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Effects of Vocabulary Size and Acoustic Similarity on Serial Recall of Mouthed Stimuli

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ABSTRACT. The characteristics of mouthed recency and suffix effects found in immediate serial recall tasks with visually presented stimuli were examined. In past research enhanced recency with mouthing when stimuli were drawn from Size 8 but not Size 3 vocabularies was found (Turner et al., 1987). One cause for these findings may have been differences in the acoustic similarity between items from the Size 3 and Size 8 vocabularies. In the present experiment the degree of similarity was manipulated for vocabulary Sizes 3 and 8. The mouthed or passively read letters were acoustically similar, dissimilar, or mixed. The results replicated the vocabulary size effects found in Turner et al. but were not confounded by the acoustic similarity of the list items. Mouthed recency and suffix effects were found in recall of Size 8 but not Size 3 vocabularies, and the vocabulary size effects were found regardless of acoustic similarity. Conversely, research has found auditory recency and suffix effects to be dependent on the acoustic similarity of list items (e.g., Crowder, 1976; Greene & Crowder, 1984) and independent of vocabulary size (Turner et al., 1987). The findings thus lead to the conclusion that auditory and mouthed recency and suffix effects are *not* mediated by the same underlying source.

IT IS WELL KNOWN that there is better immediate serial recall of items at the end of a list when the list items are presented auditorily rather than visually. The explanation of why we remember recently presented information better when it is heard than when it is seen has eluded memory theorists for some time. The superior recency of auditorily presented information suggests that some extra resource is available for the recall of *heard information* that is not available for the recall of *seen information.* This extra resource has generally been theorized as an auditory memory (Crowder & Morton, 1969; see Penney, 1989, for review).

However, an adequate explanation of why we remember recently presented information better when heard than when seen must include not only the notion of a superior, longer lasting, auditory representation but also how auditory information and visual verbal information are actively retained in working memory (WM). Baddeley's (1986) multicomponent theory of WM assumes that processing of verbal information requires a central executive in which new information and old information are integrated using a time-based articulatory loop. Focusing on processing, LaPointe and Engle (1990) suggested that the articulatory loop may be better thought of as a coding strategy than as an innate, structural WM component. A coding strategy is not a fixed process but one that can be activated in any configuration useful in specific tasks, such as immediate serial recall. Considering whether the coding strategy used during this task is articulatory may facilitate the interpretation of several findings that have been otherwise difficult to interpret.

For example, recency and suffix effects have been found when subjects read the lips of another person who is silently articulating stimuli (e.g., Campbell & Dodd, 1980; Shand & Klima, 1981) or when the subjects themselves silently articulate or mouth the stimuli (e.g., Greene & Crowder, 1984; Nairne & Crowder, 1982; Nairne & Walters, 1983; Spoehr & Corin, 1978). Further, although analogous recency and/or suffix effects have been found with mouthed and with heard or vocalized (i.e., auditory) stimuli (Greene & Crowder, 1984; Nairne & Walters, 1983; Turner et al., Exp. 1, 1987), weaker mouthed than auditory recency and/or suffix effects have also been found (Nairne & Crowder, 1982; Turner et al., 1987, see Exp. 2–6). Because those findings could not easily be explained by assuming that auditory sensory memory was purely acoustic, Greene and Crowder (1984) suggested that auditory memory should be considered a stage of processing in which both acoustical and mouthed information may be retained and become available to serve as an aid in later recall. That is, the two types of precategorized information, mouthed and auditory, may similarly determine which long-term memory (LTM) auditory features are activated, suggesting that the same coding strategy may mediate any source of precategorical information as long as it functions in the discrimination of the auditory features present in the environment.

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Nairne (1988, 1990) has focused on differences, rather than similarities, between auditory and mouthed effects found in immediate serial recall. He has suggested that multiple sets of features are coded when processing auditory, or mouthed, information. Item features are represented as qualitatively different sets of features, some independent and others dependent on the modality of presentation. For example, processing auditory information is assumed to generate a set of precategorical, acoustic features (i.e., modality dependent) *and* a set of postcategorical features (i.e., modality independent), the latter being internally generated during pattern recognition. The notion is that postcategorical features are similar, if not identical, for auditory and mouthed information. On the other hand, precategorical features coded for auditory and mouthed information are qualitatively different. In addition, fewer precategorical features are generated during perception for mouthed than for auditory items. This reduction results in fewer distinctive sets of features being available for recall of silently mouthed than for vocal or heard auditory information. Thus, the feature model assumes that both mouthed and auditory information partly determine which LTM auditory feature codes are retrieved, but that selection is based on qualitatively and quantitatively different sets of memory codes and coding strategies.

