Warmup effects in free recall

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A series of six experiments investigated warmup effects in free recall as a function of stimulus item type (words vs trigrams) and composition (related vs unrelated). Significant warmup was found when trigrams served as stimuli, but there was no sizable effect for word stimuli.

Warmup identifies a general set stemming from experience with List A₁ which facilitates performance on List A₂ when both lists are learned during the same experimental session. Such warmup effects exert a powerful influence on paired-associate learning (e.g., Thune, 1950) and on acquisition of serial lists (Postman, 1962). In contrast, the facilitative influence of warmup does not seem to occur in free recall learning. In a series of free recall experiments Murdock (1960) failed to find any substantial effect attributable to warmup. In Murdock's experiment XII-b three lists each containing 30 unrelated words randomly selected from the word list by Thorndike-Lorge (1944) were presented on slides at a 2-sec rate. After Ss had seen all the words in a list, they recorded as many of the items as they could recall. The Ss followed this procedure for four trials and then switched to the second and third lists repeating the same procedure. Since there were no significant differences in performance among lists, Murdock concluded that there were no warmup effects. Similar results were reported by Murdock in three additional experiments.

We wondered whether Murdock's finding with unrelated words would hold with related words as well. We also reasoned that warmup effects might have little opportunity to be revealed with words, related or unrelated, since such stimuli are so easily learned. Because of this possible explanation of the Murdock finding, the current study was designed to investigate the role of warmup in free recall of trigrams.

METHOD

Six separate experiments were performed; each experiment used the same procedure but incorporated one of the following kinds of stimulus materials: related words, unrelated words, related trigrams, and unrelated trigrams. Three lists of items were generated for each stimulus type. The lists of related words were high in conceptual similarity, each list using three concepts with three instances of each concept. The lists of unrelated words were low in conceptual similarity with no concept being repeated. Concepts were selected so that a minimum of overlap occurred from list to list. All words were two syllable, concrete nouns with Thorndike-Lorge G values of 1. Three lists of related trigrams were constructed; the items within a list were related in that a high correlation existed between the first and second letter positions. Each list was composed of three sets of three related trigrams, such as JZW, JZR, JZB. Both related and unrelated items were composed of high similarity CCC units with unrelated trigrams possessing no correlation between letter positions. The related and unrelated trigrams have been described in more detail elsewhere (Koeppel, 1968).

In all experiments stimuli were presented by means of a Wollensak tape recorder at a 2-sec interitem rate. After hearing all items on a list Ss had 60 sec to write those stimuli they could recall without regard to order. When Ss had continued for an appropriate number of trials (four trials for words, eight for trigrams), another list containing the same kind of stimuli was introduced, and the procedure was repeated. In this manner the three comparable lists were shown to the same Ss for free recall.

One-hundred and six volunteers from undergraduate psychology classes at the University of North Dakota served as Ss. Each experiment was based on data collected from 14 to 19 Ss.

RESULTS

Statistically significant differences among lists were obtained for trigrams but not for words. An analysis of variance was performed on the number of correct responses for each

Table 1
Newman-Keul Comparisons of Related and Unrelated Trigram Lists

Type of Item and Order	Acquisition Comparisons		
	List 2 vs List 1	List 3 vs List 1	List 3 vs List 2
Related Trigrams			
List Order 1, 2, 3	2 > 1 **	3 > 1 *	3 = 2
List Order 3, 1, 2	2 > 1 **	3 < 1 **	3 < 2 **
Unrelated Trigrams			
List Order 1, 2, 3	2 > 1 **	3 > 1 **	3 < 2 *
List Order 2, 3, 1	2 < 1 **	3 < 1 *	3 > 2 *

* $p < .05$

** $p < .01$

experiment. With related and unrelated words, there were no significant differences in acquisition of lists ($F = 1.95$, $df = 2/36$; $F = 1.95$, $df = 2/36$). A significant difference was found for related trigrams ($F = 3.76$, $df = 2/34$, $p < .05$) and for unrelated trigrams as well ($F = 8.06$, $df = 2/34$, $p < .005$).

Differences obtained from these analyses were not readily interpretable because they may have been due either to unintentional list differences or to a warmup effect. Consequently, Experiments 5 and 6 were conducted in which the lists were used in different presentation orders. For the unrelated trigrams Lists 1, 2, and 3 were reordered as List 2, List 3, List 1; and for the related trigrams the order was changed to List 3, List 1, List 2.

If characteristics of one or more lists were responsible for the acquisition differences, the differences would remain the same since reordering would not change intrinsic list characteristics. However, if warmup were responsible for the significant outcomes, the observed differences would change, depending upon the new presentation position of each list. Differences among both orders of lists were analyzed using the Newman-Keuls method; the results are presented in Table 1. These data showed that the relationships among lists changed significantly when the order of presentation was varied. Apparently list position (warmup) rather than a unique list characteristic was the primary reason for differential acquisition.

DISCUSSION

The current experiments support in part Murdock's previous statement that there are no warmup effects in the free recall learning of unrelated words. In addition, the current research indicates that there are no warmup effects with related words. However, when trigrams serve as stimuli, significant warmup effects are found.

Free recall learning is primarily a matter of response integration. Integration can take place either among letters making up an individual unit or among syllables or words making up a list. With most words Ss do not have to integrate letters into a meaningful unit; only response integration among the words constituting a list is necessary. Trigrams, on the other hand, require a double response integration. The individual letters of each trigram must be integrated via a learning process; then whole items can be integrated as a list. In a sense there is less to be done when words rather than trigrams are the stimuli to be learned. The warmup concept is useful in accounting for the integrative activities in the learning of trigrams. But in the learning of words, where these activities are minimized, warmup is found to be an unimportant factor.

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NOTE

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