Short-term memory and acoustic similarity¹

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In a STM paradigm, four groups of 96 Ss each had all combinations of low and high acoustic similarity of items and sequential and simultaneous modes of presentation. Acoustic interference occurred as a proactive inhibition effect of prior items, and then only for the sequential mode and an immediate retention test. Acoustic interference was absent at a 30-sec test, showing its short life.

Adams, Thorsheim, & McIntyre (in press) found that acoustic interference in short-term memory (STM) was a reliable effect at an immediate retention test with sequential presentation of items but absent or a minor effect at longer intervals regardless of presentation mode. Similarly, Conrad (1967) reported acoustic errors at the 0-sec test which shifted to random errors at a 10-sec test. If acoustic interference is short-lived, its role in memory theorizing (e.g., Adams, 1967) will need adjusting. This experiment asks further about variables for acoustic interference.

GENERAL PROCEDURES FOR ALL GROUPS

The apparatus was the VI (variable interval) memory drum which uses a paper tape reader to control presentation time. At the beginning of a trial the word "Ready" appeared in the drum's window for 2 sec, followed by the item. The items were consonant tetragrams, and the mode of presentation was either sequential or simultaneous. An item's presentation time was 2 sec for both modes, and S studied silently. In the sequential mode each of the four letters was displayed for .5 sec, and in the simultaneous mode the letters were displayed together for 2 sec. The retention interval then began and S read lines of random digits aloud and as fast as possible until an asterisk signaled recall. The digits were displayed in a line of 15 and changed every 3 sec to insure that S would not finish a line and have empty time for rehearsal. When the retention interval was zero the asterisk immediately followed the item. The asterisk remained showing for 10 sec, during which time S attempted his recall in writing. Next appeared the words "Recall Aid" for 10 sec which required S

to report his idiosyncratic association, or natural language mediator (NLM) as it is called, which he used in learning the item (Groninger, 1966; Kiess, 1968; Adams, Thorsheim, & McIntyre, in press). If S had no NLM he reported "Rote." The S gave his NLM verbatim but E only checked NLM or Rote on his data sheet. The S was not told that pronouncing the tetragram was an allowable mediator, but S nevertheless would infrequently pronounce the item rather than give a meaningful association and it was tallied as a NLM whenever he did (Lindley, 1966). The instructions gave the general task procedures and described rote and mediated learning without emphasizing either one. Two neutral items were used for demonstration and E illustrated a NLM for each one.

EXPERIMENTAL DESIGN

There were four groups, giving all combinations of sequential (Seq) and simultaneous (Sim) presentation mode, and low (L) and high (H) acoustic similarity between the four letters of an item. A S received four trials, each with a different item and a different retention interval of 0, 5, 15, and 30 sec. Each of the four items and each of the four intervals appeared equally often in the four trial positions.

The data of Conrad (1964) was used to choose an acoustically similar set of consonants (BCDGPTVZ), and an acoustically dissimilar set (FHJRLNWY) whose letters were acoustically dissimilar to each other and the acoustically similar set. In defining the four items of a set, the eight letters were each used twice and never twice in the same position.

SUBJECTS

There were 96 Ss in each group, 24 for each trial/retention interval combination within a group. They were university students, both men and women.

RESULTS

Analysis focused on Trials 1 and 4 and the 0- and 30-sec intervals, with number of letters in their correct position as the

measure. The NLM-rote classification gave a replication of established results and was not included in the analyses. Mediation was positively related to recall, with letters correct over all groups and retention intervals being 81% for mediated and 58% for rote items on Trial 1, and 65% and 41% on Trial 4.

Table 1 has the findings (NLM and rotes combined), and retention is very high at the 0-sec test on Trial 1, with the essential equivalence among groups showing equal input of items regardless of mode and material. At the 0-sec test on Trial 4 a decrement for Seq H was found, however. Analysis of variance for the 0-sec interval compared L and H items, Trials 1 and 4, and Seq and Sim modes. Acoustic similarity and trials were significant main effects ($p < .01$), but Seq-Sim was not. The t tests between individual group means found none significant on Trial 1, but on Trial 4 Seq H was significantly below all other groups which among themselves did not differ significantly.

On the 30-sec test all groups show forgetting, with more of it on Trial 4 than on Trial 1. The same analysis of variance as above was run for the 30-sec test, and all main effects were significant ($p < .01$). The t tests on Trial 1 found Seq L < Seq H and Sim L < Sim H, $p < .01$, which is poorer retention for L items, but this outcome deserves cautious interpretation because, for unknown reasons, Groups Seq L and Sim L had low NLM production on Trial 1. Low recall is an expected consequence. Groups Seq L and Sim L, respectively, had 4% and 17% of their items mediated, while Groups Seq H and Sim H had mediation levels of 46% and 62%. The comparisons of individual group means on Trial 4 all lacked significance.