The singularity of cognitive processes underlying mouthing phenomena was supported by research reported by Turner et al. (1987). They found that auditory and mouthed recency and suffix effects were differentially affected by phoneme condition and vocabulary size. Recency and suffix effects were found when auditory stimuli consisted of syllables differing by vowels (such as *teek, take, toke*), but not by consonants (such as *pape, tape, cape.*) On the other hand, only weak recency and suffix effects were obtained in both phoneme conditions when stimuli were mouthed. Further, strong recency and suffix effects were found with auditory presentation regardless of whether items in each eight-item trial were drawn from a vocabulary of Size 3 (e.g., *F,H,R*) or Size 8 (e.g., *F,H,J,K,L,N,R,S*). But recency and suffix effects with mouthed presentation were dependent on vocabulary size, occurring only with a Size 8 vocabulary.

In the experiments of Turner et al., auditory and mouthed letters were recalled better across all serial positions when chosen from Size 3 rather than from Size 8 vocabularies. Inasmuch as this vocabulary size effect did not occur with digits, it is possible that the acoustic similarity was lower among the letters used in Size 8 than in Size 3 vocabularies. The letters in each eight-item trial could be randomly drawn without replacement from the Size 8 vocabularies, but had to be randomly drawn with replacement from the Size 3 vocabularies, allowing repetition. If the letters were acoustically more similar and less distinctive when drawn from the Size 3 than from the Size 8 vocabularies, then the degree of acoustic similarity among list items, and not vocabulary size, may have been the mediating variable. Research has consistently shown that the acoustic similarity of stimulus items affects item recall (e.g., Crowder, 1976). Greene and Crowder (1984) found that acoustically similar lists of heard items generated a greatly reduced auditory recency effect that was reliably found with acoustically dissimilar stimuli. In addition, Greene and Crowder found a reduced recency effect with *mouthed* stimuli high in acoustic similarity. Thus, they argued that auditory and mouthed recency effects are mediated by the same underlying resource. The question addressed here is whether acoustic similarity may have played a role in the vocabulary size effects found with mouthed recall.

The purpose of this experiment was to tease apart the effects of vocabulary size and acoustic similarity on mouthed recency and suffix effects. To this end, the acoustic similarity of the list items was varied within each level of vocabulary size. The question was whether the interaction of recency and suffix conditions with vocabulary size would remain regardless of acoustic similarity. If not, the magnitude of mouthed recency and suffix effects should be affected in the same way as auditory effects, that is, increased for acoustically dissimilar and decreased for acoustically similar information. On the other hand, the magnitude of mouthed (*unlike* auditory) recency and suffix effects may be independent of acoustic similarity but dependent on vocabulary size. That is, mouthed recency and suffix effects may occur with large, but not small, vocabularies regardless of acoustic similarity. Theoretically, investigating this question should further define whether different or similar cognitive-processing resources (i.e., coding strategies) are reflected by mouthed and auditory recency and suffix effects.

Method

Subjects and Design

The participants in our study were 72 students enrolled in psychology courses at Wichita State University. Twelve students were randomly assigned to each of six conditions resulting from the two factorially crossed, between-subjects variables: (a) acoustic similarity, whether the list letters were acoustically similar, acoustically dissimilar, or duplicates of the letter stimuli used in the study by Turner et al., and (b) vocabulary size, whether the stimulus lists were drawn from a vocabulary of Size 3 or Size 8. In addition, there were three within-subject variables: (a) mouthing condition, whether the subjects mouthed or passively read the items; (b) suffix condition, whether the eight-item lists were followed by a suffix or a nonsuffix; and (c) the serial position of the eight items in each list. The order of the mouthing condition was counterbalanced so that half of the subjects mouthed the first 40 trials and passively read the last 40, and the remaining half reversed that order. Each of two experimenters conducted 6 subjects in each between-subjects condition, counterbalancing experimenter and order-of-presentation bias.

