

# The fate of to-be-forgotten sentences in semantic positive forgetting

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Semantic positive forgetting refers to making to-be-remembered (TBR) vs. to-be-forgotten (TBF) judgments for sequentially presented sentences on the basis of the semantic content of the sentences. Geiselman (1975) has shown that a logical order of presentation for the TBF as well as for the TBR sentences facilitates TBR-sentence recall. The results of the present experiment show that the TBF sentences are also recalled better if presented in a logical order. This paradox of better recall of both TBF and TBR material resulting from the logical ordering of TBF material was interpreted as supporting a "concise-differential-grouping" notion in which sequential organization is said to facilitate the formation of functionally distinct TBR and TBF memory groupings.

Selective-forgetting mechanisms have long been assigned an integral role in the processing of to-be-remembered (TBR) information [James, 1890 (p. 680); Ribot, 1882 (p. 61)]. Consequently, what governs the efficient functioning of the mechanisms involved in selective forgetting has become an important question for research (Block, 1971; Geiselman, 1974, 1975). Bjork (1972) has concluded that in most cases an increase in accessibility for TBR information, which results from cuing other information as to-be-forgotten (TBF), is a function of two basic memory mechanisms. These are a differential-grouping mechanism and a selective-rehearsal mechanism. Geiselman (1974) has shown that the differential-grouping mechanism is less efficient if logically connected sentences are used as the TBR and TBF items rather than relatively unconnected sentences. Connectedness was determined by having judges rank order topically related, though independent, sentences in their "best" possible order. A coefficient of concordance was then computed from the judges' ranks as a connectedness index.

Connectedness was also found to be an important variable in the semantic positive-forgetting procedure of Geiselman (1975) which is distinguished from other directed-forgetting procedures by the nature of the TBR-TBF cuing. In semantic positive forgetting, the subject makes the TBR-TBF distinction for individual sentences on the basis of membership or nonmembership in an experimenter-designated TBR general theme rather than on the basis of artificial postitem input cues (Davis & Okada, 1971; Geiselman, 1974; Woodward & Bjork, 1971). Two sets of sentences with distinctly different general themes were presented in an intermixed fashion with 7-sec empty intervals between sentences. Delayed substantive recall for the TBR sentences was found to be

improved if either the TBR, the TBF, or both sets of sentences were presented in their "best" orders rather than in scrambled orders. The reason for the positive effect of TBF-sentence ordering on TBR-sentence recall was not clear. Subjects who were presented both sets of sentences in scrambled orders reported more interference from the TBF sentences during TBR-sentence selective rehearsal than did subjects who were presented both sets in their "best" orders. Also, the initial reading times for randomly presented TBF sentences were longer than for logically ordered TBF sentences. There are two plausible explanations for the TBF-ordering effect and the present experiment was designed to eliminate one of them by requesting at test that subjects give the TBF as well as the TBR sentences. One hypothesis is that the logically ordered TBF sentences form a sequential structure in long-term store and therefore rarely "come to mind" during TBR-sentence selective rehearsal. Conversely, the randomly presented TBF sentences are necessarily stored in a more unorganized fashion. The likelihood of the unorganized TBF ideas being drawn from memory during TBR-sentence selective rehearsal is dependent on whether the subject has an organizational scheme for the TBR sentences. A sequential structure for the TBR sentences would reduce the subject's reliance on retrieval from short-term store for rehearsal. This hypothesis is labeled the concise-differential-grouping hypothesis. The second plausible explanation is based on the depth-of-processing notion of Craik and Lockhart (1972). Possibly the longer reading times for randomly presented TBF sentences represent a deeper level of analysis. Randomly presented TBF sentences may interfere with TBR-sentence selective rehearsal more than do logically ordered TBF sentences simply because they are more accessible from memory.

