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EFFECTS OF MEANINGFULNESS OF RELEVANT AND IRRELEVANT STIMULI IN A MODIFIED CONCEPT FORMATION TASK

LARRY L. JACOBY [1] AND ROBERT C. RADTKE

Southern Illinois University

Meaningfulness (*m*) of component stimuli was manipulated in a modified compound-stimulus paired-associate task. Stimuli consisted of two CVC syllables, with one being relevant in that it was consistently paired with a number response, and the other being irrelevant in that it was paired equally often with each relevant syllable, and hence with each number response. The *S* was required to identify the relevant syllables and to associate them with the appropriate number responses. The *m* of the relevant syllable was directly related and *m* of the irrelevant syllable was inversely related to ease of identification and association. The results were interpreted in terms of the effects of differential attention as a function of *m*.

Jacoby and Radtke (1969) investigated the effects of meaningfulness (*m*) on cue selection in a task which involved components of both paired-associate learning and concept formation. Compound stimuli, consisting of two nonsense syllables, were paired with single-digit responses. The relevant syllable in each compound stimulus was always paired with the same digit, while the irrelevant syllable was paired equally often with each digit and, thus, with each relevant syllable. The *S* had to learn to identify the relevant syllables and to associate them with the appropriate digits.

It was expected that identification of the relevant syllable would be directly related to *m* of the relevant syllable (MR) and inversely related to *m* of the irrelevant syllable (MI). The higher-*m* syllable was assumed to elicit greater attention which would facilitate association of that syllable with the digit and would increase the probability of guessing that syllable as relevant. Association of the relevant syllable with the appropriate digit was considered necessary for consistent identification of the relevant syllable.

The results of the previous study revealed no independent effects of MR or MI. Identification of the relevant syllable was dependent on the difference between MR and MI, with greater differences producing earlier identification. This result was explained on the basis of the design employed. MI and MR were between- and within-list manipulations, respectively, with MI being the most frequently represented *m* level for any list. Regardless of the level of MR, differences between MR and MI may have enhanced the salience of the relevant syllable and facilitated identification performance.

In the present study, MR and MI were varied within lists in order to eliminate the tendency to respond to the less frequently represented *m* level. This resulted in equal representation of all *m* levels and was expected to afford a less ambiguous assessment of the independent effects of MR and MI.

Method.—The design was a 2×2 factorial with two levels of MR and MI manipulated within *S*s. The basic design was replicated once with 10 introductory psychology students randomly assigned as *S*s to each replication.

The relevant and irrelevant syllables consisted of eight high-*m* (95%) and eight low-*m* (7%) CVCs selected from Archer (1960). Formal similarity among the CVCs was minimized and equated for the high- and low-*m* syllables.

The high-MR–low-MI (HL), the low-MR–low-MI (LL), the high-MR–high-MI (HH), and the low-MR–high-MI (LH) cells of the design were each represented by two relevant syllables. A single-digit number from 1 to 8 was randomly assigned to each relevant syllable. Four high-MI syllables appeared equally often with each of the relevant syllables in the HH and LH cells, and four low-MI syllables appeared equally often with the relevant syllables in the HL and LL cells. Thus, a list consisted of 32 pairs, four instances of eight concepts. It should be noted that the irrelevant syllables were only partially irrelevant since each occurred with only half of the relevant syllables. The replication list was generated by interchanging the relevant syllables paired with high MI with those paired with low MI. Thus, across replications, the two levels of MI were paired with the same relevant syllables. There were four random orders of each list, with the position of a syllable within a pair randomly determined for each instance. Contiguity of concept instances was low, with successive instances of a relevant syllable separated by a mean of 6.8 other items.

A nine-item practice list, with three relevant and three irrelevant medium-*m* syllables, was presented, using the anticipation method. The experimental lists were presented on a memory drum at a 3:1-sec. rate, and a 4-sec. intertrial interval was used. The *S*s were told that one syllable of each pair was relevant in that it was consistently associated with the same number, while the other

[1] Requests for reprints should be sent to Larry L. Jacoby, Department of Psychology, Southern Illinois University, Carbondale, Illinois 62901.

was irrelevant since it appeared equally often with each number. The *S*s were instructed to attempt to discover the relevant syllable and to associate it with the number. During the anticipation interval, *S*s were to indicate the relevant syllable, by spelling it aloud, and the number with which the relevant syllable was paired. The learning criterion for the experimental lists was two consecutive errorless trials for both identification and association responses, with each *S* receiving a minimum of eight trials.

Results.—Identification errors over the first eight trials are presented in Fig. 1A. The main effects of MR and MI apparent in Fig. 1A, with identification errors decreasing with MR and increasing with MI, were both highly significant, Fs (1, 18) = 18.89 and 43.39, respectively, both p's $< .001$. There was no MR $\times$ MI interaction, $F < 1$. These findings support the hypothesis advanced earlier that because of differential attention as a function of *m*, identification of the relevant syllable would be directly related to MR and inversely related to MI. When MR and MI were both manipulated within *S*s so that each level of *m* was equally represented in a list, the MR $\times$ MI interaction found in the previous study (Jacoby & Radtke, 1969) was eliminated.