Stimuli

Eight consonants were randomly selected from one of six vocabulary pools for each trial:

1. Three acoustically similar letters with the same ending-vowel sound (i.e., *B, C, D*)
2. Three acoustically dissimilar letters (i.e., *L, D, M*)
3. Three original letters, which were duplicates of letter stimuli used in the Turner et al. (1987) study (*F, H, R*)
4. Eight acoustically similar letters (*B, C, D, G, P, T, V, Z*)
5. Eight acoustically dissimilar letters (*D, F, H, J, L, M, R, Q*)
6. Eight original letters that were duplicates of letter stimuli used by Turner et al. (*F, H, J, K, L, N, R, S*).

Each eight-item trial was randomly drawn without replacement from the Size 8 vocabularies, but randomly drawn with replacement from the Size 3 vocabularies, with the following constraints: first, that the same letter could not be presented at the last three serial positions (6, 7, or 8), and second, that the same letter could not be presented at more than two adjacent, earlier serial positions (Positions 1, 2, 3, 4, and 5). It is important to note that items at the end of the list (Positions 6, 7, and 8) were not repeated, whether or not they were randomly drawn from Size 3 or Size 8 vocabularies. The degree of acoustic similarity was based on the mean confusabilities reported in Conrad's (1964) confusion matrix and was consistently greater for acoustically similar than for dissimilar letters whether randomly drawn from Size 3 (.49 = similar; .17 = dissimilar) or Size 8 (.49 = similar; .17 = dissimilar) vocabularies. The list letters in the original condition were the same letters used in the study by Turner et al. and therefore were not chosen based on the degree of acoustic similarity among the items. Thus, the mean confusability for the Size 8 vocabulary letters (.37) was somewhat lower than that for the Size 3 vocabulary (.51) in the original condition. In the suffix condition, subjects mouthed or passively read the word *recall,* which randomly followed half of the lists as the cue to begin recall. A string of dots (. . . .) served in the nonsuffix condition as the cue to recall.

Procedure

The lists of letters were presented one at a time in the center of a computer screen. The subjects in the mouthing condition silently moved their lips in a somewhat exaggerated manner so that the experimenter could understand each item from watching their lips. However, they were cautioned not to whisper or make any sound while mouthing the items. The subjects in the nonmouthing condition viewed the letters without moving their lips or making any sound. An experimenter was with each subject throughout the experiment to be sure that the specific mouthing/nonmouthing instructions were followed.

All subjects were given practice in their particular condition, immediately followed by the initial block of 40 experimental trials, a 5-min break, and the last block of 40 trials. On each trial the subject saw the */ready/* signal, and after 1 s, sequentially mouthed or passively viewed the eight letters, followed randomly by either the suffix *(recall)* or the nonsuffix *(. . . .)*. All items, including the suffix (nonsuffix), were presented sequentially at a rate of two per s, with an item duration of 300 ms followed by a 200-ms interitem interval. A minimum of 20 s separated the appearance of the last item (suffix or nonsuffix) from the */ready/* signal that began the next trial. During this period the subjects wrote the recalled letters on answer sheets in the same serial order as they saw them. They then indicated to the experimenter that they were ready for the next trial.

Results

We performed analyses of correct responses at each of the eight serial positions. Only correct responses in the correct position were counted. Planned comparisons were made using an F ratio (Hayes, 1981) for the specific hypotheses regarding recency and suffix effects. Tests for recency were based on differences in the recall of items in the preterminal (seventh) and terminal (eighth) positions in the nonsuffix conditions only. Tests for suffix effects were performed in those conditions finding recency and were based on the differential recall of items in the suffix versus nonsuffix conditions at the terminal position.

