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The locus of the lexicality effect in short-term memory for phonologically identical lists

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An earlier experiment showed that serial recall for lists of phonologically identical items was better if the items were words (KNEAD-NEED-KNEED-etc.) than if they were nonwords structurally derived from the words (KNEAP-NEEP-KNEEP-etc.). In the present experiment, the comparison of such words and nonwords was extended to a three-alternative forced-choice testing method. Since there was no difference with the recognition test, it was concluded that the earlier advantage of words may have resulted from retrieval processes.

An earlier report (Crowder, 1974) made the point that the conventional modality effect in serial recall of word lists (auditory presentation better than visual for the last few items) is eliminated when the items within the list are all phonologically identical, as in the list KNEAD- NEED- NEED- KNEED- KNEAD- KNEED-KNEAD. In fact, subjects who see a list of this sort presented visually score better if they read the items silently than if they read them aloud, just the opposite of what happens with more ordinary stimulus materials (Crowder, 1970). Even a minimal degree of phonological variety in the items to be retained, however, was sufficient to restore the familiar auditory advantage, as in the list KNEAD-NOD-NOD-NODE-NOD-KNEAD-NODE. This result was used to strengthen the proposition that the modality effect originates in a precategorical rather than a postcategorical auditory memory (Crowder & Morton, 1969).

That subjects can retain phonologically identical lists at all is interesting, for it denies the popular assumption that coding in immediate memory for verbal items is phonological and it also raises the question of what type of coding subjects use instead. One possibility is that subjects manage to inject phonological distinctiveness into nominally homophonous lists by a consistent system of covert mispronounciations of the items. For example, encoding KNEAD, KNEED, and NEED as "ay," "kay," and "en" would capitalize on graphemically distinct features and provide the subject with a functionally heterophonic list to remember. Two pieces of evidence discount this phonological recoding hypothesis, although neither is decisive. In the condition with overt vocalization, it would seem almost impossible for the subjects simultaneously to pronounce the nominal item aloud and the recoded item covertly. Second, the experiment (Crowder, 1974) used a given vocabulary (such as KNEAD, etc.) on two successive trials before a new vocabulary was introduced. One might reasonably expect a substantial improvement between the first and second trial because invention of a phonological mediator would absorb some processing capacity on the first, but probably not the second, trial. There was no such improvement.

It is more likely that subjects use either a visual code or some correlate of lexicality with phonologically identical lists. A lexically based code might entail semantic features, but it might also be an abstract code at the level of Morton's logogens (Morton, 1970). To choose between the visual and lexical hypothesis, an experiment was conducted (Crowder, 1974) comparing memory for lists of phonologically identical words with memory for lists of phonologically identical nonwords derived from the words. Subjects saw either vocabularies of three words such as KNEAD-KNEED-NEED and RAPT-WRAPPED-RAPPED or they saw vocabularies of similar nonwords such as KNEAP-KNEEP-NEEP and REPT-WREPPED-REPPED. The words and nonwords do not differ in their degree of visual distinctiveness but they are quite different in lexicality.

The seven items in a list were presented together for 5 sec, with separate groups of subjects either vocalizing the items silently or aloud. Performance in the resulting four conditions (words vs. nonwords and silent reading vs. aloud reading) is shown in the left panel of Figure 1.[1] The result of interest was a large advantage of the word items over the nonword items. If visual coding were involved, this difference would make no sense because the nonwords are no less distinctive, visually, than the words. Accordingly, it

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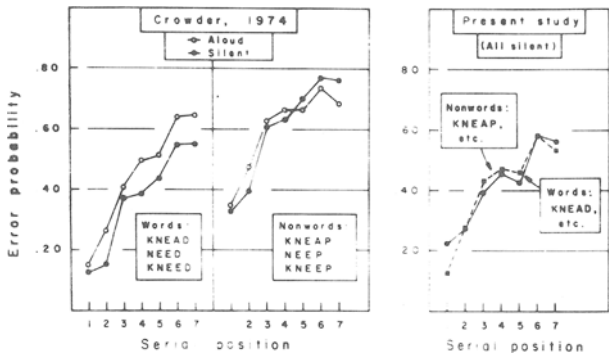

Figure 1.

was concluded (Crowder, 1974) that some mechanism of coding mediated by lexicality, semantic or abstract, was supporting performance. However, the experiment to be reported here suggests that conclusion may have been premature.

