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PRE-EXISTING ASSOCIATION BETWEEN WORDS WAS HYPOTHESIZED TO BE A VARIABLE INFLUENCING CHOICE OF WORDS DURING THE PROCESS OF SENTENCE CONSTRUCTION. IN THE FIRST EXPERIMENT, 32 SS (SUBJECTS) ENGAGED IN A PACED-RECALL TASK. MATERIALS WERE SETS OF THREE SENTENCES WHICH VARIED ONLY IN TWO NON-ASSOCIATED EMBEDDED ADJECTIVES WHICH COULD BE INTERCHANGED WITHOUT GROSS DISTORTION OF ORIGINAL SENTENCE MEANING. WORD-ASSOCIATES OCCURRED AS INTRUSION ERRORS RELIABLE MORE OFTEN THAN DID NON-ASSOCIATES, INDICATING THAT INTRAVERBAL ASSOCIATIONS PLAY A ROLE IN THE LEXICAL SELECTION PROCESS IN SENTENCE RECALL. THE SECOND EXPERIMENT REQUIRED THE DELIBERATE COMPOSITION OF SENTENCES, GIVEN ALTERNATIVE WORDS FOR EACH OF TWO SLOTS IN A SENTENCE FRAME. BOOKLETS CONTAINING SENTENCE FRAMES AND ADJECTIVE-ALTERNATIVES ADAPTED FROM EXPERIMENT 1 MATERIALS WERE COMPLETED BY 72 SS. WORD-ASSOCIATES WERE PUT INTO THE SAME SENTENCE RELIABLY MORE OFTEN THAN WERE NON-ASSOCIATES. SENTENCES EMBEDDING WORD-ASSOCIATES WERE RATED MORE FLUENT THAN SENTENCES EMBEDDING NON-ASSOCIATES. IT WAS CONCLUDED THAT INTRAVERBAL ASSOCIATION IS A VARIABLE INFLUENCING THE SELECTION OF WORDS IN SENTENCE PRODUCTION. THIS REPORT APPEARS IN "STUDIES IN LANGUAGE AND LANGUAGE BEHAVIOR, PROGRESS REPORT V," SEPTEMBER 1, 1967. (AUTHOR/AMM)

Intraverbal Associations in Sentence Behavior[1]

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Pre-existing association between words was hypothesized to be a variable influencing choice of words during the process of sentence construction. In the first experiment, 32 Ss engaged in a paced-recall task. Materials were sets of 3 sentences which varied only in 2 non-associated embedded adjectives which could be interchanged without gross distortion of original sentence meaning. Each second adjective was a low-frequency word-associate to a first adjective embedded in one of the 2 remaining sentences of the triad. Second adjectives were omitted during the recall trial. Word-associates occurred as intrusion errors reliably more often than did non-associates, indicating that intraverbal associations play a role in the lexical selection process in sentence recall. The second experiment required the deliberate composition of sentences, given alternative words for each of 2 slots in a sentence frame. Booklets containing sentence frames and adjective-alternatives adapted from Experiment 1 materials were completed by 72 Ss. Word-associates were put into the same sentence reliably more often than were non-associates. Sentences embedding word-associates were rated more fluent than sentences embedding non-associates. It was concluded that intraverbal association is a variable influencing the selection of words in sentence production.

Carroll (1958) suggests that linguistic structures, such as sentences, precondition the pieces that can be fitted into them. That "pieces" are selected to fit into grammatically structured slots is supported by Maclay and Osgood's (1959) report that speakers pause both at the beginning of a phrase, indicating a syntactic selection process, and also before saying the final content word in the phrase, indicating a lexical selection process. The hypothesis tested in the present study was that the response probability of a given lexical item in a sentence will be increased if a prior association obtains between that item and another item used in the construction.

The relevance of previously established word associations in selection of words for use in a sentence is evidenced in a series of Minnesota studies described by Jenkins and Palermo (1964) in which phrase stems such as "table and _____", and sequential fragments such as "the table is _____", tended to elicit word associates, although at different levels of associative frequency.

Substitution of associates for words deleted from sentences has been reported by Saporta (1959). Deese (1959) has found the probability a word will occur as an intrusion in free recall is directly proportional to its association strength to other words on the list. Koen (1965) has demonstrated selection and recovery of specified alternative words in sentence context, given the additional context of word associates unique to one word or the other. Koen's experiment demonstrated a convergent effect of intraverbal associations on item selection, where the associates were initially obtained in response to the experimental word in the context of its sentence. Rosenberg (1966) has found that occurrence of specific content words in recall of connected discourse is a function of pre-experimental associative habits. Skinner (1957) discusses intraverbal response elicitation, but suggests this phenomenon is not ordinarily traceable to a single item in the preceding complex stimulus pattern, but rather it is dependent on the entire set of stimuli arranged in the sentence. It seems necessary, however, that if several stimuli combine to elicit a single response, then the contributing stimuli, taken separately, would tend to evoke that same response, albeit at lower strength. The present study was designed to show word selection to be dependent on a single word in the embedding sentence. It was predicted that one item rather than another would be chosen to complete a sentence if it is elicited as a word associate to another previously selected item in the communication.