The two hypotheses differ in their prediction of the effect of TBF ordering on TBF-sentence recall. The concise-differential-grouping hypothesis predicts that a

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Table 1  
Probability of Sentence Recall as a Function of  
Sentence Type and Presentation Condition

Sentence Type	Condition*							
	TBR S	TBF S	TBR O	TBF S	TBR S	TBF O	TBR O	TBF O
TBR	.31 (.36)	.40 (.46)	.47 (.53)	.58 (.64)				
TBF	.28	.21	.41	.29				

Note—Values in parentheses are from Geiselman (1975).

\*S = scrambled, O = ordered.

sequential structure can be formed and used as a retrieval scheme for a logically ordered set of TBF sentences. Hence, TBF-sentence recall should be better if the TBF sentences are presented in their "best" order. The present depth-of-processing hypothesis predicts that a scrambled set of TBF sentences should be more accessible at test.

## METHOD

### Subjects

The subjects were 24 male and 24 female undergraduates from various psychology courses at Ohio University who volunteered to participate in a psychology experiment for course credit.

### Materials and Apparatus

The two sets of 10 sentences which were used in the first investigation of semantic positive forgetting (Geiselman, 1975) were again employed, *Home Winemaking* and *The Island of Flomoa*. Both of these sets appear verbatim in Geiselman (1974) and their similar attributes with respect to the connectedness variable are listed in Geiselman (1975).

The two sets of 10 sentences were intermixed with the restriction that no more than two instances of any one theme could appear in a row. The sentences within each theme were either arranged in their "best" possible order or in a scrambled order. Thus, there were four different presentation orders of the 20 sentences. The sentences were shown one at a time on a Lafayette IBM memory drum.

**Procedure.** All subjects, tested individually, were told the general themes of both sets of sentences but that they would only be asked to recall the substances of the sentences of a designated theme. Each theme was designated as the TBR theme for an equal number of subjects. To reduce the disruption resulting from being requested to give both the TBR and TBF sentences at test (Reitman, Malin, Bjork, & Higman, 1973), the subjects were further told that "1 out of 20 subjects is asked to give the substances of the sentences about both topics; but since only 1 out of 20 subjects is asked to do so, you should assume that you will only be tested for the substances of the sentences about (the designated theme)."

Each subject was shown one presentation order of the 20 sentences. Each sentence was shown for 7 sec, during which time the subject read the sentence aloud. Then, there was a 7-sec blank rehearsal interval followed immediately by another sentence. Following the presentation of all 20 sentences, all subjects were asked to answer a series of unrelated questions for 30 sec. The subsequent free-recall test was for the substances of the sentences of both themes. All subjects were told, "You are one of the few subjects who are asked to write down as many of the 20 sentences as you can. You should write down the

substance of any sentence that was presented to you, regardless of what it was about." The recall interval was 6 min unless the subject was still writing down sentences.

### Design

The data matrix, collapsed across subjects within cells, was a  $2 \times 2 \times 2 \times 2$  with the factors being TBR passage (*Winemaking* or *Flomoa*), TBR ordering ("best" order or scrambled order), TBF ordering ("best" order or scrambled order), and sentence type (TBR, TBF). All factors were between-subject factors except the sentence-type factor. The free-recall data were scored by two judges for sentence substance and the average score for each subject for each sentence type was used in the analysis of variance.

## RESULTS

The interjudge reliability was .82. The analysis of variance showed a main effect of sentence type,  $F(1,40) = 68.8$ ,  $p < .001$ ,  $MS_e = .7$ , with the TBR sentences being recalled better than the TBF sentences. The TBR Passage by Sentence Type interaction was also significant,  $F(1,40) = 46.7$ ,  $p < .001$ ,  $MS_e = .7$ . A Cicchetti test (Cicchetti, 1972) on the interaction showed that the TBR sentences were recalled better when the *Flomoa* passage was designated as TBR ( $p < .01$ ); whereas the TBF sentences were recalled better when the *Winemaking* passage was TBR ( $p < .05$ ). As in two previous studies (Geiselman, 1974, 1975), the sentences about the island were easier to remember. The TBF-ordering main effect was significant,  $F(1,40) = 30.8$ ,  $p < .001$ ,  $MS_e = 1.5$ , with more TBR and TBF sentences being recalled when the TBF sentences were presented in their "good" order. Hence, the concise-differential-grouping hypothesis was supported. The TBR-ordering main effect was not significant; but the TBR-Ordering by Sentence Type interaction was significant,  $F(1,40) = 34.3$ ,  $p < .001$ ,  $MS_e = .7$ . A Cicchetti test on the effect showed that the TBR sentences were recalled better if the TBR passage was presented in its good order ( $p < .01$ ); but the TBF sentences were recalled better if the TBR passage was presented in a scrambled order ( $p < .05$ ). Hence, if the subjects have an organizational structure to more efficiently rehearse the TBR sentences, the TBF sentences receive fewer unintentional rehearsals.