Again, the purpose of this experiment was to determine whether acoustic similarity and vocabulary size jointly determined the magnitude of mouthed recency and suffix effects. By selectively focusing on analyzing the end-of-list, nonrepeated items, a possible confound between acoustic similarity and vocabulary size was avoided. Adjacent letter repetition in earlier serial Positions 1–5 was required to build eight-item trials from Size 3 vocabularies, necessarily increasing the acoustic similarity of the repeated earlier positions in the Size 3 trials above those of the Size 8. The important finding was that acoustic similarity did not affect recent recall of mouthed lists, but mouthed recency was dependent on vocabulary size.

Effects of Acoustic Similarity

Although there was a main effect of acoustic similarity on recall, with mean recall increasing from similar (19%) and original (22%) to dissimilar items (26%), $F(2, 60) = 7.78, p < .001$, there was no interaction of acoustic similarity with serial position or end-of-list recall. Further, acoustic similarity did not significantly interact with vocabulary size or mouthing condition, $p >$ .14.

Recall of original letters was dependent on vocabulary size (Figure 1). When the letters were mouthed and were from a Size 8 vocabulary, recall increased 15% from the seventh to the eighth position, $F(1, 35) = 6.61, p < .005$, $MS_e = .06125$, and eighth-position recall was reduced 11% by the suffix, $F(1, 35) = 3.56, p < .05$, $MS_e = .06125$. End-of-list effects were not found in any other condition with original letters.

These results replicated the findings from our earlier study (Turner et al., 1987) using these same stimuli. But, as we noted earlier, those letters were selected without consideration of their overall acoustic similarity. Thus, the mean confusability of the Size 8 vocabulary (.37) was somewhat lower than that for the Size 3 vocabulary (.51) in the original condition. That possible confound was eliminated in this experiment by selecting list letters for Size 3 and 8 vocabularies equivalent in mean confusability, each in the acoustically similar (.49) and acoustically dissimilar (.17) conditions.

Recent recall of mouthed, acoustically dissimilar letters was also dependent on vocabulary size. When the letters were mouthed and from a Size 8 vocabulary, recall increased 16% from the seventh to the eighth position, $F(1, 35) = 9.61, p < .001$, $MS_e = .06125$, and eighth position recall was reduced 10% by the *suffix*, $F(1, 35) = 2.94, p < .05$, $MS_e = .06125$ (Figure 2). Thus again, the only recency found in nonsuffixed recall was reduced in suffixed lists drawn from a Size 8 vocabulary but not in any other condition.

Results found with acoustically similar stimuli replicated end-of-list recall for acoustically dissimilar and original letters. Vocabulary size was clearly the important factor determining mouthed recency and suffix effects (Figure 3). When letters from a Size 8 vocabulary were mouthed, recall increased 15%, $F(1, 35) = 6.61, p < .005$, and eighth position recall was reduced 13% by a suffix, $F(1, 35) = 4.77, p < .05$. Once again, the nonsuffixed recall was reduced in suffixed lists in only one condition, that in which mouthed letters were drawn from a Size 8 vocabulary. Therefore, recency and suffix effects occurred when acoustically similar, original, and acoustically dissimilar letters were mouthed and drawn from a Size 8 vocabulary but not in any other condition.

Vocabulary Size Effects

It was clear that the important manipulation affecting mouthed recall was vocabulary size when considering the end-of-list recall (Tables 1 and 2). The greater nonsuffixed recall in the terminal than in the preterminal serial position was found with mouthed, but not with nonmouthed, visually presented letters when they were drawn from a vocabulary of Size 8 (Table 1). These effects were *not* found with letters drawn from a Size 3 vocabulary. Suffix