In the first experiment, a paced-recall task was used in order to approach the speed of free sentence generation. The second experiment required the deliberate composition of sentences, given alternative words for each of two slots in the sentence frame.

Method

Experiment I

Materials. Two sets of 12 pairs of adjectives, shown in table 1,

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Insert Table 1 about here

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were selected from the Palermo and Jenkins (1963) word association norms. The second member of each pair is a low frequency associate (college norms) which is elicited by no other first member of any pair within either set of 12 at any age level.

Pairs were grouped in triplets such that the second members could be used interchangeably in a sentence frame without causing a drastic change in the semantic meaning of the sentence. The three interchangeable adjectives comprised the lexical pool available for use in the sentence provided. Within a triplet of adjective pairs, members were re-paired such that the second adjective was not a normative associate of the first adjective. Both of the possible re-pairings were used, but in separate lists. Re-paired adjectives (presented within a list) were termed Training pairs (T). The sentence frames used to embed T adjectives are given in Table 2.

Insert Table 2 about here

Materials were prepared in primary-size type for presentation on a memory drum. Three sentences, identical except for adjectives, were typed consecutively in random order, followed by a row of five digits selected from a table of random numbers. The row of digits reappeared immediately, with one digit replaced by a blank. Then the three sentences reappeared consecutively, in random order, with the second adjective replaced by a blank. An empty space separated each triad of sentences. Four sentence triads were repeated in two different random orders in one list. There were two sets of materials (M1 and M2), and two lists of the alternative adjective pairings were prepared for each set.

Subjects. The Ss were 32 paid volunteer undergraduates of the University of Michigan. All Ss were native speakers of English.

Procedure. The Ss were assigned randomly in order of appearance in the laboratory to one of the two sets of materials, M1 or M2, and to one of two lists within the set. Starting order for each list was counterbalanced. Materials were presented at a 2.5 sec. rate through the double-width aperture of a Stowe memory drum. The S read aloud each of the three sentences, the row of digits, the row of digits including the presently omitted number, and each of the three sentences (re-ordered) including the presently omitted second adjective. A 2.5 sec. pause separated different groups of sentences. All Ss were run for eight trials. Study-recall of four triads comprised a trial. The Ss were encouraged to guess when they were not sure of a missing word or digit.

Experiment II

Materials. Six sets of 8-page booklets were prepared with one of the sentence frames shown in Table 2 appearing per page. The sentence frame, with two adjectives omitted, was typed twice on a page. Two adjectives were typed above the sentences in line with the first omission, and two adjectives in line with the second omission. Adjectives were two of the three adjective pairs in the sentence frames in Table 2. Each adjective and its word associate occurred once with each of the other two adjective pairs, making three different sets of booklets, all with identical sentence frames. For example, typed above the frame A _____ look accompanied the _____ reply, were cold and hard (with freezing and brittle) in one set of booklets, cold and long (with freezing and distant) in another, and hard and long (with brittle and distant) in another. Assignment of adjective combinations to booklets was random. Order of listing the first two adjectives was randomly determined. Alignment of the second adjective with its associate or non-associate was counter-balanced. Three additional sets of booklets were made by reversing the alignment of the second adjective. At the bottom of each page were two 5-inch rating scales labeled Sentence 1 and Sentence 2. Phrases, evenly spaced above the scales, were very awkward, slightly awkward, fairly smooth, and very smooth. Within each of the six sets of booklets, order of pages was randomized. The same set of instructions was used as the cover page for all booklets. Instructions included sample materials.

Subjects. The Ss were an undergraduate history class of 44 students and an undergraduate government class of 39 students, of the University of Michigan. Data from 11 Ss were discarded for failure to follow instructions. An S failed to follow instructions if he put a first insert word into the second insert position, or vice versa, and/or if he rated the sentences by writing comments rather than by using a check or other measurable mark. To obtain proportional n's, the total n for the first analysis was reduced to 60 by random discard within classroom and booklet groups. Because ratings on both kinds of sentences by each S were needed for the ratings analysis, rating data from those Ss who constructed only one kind of sentence were discarded, leaving n = 63 for the second analysis.