The probabilities of recall for the TBR and TBF sentences as a function of presentation condition are shown in Table 1. The TBR-passage results obtained by Geiselman (1975) are given in parentheses. The inferior TBR-sentence recall in the present experiment may have been due to (1) output interference from long-term store (Roediger, 1974) due to recalling the TBF sentences, or (2) the present "strategy-control" instructions (Reitman et al., 1973) which were not used by Geiselman (1975).

## DISCUSSION

In semantic positive forgetting, better TBR-item recall is not necessarily associated with poorer TBF-item recall (Geiselman,

1974; Reitman et al., 1973). In agreement with the concise-differential-grouping hypothesis, connected TBF sentences are more accessible than random TBF sentences but are less interfering with TBR-sentence selective rehearsal. Further, the fact that the TBF sentences were read faster (Geiselman, 1975) but recalled better when presented in their "good" order supports the conclusion of Bellezza and Richards (Note 1) that organization as well as semantic processing is necessary for optimal recall. In the present case, organization can be viewed as a sequential logical structure with the specific sentence contents as terminal lexical entries.

### REFERENCE NOTE

1. Bellezza, F. S., & Richards, D. L. Semantic processing and organization in word recall. Paper presented at the meeting of the Midwestern Psychological Association, Chicago, May 1975.

### REFERENCES

- Bjork, R. A. Positive forgetting, the non-interference of items intentionally forgotten. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 255-268.
- Bjork, R. A. Theoretical implications of directed forgetting. In A. W. Melton and E. Martin (Eds.), *Coding processes in human memory*. Washington, D. C: Winston, 1972.
- Block, R. A. Effects of instructions to forget in short-term memory. *Journal of Experimental Psychology*, 1971, 89, 1-9.
- Cicchetti, D. V. Extention of multiple-range tests to interaction tables in the analysis of variance: A rapid approximate solution. *Psychological Bulletin*, 1972, 77, 405-408.
- Craik, F. I. M., & Lockhart, R. S. Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, 1972, 11, 671-684.
- Davis, J. C., & Okada, R. Recognition and recall of positively forgotten items. *Journal of Experimental Psychology*, 1971, 89, 181-186.
- Geiselman, R. E. Positive forgetting of sentence material. *Memory & Cognition*, 1974, 2, 677-682.
- Geiselman, R. E. Semantic positive forgetting. Another cocktail party problem. *Journal of Verbal Learning and Verbal Behavior*, 1975, 14, 73-81.
- James, W. *The principles of psychology* (Vol. 2). New York: Holt, 1890.
- Reitman, W., Malin, J. T., Bjork, R. A., & Higman, B. Strategy control and directed forgetting. *Journal of Verbal Learning and Verbal Behavior*, 1973, 12, 140-149.
- Ribot, T. A. *Diseases of memory: An essay in the positive psychology*. New York: Appleton-Century-Crofts, 1882.
- Roediger, H. L. Inhibiting effects of recall. *Memory & Cognition*, 1974, 2, 261-269.
- Woodward, A. E., & Bjork, R. A. Forgetting and remembering in free recall: Intentional and unintentional. *Journal of Experimental Psychology*, 1971, 89, 109-116.

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