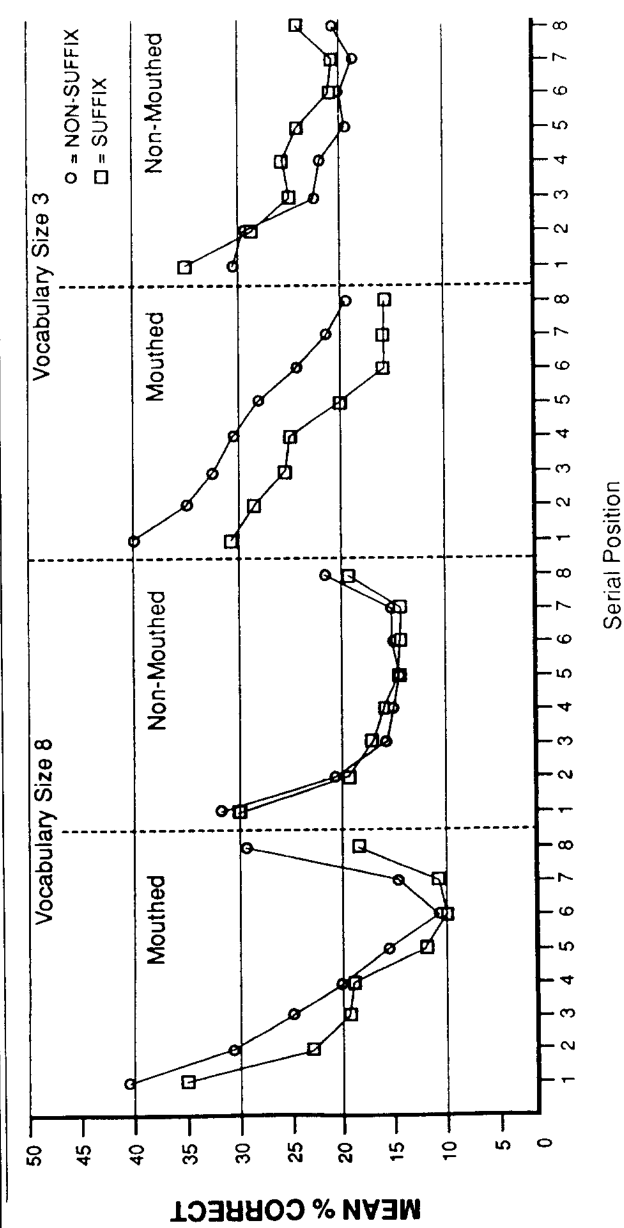

FIGURE 1. Mean percentage correct recall as a function of vocabulary size and mouthing condition for original stimulus letters.

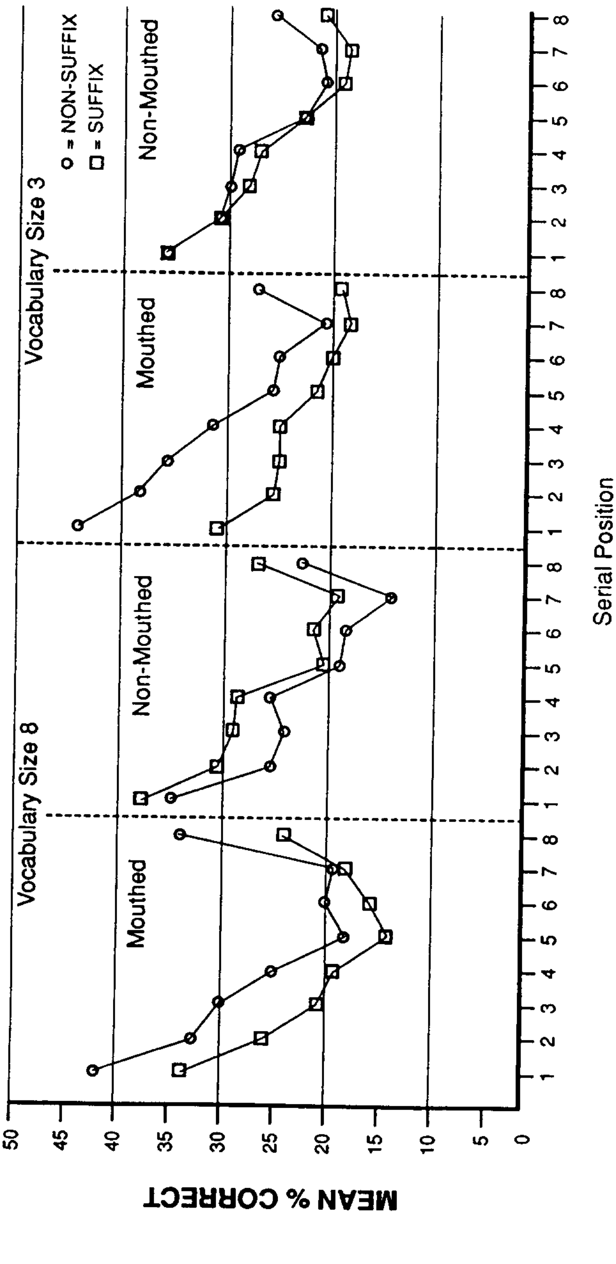

FIGURE 2. Mean percentage correct recall as a function of vocabulary size and mouthing condition for acoustically dissimilar stimulus letters.