Although the lexicality effect was interpreted as an acquisition (encoding) effect, it is possible that words and nonwords could be handled identically up to the time of retrieval and still show different performance. If, for example, subjects enter the retrieval phase of each trial with visual traces sufficient to distinguish the items within a vocabulary, these traces could be referenced against a set of well-learned spelling patterns in the case of words but not in the case of nonwords. Say the subject knew a particular item had been a short word ending in "t" and that the words on that list had all been pronounced /ræpt/; the item in question must be RAPT. But with the same information for a nonword list, either WREPT or REPT (perhaps even REPD) would qualify. It will be recognized that this is a form of the sophisticated guessing hypothesis (Broadbent, 1967) employed in the field of word perception: Visual information combines with the subject's knowledge that he saw a word to limit the range of possible response candidates.

To test for the locus of the lexicality effect shown in the left panel of Figure 1, a new experiment was prepared with a new response mode. Instead of having seven blank spaces for each trial, the answer sheet in the new study had a row of seven three-alternative forced-choice tests in which the three words (or nonwords) comprising the vocabulary for that trial were printed on top of each other; the subject's task was just to encircle the correct alternative for each of the seven positions, from left to right. The idea was that this recognition procedure would restrict the range of alternatives equally for words and nonwords, removing the sophisticated guessing artifact that is present with a simple recall measure.

METHOD

Thirty paid Yale undergraduates received 18 trials, each with a seven-item list to be retained in order. There were nine vocabularies of three phonologically identical words and each vocabulary was used on two (nonadjacent) trials. Fifteen of the subjects saw only the word items and 15 saw only the nonwords.[2] Each list was typed on a slide in descending staircase order from left to right and was exposed for 5 sec of study. All subjects were instructed to read the items silently during this period. There was then a 25-sec period for responding, after which the slide-change mechanism signaled the start of the next trial. The answer sheets contained rows of seven identical triplets of items, single-spaced vertically, with the items in the same order for each of the seven positions. The subjects were told not to look at the answer sheets (which held six trials on each page) while the items were being presented or during any free time they had between responding on one trial and watching the stimulus presentation on the next trial.

RESULTS AND DISCUSSION

The results, shown in the right panel of Figure 1, gave no evidence for a lexicality effect under conditions of forced-choice recognition testing. Performance in both conditions resembled that for word items in the previous experiment, exactly as one would expect if spelling uncertainties were responsible for the poor performance on nonwords in that study.

At face value these new results suggest no lexical influence on immediate memory for phonologically identical items. They leave open the possibility of visual coding, also permitting us to assign the previous lexicality effect to sophisticated guessing. At the very least, the present results inhibit a quick dismissal of the visual hypothesis. But the identity of performance under conditions of forced-choice recognition testing is by no means conclusive, because the change from a recall to a recognition procedure could have altered subjects' "normal" encoding strategies. It is known that in other memory paradigms subjects will encode information differently depending on their anticipation of a recall or a recognition test (Tversky, 1973), so perhaps subjects here abandoned their customary lexically based code in favor of some other format just for the particular testing mode in effect. Further research can clarify this matter, but for the moment the coding of phonologically identical materials in short-term memory is unclear.

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NOTES

1. The modality comparison (silent vs. aloud) is not of concern here but note that the ceiling effect on performance in nonwords—chance guessing would give .67 errors—invalidated comparisons beyond the second serial position in that condition.

2. The nine vocabularies of words and their derived nonwords are as follows: TEES-TEASE-TEAS, MEET-MEAT-METE, AID-AIDE-ADE, NOSE-KNOWS-NOES, RAPT-WRAPPED-RAPPED, COAL-KOHL-COLE, KNEAD-KNEED-NEED, MAZE-MAIZE-MAYS, RUDE-ROOD-RUED, MEES-MEASE-MEAS, KEET-KEAT-KETE, AVE-AIVE-AIV, NUSE-KNUWS-NUES, REPT-WREPPED-REPPED, TOAL-TOHL-TOLE, KNEAP-KNEEP-NEEP, VAZE-VAIZE-VAYS, YUDE-YOOD-YUED.

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