DISCUSSION

Our data produce three main findings for acoustic interference. First, acoustic interference has a short life. It was strong on the 0-sec test for Trial 4 and absent on its 30-sec test. Second, the absence of acoustic effects on the 0-sec test of Trial 1 and its presence on Trial 4 shows that acoustic interference is an interitem proactive inhibition (PI) effect, not an intraitem effect. If interference was

Table 1
Per Cent Letters Correct for Each Group

Group	Retention Interval			
	0 Sec		30 Sec	
	Trial 1	Trial 4	Trial 1	Trial 4
Seq L	98	95	27	29
Seq H	89	64	57	21
Sim L	98	92	46	32
Sim H	95	83	75	28

between letters within an item we would have expected it on the 0-sec test of Trial 1, but it did not appear until Trial 4. Third, acoustic interference depends on the Seq mode. The presentation mode may be a determiner of associative strength and the Seq mode, producing less of it than the Sim mode, is at the low levels of associative strength where acoustic interference is supposed to operate in STM before its transition to long-term memory (Adams, 1967, p. 139). The Sim mode has all the letters and their correct order fully available for rehearsal and mediation throughout the learning period, and these advantages are lacking for the Seq mode. The STM task that most commonly shows acoustic interference in the literature is the Seq mode, immediate recall, and average recall taken over a series of trials where Trial 1 has small weight relative to later trials, and this is consistent with our finding that acoustic interference occurred on the 0-sec test of Trial 4 for the Seq mode.

All groups on Trial 1 showed forgetting over 30 sec, which is consistent with Experiment 1 of Keppel & Underwood (1962) and creates discomfort for the interference theory of forgetting because the source of interference is not evident. Keppel and Underwood surmised that extraexperimental interference affects first items when associative strength is weak enough, although the failure of extraexperimental interference to earn empirical support (Adams, 1967, Chap. 7) makes our two practice items a more likely source of PI. The decay theory of forgetting can painlessly explain Trial 1 forgetting, but the greater forgetting on Trial 4 is more consistent with interference theory and the role it gives PI. A more difficult explanatory task for interference theory is the loss of acoustic interference from 0 to 30 sec.

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NOTES

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Comments on "Experience with congruity in the perception of incongruity"

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Lasko & Lindauer (1968) concluded from their study that recognition thresholds for perception of a trick card were higher than that for normal cards. It is suggested that their conclusion is inappropriate in the absence of basic control measures.

There have been numerous criticisms of tachistoscopic studies of recognition threshold for unusual, rare, emotional, or incongruous stimuli (see reviews by Eriksen, 1958, 1960, 1962, and by Neisser, 1967, among others). In light of such criticisms, Lasko & Lindauer's (1968) conclusions about their attempt to replicate Bruner & Postman's (1949) study of recognition thresholds for incongruous playing cards are rather surprisingly forthright.

The gist of these criticisms would suggest that the basic phenomenon itself—Bruner & Postman's finding that recognition thresholds for incongruous playing cards were higher than those for congruous, i.e., real, playing cards—may have nothing whatever to do with "recognition threshold." Interpretation of this finding is made no less difficult for its having been replicated 19 years later.

The critical literature raises a number of questions; for instance, as Neisser (1967, p. 118) puts it, "Do variables such as expectancy and experience [in the current case this would be experience with congruous playing cards] affect 'perception,' or do they just create biases? Can these factors determine what people see or only

what they say? [emphases Neisser's]." In the Lasko & Lindauer case, it would seem that the only empirically justified conclusion is that "volunteer Ss" took longer to verbally report that they had recognized a trick card—the four of hearts in black—than any of the four normal playing cards. Just as the S may quite deliberately refrain from reporting taboo ("dirty") words lest he be thought "dirty-minded" (cf. Postman, Bronson, & Gropper, 1953; Lacey, Levinger, & Adamson, 1953; Freeman, 1954, 1955), so in the present case might he have refrained from reporting an "impossible" card lest he be thought naive. Presuming one could control for experience with playing cards, it would be interesting to see whether a S's concern for being perceived as "card-wise" is related to his tendency to report an impossible card. In this connection it would be important to know more about Lasko and Lindauer's Ss. If, as is possible, they were college students, they may value skill with playing cards more than do people from noncollege populations.

Lasko and Lindauer might have included a control group told *in advance* which cards would be presented and then given the series of tachistoscopic exposures. These Ss would be instructed to report only the figures that they were certain they perceived on each trial and no others. The threshold would not be defined by the trial on which they could identify the card, since they would already know which card it was, but by the point when they could identify all of the figures on the card. When Haber (1965) used such a procedure for the presentation of rare and common words, the usual differences in