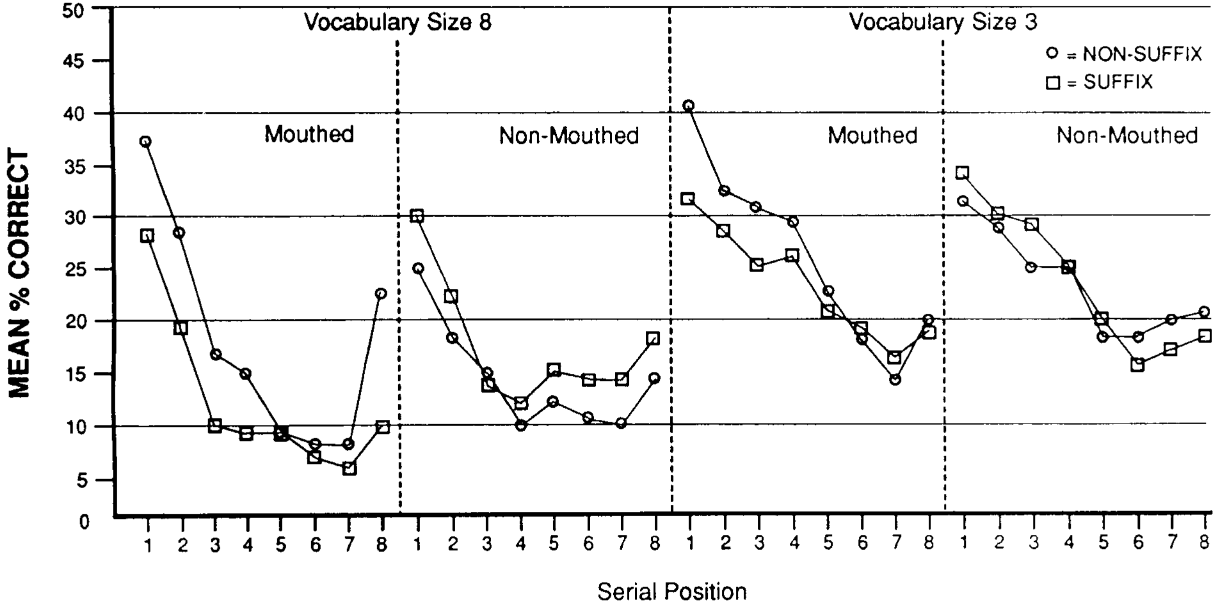

FIGURE 3. Mean percentage correct recall as a function of vocabulary size and mouthing condition for acoustically similar stimulus letters.

TABLE 1
Recency Effects (Mean % Correct Recall at Serial Position 8 Less That at Serial Position 7 in Nonsuffixed Condition) as a Function of Mouthing, Acoustic Similarity, and Vocabulary Size

	Vocabulary Size 8		Vocabulary Size 3	
Acoustic similarity	Mouthed	Nonmouthed	Mouthed	Nonmouthed
Dissimilar	16*	9	6	4
Original	15*	7	−3	3
Similar	15*	3	6	1

*$p < .005$.

TABLE 2
Suffix Effects (Mean % Correct Recall at Serial Position 8 in Suffix Condition Less Mean % Correct Recall at Serial Position 8 in Nonsuffix Condition) as a Function of Mouthing, Acoustic Similarity, and Vocabulary Size

	Vocabulary Size 8		Vocabulary Size 3	
Acoustic similarity	Mouthed	Nonmouthed	Mouthed	Nonmouthed
Dissimilar	10*	−4	8	5
Original	11*	3	3	−3
Similar	13*	−5	1	3

*$p < .005$.

effects, of course, could not occur in any condition unless recency occurred. If recency was present in the nonsuffix condition, then the possibility existed of reducing terminal position recall by adding a verbal suffix to the end of the list. Accordingly (Table 2), the suffix significantly reduced recency (i.e., suffix effects) when the letters were mouthed and drawn from a Size 8 vocabulary.

