Connotative classification and proactive interference in short-term memory¹

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Each of 360 Ss received four successive short-term memory tests with connotatively defined word triads. All Ss in all conditions were presented on Test 4 with a word triad classified as evaluative negative on the semantic differential. The connotative classification of the triads on Tests 1-3 differed across conditions. A release from proactive interference was observed on Test 4 for both within-dimension and between-dimension shifts in connotation for both a 5-sec retention interval test series and a 20-sec retention interval test series. Proactive interference was not prevented, however, by changing the connotative classification of the triads on each of the successive short-term memory tests. The results also suggested that a release from proactive interference could be obtained with a change in polarity independent of connotative dimension changes.

Several experiments (e.g., Keppel & Underwood, 1962; Loess, 1964) have shown that recall performance declines across successive short-term memory (STM) tests of the Peterson & Peterson (1959) variety, suggesting that proactive interference (PI) operates in STM. A study by Wickens, Born, & Allen (1963) indicated that PI in STM is relatively class specific. Wickens et al observed that shifting to digits, for example, after a series of STM tests with consonants, produced an apparent "release from PI" in that the digit target item was recalled at approximately the same level as the first item of the series. As Wickens (1968) has indicated, the Wickens, Born, and Allen procedure of shifting classes in a STM test series provides a possible means for probing organizational properties of STM. If recall declines across successive STM tests and then a significant improvement occurs on the shift-in-class test, over a control condition in which the same class of items has been presented throughout the STM test series, it can be assumed, argues Wickens (1968), that there is a common way of encoding within a class (which would account for the decline in recall) which differs between the two classes (which would account for the increase in recall on the shift test).

Recent experiments (Turvey, 1968;

Wickens & Clark, 1968) have demonstrated that a release from PI occurs with a shift in connotation as defined by the semantic differential (Osgood, Suci, & Tannenbaum, 1957). The semantic differential defines the connotative meaning of a word by the word's location in a semantic space which has three orthogonal axes. The three axes are evaluative, activity, and potency and each axis has a positive and negative pole.

The present experiment was conducted as a further examination of the relation between the dimensions of the semantic differential and interference in STM. First, the experiment was designed to compare intra- and extradimensional shifts. For this purpose a sample of the total number of comparisons that could be made was used. Second, the experiment was designed to assess whether the degree of PI release obtained with connotative change was dependent upon the retention interval of the STM test series. Previous experiments with the PI release procedure and connotatively defined words have used relatively long retention intervals of 15 sec and 20 sec. In the present experiment two retention intervals of 5 sec and 20 sec were used. Third, the present experiment was conducted to examine the effect of changing connotative class on each test of the STM test series. Although Loess (1967) observed that changing taxonomic class on each test of a STM test series prohibited the build-up of PI, Turvey (1968) failed to find a similar effect with successive changes of connotative class. This latter observation, if valid, suggests an important difference between taxonomic and connotative classification in STM.

SUBJECTS

The Ss were 360 undergraduates at the University of Connecticut who participated in the experiment as part of a course requirement in introductory psychology. Ss were allocated to 1 of 10 groups by order of appearance at the laboratory with 36 Ss per group.

MATERIALS

Words were selected from a list of 1,000 common English words rated on each of the three dimensions of the semantic differential (Heisse, 1965). Twelve words rated as evaluative negative (E-) were chosen to construct four E- triads. Nine words rated as evaluative positive (E+), nine words rated as potency positive (P+), and nine words rated as activity positive (A+) were selected

to construct three E+ triads, three P+ triads, and three A+ triads, respectively. In selecting the words care was taken to insure that the words chosen to represent a particular polarity on a particular dimension rated as close to zero or neutral as possible on the other two dimensions. None of the P+, A+ words carried an E- rating.

DESIGN

The experimental design was one which assessed the recall of a common set of items as a function of five different STM histories. A STM history was defined as the connotative class of words presented on Tests 1-3 of four successive STM tests. On Test 4 all Ss in all conditions were presented with one of four possible word triads classified as E-. Of the five STM histories four were homogeneous and one was heterogeneous. In the four homogeneous histories the triads on Tests 1-3 were either E-, E+, P+, or A+. The heterogeneous STM history, designated as Condition H, was composed of a E+ triad, a A+ triad, and a P+ triad. The E- homogeneous history provided the control condition.

The retention interval for each of the four successive STM tests was either 5 sec or 20 sec. There were, therefore, 10 groups differing as to the type of STM history and the STM test retention interval. These groups were designated as 5E-, 20E-, 5E+, 20E+, 5A+, 20A+, 5P+, 20P+, 5H, and 20H. In the two control groups, 5E- and 20E-, the four E- triads were partly counterbalanced so that each triad appeared an equal number of times at each of the four test positions. In the eight experimental groups the triads comprising the STM history were counterbalanced across Tests 1-3 so that each triad appeared an equal number of times in each test position. The particular E- triad presented on Test 4 to a control S receiving a particular order of the E- triads was the E- triad presented on Test 4 to the corresponding experimental S in each of the experimental groups. Thus, each of the E- triads was presented an equal number of times on Test 4 in each of the experimental and control conditions.