Procedure. Booklets were randomly stacked and distributed to Ss in the classrooms. The Ss were instructed to construct the two best-possible sentences with the materials provided, using each word only once and in its appropriate slot. After he had completed all the sentences, the S rated each sentence for fluency. The Ss worked independently.

Results and Discussion

In the paced-recall experiment, only the incorrect responses which were intrusions from within the triad were of interest. If adjectives were paired incorrectly within a triad, there were only two alternatives, viz; a pre-experimentally associated pair (PreX), or an unassociated control pair (C). Chance combinations attributable to guessing were equally distributed among the three possible kinds of pairs: T, PreX, and C. The dependent variable was a difference score: PreX - C. The mean difference score over 8 trials, 6.8, was significantly greater than zero, F (1,30) = 33.18, $p < .01$, indicating recall errors were biased in favor of word-associates. Response biases peculiar to materials were amenable to test because two sets of materials were used. Which set of materials the Ss responded to seemed to make little difference; the F for materials was < 1. The results of the first experiment may be interpreted as evidence that, if Ss fail to recall a sentence verbatim, they will be more likely to use, in their paraphrase, an appropriate word which is associated with another word in the sentence rather than one which is not.

In the second experiment, the dependent variable for sentence construction was the number of sentence pairs completed by using word associates. Had the adjectives been inserted at random into the sentence frames, half, or four, of the sentence frame pairs would have been completed with PreX words, and the other half with C words. The mean number of sentence pairs actually completed by PreX combinations was 5.7, and this was reliably more than chance number of such combinations, F (1,48) = 88.82, $p < .01$. That is, word associates were used in the same sentence significantly more often than were non-associates. Differences in sentence construction between classes, between booklets, and in the classes x booklets interaction were not significant; in each case, $F < 1$.

Each S rated for fluency the 16 sentences he had completed. A two-factor mixed-design analysis of variance was used (Lindquist, 1953). Fluency ratings were significantly higher for the PreX sentences that the Ss had completed than for the C sentences they had completed, F (1,61) = 7.05, $p < .05$. The mean fluency rating, on a 5-point scale, for PreX sentences was 3.30. The mean fluency rating for C sentences was 3.02. The F for classes was significant, F (1,61) = 5.72, $p < .05$, indicating that the Ss from one class tended to give higher ratings over-all than did the Ss from the other class ($\bar{X}$'s = 3.37 and 2.29). The interaction between classes and PreX vs C ratings was not significant ($F < 1$).

In summary, three cases of intraverbal associations in sentence behavior were demonstrated: (a) when Ss reconstructed sentences in a restricted paraphrase in a paced recall task, they were more likely to use word-associates than non-associates: (b) when Ss deliberately chose a word to complete a sentence, they chose a word-associate more frequently than a non-associate: (c) those sentences embedding word-associates were rated as being more fluent than those sentences embedding non-associates. It may be concluded that intraverbal association is one of the variables involved in the selection of words in sentence production.

Footnote

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Table 1

Low Frequency Word Associates Unique to a Single Stimulus Item

Materials 1			Materials 2		
stimulus	associate	frequency (college norms)	stimulus	associate	frequency (college norms)
blue	moody	1,1	quiet	calm	1, 4
dark	gloomy	0,1	smooth	even	3, 6
light	dim	0,1	hungry	satisfied	3, 0
cold	freezing	2,0	square	odd	2, 0
hard	brittle	2,1	loud	shrill	3, 1
long	distant	1,0	running	wild	6,10
soft	fuzzy	1,2	rough	ready	7, 9
sweet	sticky	2,0	salty	crisp	1, 0
thirsty	wet	4,1	slow	quick	2, 4
high	mighty	1,2	deep	shallow	98,73
heavy	iron	4,4	sour	spoiled	0, 1
short	stout	2,3	beautiful	homely	2, 4

Table 2

Sentence Frames Accommodating Adjective Pairs
with Second Members Interchangeable

Set	Sentence
M-1	A hard (cold / long) face accompanied the brittle (freezing / distant) reply.
M-1	The sweet (soft / thirsty) kitten chewed the sticky (fuzzy / wet) rag.
M-1	A heavy (high / short) officer praised our iron (mighty / stout) defense.
M-1	His dark (blue / light) poetry cut the gloomy (moody / dim) atmosphere.
M-2	Usually, loud (square / running) kids have shrill (odd / wild) parents.
M-2	The salty (rough / slow) skipper gives crisp (ready / quick) commands.
M-2	He writes sour (deep / beautiful) stories about spoiled (shallow / homely) women.
M-2	He has a smooth (quiet / hungry) look and an even (a calm / a satisfied) smile.