Over all serial positions, letters were recalled better from Size 3 (25%) than from Size 8 (19%) vocabularies, $F(1, 60) = 20.54$, $p < .0001$. Further, the vocabulary factor interacted with serial position, $F(7, 420) = 6.23$, $p < .0001$. However, the better recall of Size 3 than of Size 8 vocabulary items occurred at midlist positions rather than at the beginning or end of the lists and thus does not directly pertain to this investigation.

In summary, results showed that the important manipulation for obtaining mouthed recency and suffix effects in this experiment was vocabulary size. The effects were found with large, but not small, vocabularies. They were not dependent on the level of acoustic similarity. That is, whether the stimuli were original, acoustically similar, or acoustically dissimilar, recall of mouthed stimuli resulted in recency and suffix effects when drawn from a vocabulary of Size 8, but not Size 3.

Discussion

The theoretical question that motivated this experiment was whether mouthed and auditory recency and suffix effects are mediated by the same underlying resource. Findings from an earlier experiment (Turner et al., 1987) suggested that the two sets of effects may be mediated by different cognitive processes because they were not similarly affected by the same variables (i.e., phoneme condition and vocabulary size). Specifically, the size of the vocabulary from which list items were generated predicted the occurrence of recency and suffix effects with mouthed visual, but not with auditory, stimuli. Conversely, vocalized auditory *but not mouthed* effects were found dependent on phoneme condition but were independent of vocabulary size.

The data presented here clearly show that mouthed recency and suffix effects are dependent on vocabulary size whether list items are acoustically similar, dissimilar, or original. Sizable mouthed recency and suffix effects were found when the list items were generated from a Size 8 vocabulary, independent of the level of acoustic similarity. On the other hand, these effects were nearly nonexistent with Size 3 vocabularies, again at all levels of acoustic similarity. Therefore, the effects of vocabulary size found in Turner et al. (1987) were real and not confounded by the acoustic similarity of the list items.

Past research has demonstrated that *auditory* recency and suffix effects are dependent on acoustic similarity (Greene & Crowder, 1984) but independent of vocabulary size, in that the effects have been found with vocabularies of Size 3 (Greene & Crowder, 1984) and Size 8 (Crowder, 1976; Turner et al., 1987). Conversely, our findings have demonstrated *mouthed* recency and suffix effects with large, but not small, vocabularies regardless of the acoustic similarity among stimulus items. We contend, therefore, that mouthed recency and suffix effects are *not* mediated by the same psychological processes as the recency and suffix effects found with auditorily presented stimuli.

What then are the cognitive processes/resources that underlie mouthed effects found in immediate recall? We have argued that it is necessary to consider how mouthed items are processed in working memory (WM) as an approach to this question. In Baddeley's (1986) multicomponent WM theory, the memory codes for verbal, speech-based items, such as the target letters used in immediate serial recall, would be maintained in an articulatory loop by using a "refreshing" strategy to keep the memory codes from decaying over time. It has been suggested that the articulatory loop would be best conceptualized as one of many coding strategies that continually refresh memory codes for recall when needed (LaPointe & Engle, 1990; Reisberg, Rappaport, & O'Shaughnessy, 1984). The notion is that people code information in WM by activating the most economical strategy available in the performance of any particular task. It seems probable that the best strategy for coding mouthed information is different from that for coding auditory items. For example, using a coding strategy to maintain sound features would be useful for heard letters, but a coding strategy focusing on features of the mouthing movement needed to silently articulate would be more beneficial for mouthed items.

Although focusing on multiple structural components rather than coding strategies, Baddeley, Lewis, and Vallar (1984) have also argued that the WM system may need further "fractionation" based on whether memory items are presented auditorily or visually. They questioned whether articulatory suppression would differentially affect the finding of an acoustical similarity effect in the immediate serial recall of heard and seen items. When analyzing items that were heard, they found an effect of acoustic similarity that was consistent, that is, they found better recall of acoustically dissimilar than similar items, whether or not subjects articulated an irrelevant item. However, when items were presented visually the acoustic similarity effect disappeared during articulatory suppression; that is, articulating an irrelevant item during visual presentation did not decrease the immediate recall of similar, more than dissimilar, list items. Baddeley (1986) has suggested that the acoustic similarity effect may reflect a second phonological storage code, rather than the articulatory loop.

