of six sets of numbers shown in the top panel of Table 1. Each set consisted of three high (H) numbers between 100 and 200, and three low (L) numbers between 5 and 50. The numbers were not selected entirely at random, because a requirement was imposed that all six sets have the same mean in order to ensure relatively similar sets. By random choice, a sum of 575 for the six numbers was selected, yielding a mean of 95.8. Given this requirement, the numbers were selected at random insofar as was possible. Each stimulus set was presented in both an HL and an LH order. In addition, there were eight filler sets consisting of H and L numbers mixed in random order. The filler sets prevented Ss from developing an expectancy that the numbers would always be presented in an orderly HL or LH sequence.

The Ss were 10 males and 7 females from a section of introductory psychology. The data were collected from each S individually. The experiment was presented to the Ss as a study in human information processing. Their job was to listen to the E read off sets of six numbers and to form an impression of the "psychological average." It was stressed that accuracy was not important—the impression of what the average might be was the desired response.

The E read the numbers at a steady rate of one number every 2 sec. The S was required to respond within 5 sec after the E read the sixth number. Each set of numbers was printed on a separate card. The deck of cards, including both filler and experimental sets, was shuffled randomly for each S, except that an HL and LH

Table 1
Number Sets, Guessed Means, and Primacy-Recency in the Two Experiments

Experiment 1

Sets	Stimuli H1	H2	H3	L1	L2	L3	Guessed Means HL	LH	Diff.
A	151	128	198	35	46	17	104.7	90.7	+14.0
B	183	169	175	20	18	10	101.2	80.6	+20.6
C	189	146	125	26	40	49	95.0	73.6	+21.4
D	146	161	154	36	32	46	93.8	90.8	+3.0
E	163	188	199	07	13	05	108.9	89.3	+19.6
F	191	159	153	17	46	09	106.6	85.5	+21.1
						Mean	101.7	85.1	+16.6

Experiment 2

Sets	High Discrepancy HL	LH	Diff.	Low Discrepancy HL	LH	Diff.
A	97.2	88.8	+8.4	95.9	86.2	+9.7
B	102.9	89.8	+13.1	92.5	81.8	+10.7
D	90.5	82.7	+7.8	91.9	88.3	+3.6
E	105.4	85.4	+20.0	93.5	88.1	+5.4
F	105.7	84.9	+20.8	94.3	82.7	+11.6
	100.3	86.3	+14.0	93.6	85.4	+8.2

order of a given set could not follow each other consecutively.

EXPERIMENT 2

The general procedures were the same as in Experiment 1. The main difference was in the stimulus sets. The size of the numbers used to construct sets was systematically varied. The main concern was whether the difference between the sum (or average) of the three H numbers and the three L numbers in a set might affect the magnitude or even the direction of the order effect. In order to vary size of the numbers, two types of number sets were constructed. One type contained numbers with a relatively large difference between the average of the H and L numbers (high discrepancy sets). The other type contained numbers with a smaller difference between H and L numbers (low discrepancy sets). Five of the six sets used in Experiment 1 were selected as high discrepancy sets. The difference between the $H_1H_2H_3$ average and the $L_1L_2L_3$ average for Sets A, B, C, D, E, and F, respectively, was 126, 160, 115, 116, 175, and 144. Since the discrepancy scores for Sets C and D were almost identical, Set C was randomly discarded, leaving five high discrepancy sets. Low discrepancy sets were created by subtracting 40 from each of the H numbers in the five sets and by adding 40 to each of the L numbers. In this way, discrepancy between H and L numbers was established without varying the actual mean.

Since there were five sets in each discrepancy condition, and each set was presented in both HL and LH orders, there were 20 experimental sets altogether. In addition, there were 10 filler sets. The instructions and procedures were identical to those of the first experiment. Twelve males and four females from an introductory psychology class participated as Ss.

RESULTS

Experiment 1

The guessed means for the HL and LH orders of presentation as well as the mean difference are shown in the last three columns of the top panel of Table 1 for each of the six experimental sets. The net difference score was positive for each set, indicating primacy effects. The overall mean difference score of +16.6 was tested against a hypothesized mean of zero. The mean was significantly greater than zero ($F = 23.32$, $df = 1/16$, $p < .001$). Thus the primacy prediction was strongly confirmed. The overall guessed mean for the HL order of presentation was 101.7, which overshot the true mean of 95.8 by 5.9 points. The guessed mean of 85.1 for the LH order undershot the true mean by 10.7 points.

Experiment 2

The guessed means for HL and LH orders of presentation and the mean differences are shown in the lower panel of Table 1. Since the high discrepancy sets were the same as five of the six sets used in Experiment 1, the means are relevant to the question of replicability. The HL mean of 100.3 and the LH mean of 86.3 were very similar to the comparable means obtained in Experiment 1. All five sets showed a primacy effect. The mean overall primacy of +14.0 was significantly greater than zero ($F = 14.91$, $df = 1/15$, $p < .01$).

There were several points of interest concerning the low discrepancy sets. First, a primacy effect was obtained for each set. The overall mean primacy of +8.2 was significantly greater than zero ($F = 18.29$, $df = 1/15$, $p < .01$). The LH guessed mean of 85.4 was comparable to the LH mean of 86.3 for the high discrepancy sets. However, the HL mean of 93.6 was less than the HL high discrepancy mean. In fact, this guessed mean slightly undershot the true mean. The reason for this latter result is unclear but may simply be sampling bias since the LH mean was virtually the same as the other LH means.

The final point of interest was whether or not the mean primacy of +8.2 for the low discrepancy sets was significantly smaller than the mean of +14.0 for the high discrepancy sets. A repeated measures analysis of variance was performed on the data. The results indicated the two means did not differ significantly from each other ($F = 2.01$, $df = 1/15$, $p > .05$). The difference between the two set types in the magnitude of the primacy effect was in the direction that might be anticipated. However, the lack of significance requires caution in interpretation.

DISCUSSION

The results of both experiments strongly supported the prediction of a primacy effect with a final mode of responding. As anticipated, the primacy effect was comparable to that obtained with sets of personality traits when a final mode of response has been used (e.g., Hendrick & Costantini, in press). When either numbers or traits are used as stimuli, Ss tend to overweight the earlier information in the sequence.

The present results contrast rather clearly with the recency effect obtained by Anderson (1964) with a continuous mode of number-averaging. Since recency effects were also obtained with traits when a continuous mode of response was used (Stewart, 1965), the results of the present experiments with numbers provide generality across classes of verbal stimuli. At the same time, the results indicate the importance of response requirements in determination of order effects. Since the order effects are relatively independent of type of verbal stimuli, but very sensitive to response mode, the personality impression paradigm is perhaps best considered as just one type of serial information integration, as Anderson (1968a) suggested. The generality across verbal stimuli suggests the possibility that one general descriptive model may eventually be able to account for serial integration of information, including trait information as a special case. Since response requirements is such a potent variable, future work might focus on precisely how various response requirements affect the attentional and combinatorial operations involved in the processing of serial information.

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