PROCEDURE

Each S received four successive STM tests. A test was comprised of the following events presented as a sequence of slides delivered by a Kodak Carousel projector and controlled by a tape-timer. First, a ready signal of 2 sec duration; second, a triad of words of 2 sec duration read aloud once by S; third, a three-digit number, present throughout the retention interval of either 5 sec or 20 sec, from which S counted backwards aloud by threes to the beat of a metronome set at 72 beats per minute; fourth, a recall cue of 10 sec duration which cued S to recall the word triad. On termination of the recall cue the ready signal

Table 1
Proportion of Words Correctly Recalled as a Function of Tests for the 5-sec Retention Interval Conditions

Conditions	STM Test			
	1	2	3	4
E-	.87	.65	.66	.61
E+	.87	.70	.59	.72
A+	.87	.69	.51	.72
P+	.86	.72	.50	.75
H	.87	.65	.53	.70

Table 2
Proportion of Words Correctly Recalled as a Function of Tests for the 20-sec Retention Interval Conditions

Conditions	STM Test			
	1	2	3	4
E-	.89	.65	.52	.55
E+	.87	.75	.47	.67
A+	.82	.51	.46	.74
P+	.84	.71	.50	.70
H	.86	.60	.47	.70

for the next test appeared. S's recall and performance on the interpolated activity were recalled by E. Preexperimental instructions were the same for all Ss. Ss were instructed to perform as efficiently as possible on both the retention task and the interpolated activity.

RESULTS AND DISCUSSION

Tables 1 and 2 represent the proportion of words recalled across tests for the 5-sec retention interval conditions and the 20-sec retention interval conditions, respectively. The Test 4 recall data were analyzed by means of a 5 (STM history) by 2 (retention interval) analysis of variance. The analysis revealed that the effect of STM history, i.e., the connotative class of prior-items, was significant [$F(4,350) = 2.7, p < .05$]. The main effect of retention interval and the Retention Interval by STM History interaction were, however, insignificant with $F < 1$ in both cases.

Inspection of Tables 1 and 2 indicates that PI developed across Tests 1-3 in all conditions, and that release from PI occurred on Test 4 for all conditions but the control conditions. A comparison of the E+ conditions at Test 4 for both retention intervals with the A+ and P+ conditions at Test 4 for both retention intervals indicates that the effect of the within-dimension shift and the effects of the between-dimension shifts were equivalent. That these varieties of connotative change produced a release from PI is congruent with previous

experiments by Turvey (1968), Wickens & Clark (1968), and Simpson (1967). The present experiment complements previous findings by indicating that the effect of connotative change in a STM series can be obtained with a short retention interval as well as with a long retention interval.

The recall data for the H condition across Tests 1-3 for both retention intervals corroborates Turvey's (1968) observation that PI does develop across connotative classes. It is paradoxical that PI release occurs if a new connotative class is presented after a series of tests with words from a particular connotative class yet PI develops across tests where a different connotative class is employed on each test. This paradox questions the validity of an interference theory of PI release with shift in connotation (cf. Turvey, 1968). That PI did develop across connotative classes on Tests 1-3 of the H condition in the present experiment could have been due to an inadequacy in the words chosen to represent the dimensions of the semantic differential. However, the words chosen were those words available in the population of words measured by Heisse (1965) which most closely met the criteria of rating high on one dimension and rating neutral on the other dimensions. Furthermore, criticism of the inadequacy of the connotatively defined words would have to explain why PI release did occur in the other conditions. It would seem, therefore, that connotative difference between words in a STM test series can only operate as a means of facilitating recall in a novelty context. The term "novel" is applicable to a new class of words appearing after a number of STM tests with words of the same class but is not immediately applicable to the case where a new class of words is presented on each test of the STM test series. It is notable, for example, that in a STM test series a P+ triad on Test 2 subsequent to a E+ triad on Test 1 does not prohibit PI (as in the present experiment, and Turvey, 1968) whereas a P+ triad presented on a later test after a series of E+ triads would result in PI release (Simpson, 1967). The possibility that PI release with change in connotation operates via a novelty-arousal mechanism has been proposed by Turvey (1968).

The question remains, however, as to why PI release should have occurred on Test 4 of the H condition. The notion that connotative differences operate in a novelty context

suggests that in some way the STM history of Condition H must have been homogeneous and that in some way the homogeneous STM history of Condition H must have been different from the E- triads presented on Test 4. The homogeneity of the H condition STM history might have arisen from the fact that all the words in this particular history were drawn from the positive pole of their respective dimensions. The Test 4 triads, on the other hand, were comprised of words selected from the negative pole of their dimension. The possibility that this polarity difference may have produced the release from PI in the H condition, independently of the dimensional differences, is now being explored.

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NOTE

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