The available evidence, therefore, suggests that the coding strategy used for heard letters is affected by acoustic similarity but not by articulatory suppression or vocabulary size. On the other hand, these two variables, articulatory suppression and vocabulary size, may affect strategies used to code visual items. During articulatory suppression the coding strategy normally used for visual items must be unusable. But when articulatory suppression is not required, a visual strategy could be used to code mouthed target items, in which case the coding strategy would be affected by the size of the vocabulary from which the items are drawn.

Our finding of better recall from Size 3 than from Size 8 vocabularies provides additional evidence for the argument that different coding strategies underlie auditory and mouthed recency effects. Because each memory list consisted of eight items, letters drawn from Size 8 vocabularies did not need to be and were not repeated, but those drawn from Size 3 vocabularies were repeated in the first five serial positions. It is thus possible that the enhanced recall of Size 3 letters was due to item repetition within each list. Research has repeatedly shown that immediate serial recall improves when repeated list items are adjacent and is impaired when they are separated (e.g., Jahnke & Bower, 1986). This phenomenon, known as the *Ranschburg effect,* is generally attributed to the use of guessing strategies at recall (Greene, 1991; Jahnke & Bower, 1986). The guessing explanation assumes that subjects avoid using an item as a guess if that item had previously been recalled on the list. Further, Lee (1976) has suggested that a dual-coding strategy is used. The memory code for a target letter, whether repeated or not, and the "tag" for coding whether the letter was repeated in a list were hypothesized as two different codes attached to each of the list items.

In the studies we have cited above, which investigated the Ranschburg effect, repeated items, whether presented in adjacent or separated serial positions, were consistently repeated in the same two serial positions across all trials. In our experiments, a letter randomly drawn from any of the Size 3 vocabularies could be repeated in adjacent (1–5) or separated serial positions on each trial. Although each subject received a different random ordering of list items on each trial, more items were repeated in adjacent than separated serial positions on most trials. Thus, if the Ranschburg effect was operating in our findings, recall of repeated items (Size 3 vocabulary) should have been better than recall of nonrepeated items (Size 8 vocabulary), and that occurred. Recall of auditorily presented letters was also greater for letters from Size 3 than from Size 8 vocabularies in Experiment 5 of Turner et al. (1987). Yet the auditory recency reported in that experiment was independent of vocabulary size. The implication is that auditory recency is not affected by whether items in a list are repeated, but that item repetition does affect mouthed recency. Perhaps the dual-coding strategy suggested by Lee (1976) is available and useful in recall of heard and mouthed items at all serial positions. But when items are mouthed, the additional, visual-coding strategies that enhance mouthed recency are unavailable, or they overload the system.

In conclusion, we maintain that mouthing and auditory recency and suffix effects found in immediate serial recall are phenomena resulting from invoking different coding strategies in a WM system. Enhanced recall of mouthed end-of-list items requires the use of motor and gestural coding strategies in WM, strategies than can be affected by the dual-coding strategies used for repeated, early-list items, which in turn result in vocabulary size effects. The coding strategies used for immediate serial recall of auditory information, at least at the terminal position, appear to be tied *solely* to the processing of acoustic code that is not affected by vocabulary size but is affected by acoustic similarity within the working memory system. McDowd and Madigan (1991) have recently reported results that lead to the same conclusion. In several experiments those authors reduced visual interference, or varied the distinctiveness, including color and spatial location, of their visual stimuli. However, visual recency did not increase when the interference of background visual stimuli was reduced, nor when enhanced with visual sensory attributes, appearing instead to be independent of visual characteristics.

Results of recent studies in our lab have also shown that nearly eliminating extra-list visual interference does not affect the magnitude of visual recency (Turner, Johnson, McNamara, & Engle, 1992). Something more than the distinctiveness of information thus appears to determine recency in immediate recall.

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