Nonassociative effects of differential attention as a function of *m* were directly evidenced on first-trial identification performance. On the first trial in the HL and LH conditions, the high-*m* syllable was selected 71% and 73% of the time, respectively. Thus, regardless of whether the high-*m* syllable was relevant or irrelevant, when it was paired with a low-*m* syllable, it was selected approximately 70% of the time. When the syllables did not differ in *m*, as in the HH and LL conditions, and there was no basis for differential attention, each syllable was responded to approximately 50% of the time on the first trial. It should be noted that first-trial identification would reflect differential attention as a function of *m* only if there were no first-trial differences between the conditions in the association of the relevant syllable with the number response. Since there were eight number responses, proportion of errors expected by chance would be .875. As can be seen from the association data in Fig. 1B, there were approximately 3.5 out of 4 possible association errors, or a proportion of .875 on the first trial for each condition. Thus, on the first trial there was no evidence for associations between syllables and number responses.

As shown in Fig. 1A, both MR and MI interacted with trials, Fs (7, 126) = 2.86 and 5.72, p's $< .01$ and .001, respectively. The MR $\times$ Trials interaction appears to be primarily due to a floor effect, with the high- and low-MR curves converging as they approach errorless performance. The MI $\times$ Trials interaction is more interesting in that it appears to arise from the lack of improvement in the early trials for the high-MI conditions. In the LH condition, the persistent

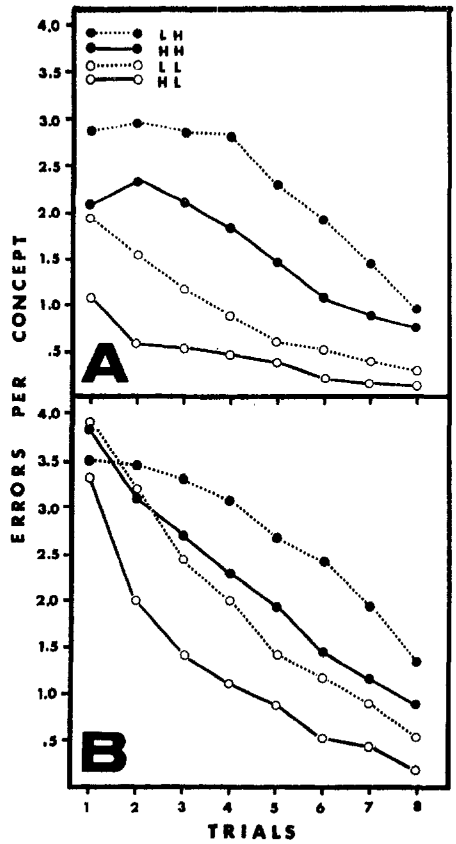

FIG. 1. Mean number of identification errors (A) and association errors (B) per trial as a function of meaningfulness of the relevant and irrelevant syllables.

identification errors early in training may be readily explained by differential attention as a function of *m*. It was expected that *S*s would attend more to high-*m* syllables and guess them as the relevant syllable, thus producing more identification errors when the high-*m* syllable was irrelevant, as in the LH condition. In addition, attending more to the high-*m* syllable would retard the formation of associations between the relevant syllables and the number responses. Since consistent correct identification was assumed to depend on association of the relevant syllable with the number response, the retarded association formation would produce more persistent identification errors.

The lack of improvement in the HH condition on the early trials cannot be due to differential attention as a function of *m* since both syllables are of the same *m* level. One explanation for the persistent errors of the HH condition appeals to the influence of the LH condition, the condition with which HH shared irrelevant syllables. The frequent responding to the irrelevant syllables in the LH condition due to their higher *m* may have induced more frequent responding to the same irrelevant syllables in the HH condition.

Association errors over the first eight trials are presented in Fig. 1B. Essentially similar effects were observed in the association data as in the identification data. The main effects of MR and MI were again significant, Fs $(1, 18) = 121.12$ and 46.34, p's $< .005$ and $.001$, respectively, with associative errors decreasing with MR and increasing with MI. There was no MR $\times$ MI interaction, $F < 1$, and both MR and MI interacted with trials, Fs $(7, 126) = 2.88$ and 5.60, p's $< .01$ and $.001$, respectively.

The MR $\times$ MI $\times$ Trials triple interaction was significant, F $(7, 126) = 2.95$, $p < .01$. When compared with identification errors, the triple action in associative errors seems to arise primarily from the HH condition. The associative error data of the HH and LL conditions were more similar than the identification data of the same two conditions, and there was no persistence of associative errors in the HH condition. One might have expected better associative performance on HH than on LL because of the demonstrated effect of stimulus *m* on the associative stage of paired-associate learning (Cohen & Musgrave, 1964; Hopkins & Schulz, 1969). The fact that HH is, if anything, slightly inferior to LL may be the result of the previously mentioned identification bias for the irrelevant syllable in the HH condition. Such a bias may have eliminated the expected associative advantage for the HH condition.

It has been emphasized that identification of the relevant syllable was dependent on the formation of an association between the relevant syllable and the digit response. A conditional probability analysis of the type employed by Jacoby and Radtke (1969) was performed to assess associative learning prior to the attainment of the identification criterion. The difference between the conditional probability of a correct association given a correct identification, $P(C/C)$, and a correct association given an incorrect identification, $P(C/I)$, can be considered to reflect such learning. The results of the analysis revealed significant preidentification-criterion associative learning, with $P(C/C) = .34$ and $P(C/I) = .10$, $p < .001$. There was no evidence that such learning differed over MR or MI. These results would be expected if some constant amount of association between the relevant syllable and the digit response were required for consistent correct identification of the relevant syllable. Differential attention as a function of *m* would then not affect the amount of preidentification-criterion associative learning, but the speed with which the critical amount of association was developed.

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