

Effects of Different Terminal Sounds on Short-term Memory for Initial Consonant Sounds

If more items are presented than are to be recalled, the additional items produce a large amount of 'stimulus interference' in the recall of the remaining items¹. This is true under conditions where subjects have complete knowledge of the items that are not to be recalled, this knowledge being possessed by the subjects before, during, and after presentation of the list. Even though subjects know which items to ignore, they cannot ignore them completely, and therefore the extra presented items interfere with the memory trace for the items to be recalled.

The purpose of the present experiment is to investigate stimulus interference in short-term recall under conditions where the number of items presented is constant, but the items in some lists contain more phonemes or 'longer' phonemes than the items in other lists. As in the previous experiment, it is important to control for response interference by holding constant the amount to be recalled. In this experiment subjects are to recall the six initial consonant phonemes of a list of six artificial items, each item consisting of a consonant followed by a vowel (CV) or a consonant followed by a vowel and another consonant (CVC). Within any one list the terminal vowel or terminal vowel and consonant are the same for each item in the list. Some of the terminal vowels and consonants are 'longer' than others in temporal duration in ordinary English speech. The experiment described here is designed to determine: (1) whether items that consist of three phonemes (CVC items) produce more stimulus interference in the recall of the initial consonant of the items than items that consist of two phonemes (CV items); (2) whether temporally longer terminal phonemes produce more stimulus interference in the recall of initial consonants than shorter terminal phonemes.

Subjects listened to a 'ready' signal, followed after 1 sec by a list of six artificial items, followed immediately by recall of the six initial consonant phonemes. Correct recall consisted of filling-in six boxes with the correct consonants in the correct order. Presentation of the artificial items was at a rate of two items/sec, and 15 sec was provided for recall. There were six conditions, each with four sub-conditions. The six conditions are six different types of lists, each type of list being a list consisting of one type of item: (SV) consonant followed by a short vowel ('a' as in father, 'e' as in let, 'i' as in bit, or 'u' as in but), (LV) consonant followed by a long vowel

Table 1. ERRORS IN ORDERED RECALL OF INITIAL CONSONANTS (%)

Type of terminal	Terminal phonemes			Mean
	V	V + k	V + z	
Vowel (V)				
Short (SV)	41.5	44.2	45.3	43.7
Long (LV)	39.2	47.5	45.3	44.0
Mean	40.3	45.8	45.3	43.8

(‘ā’ as in made, ‘ē’ as in eat, ‘ī’ as in bite, or ‘ō’ as in hope), (SV + k) consonant followed by a short vowel followed by the short consonant ‘k’, (LV + k) consonant followed by a long vowel followed by the short consonant ‘k’, (SV + z) consonant followed by short vowel followed by the long consonant ‘z’, (LV + z) consonant followed by long vowel followed by the long consonant ‘z’. A typical list of items in condition (SV + k) was as follows: pak, dak, gak, vak, bak, kak. The four subconditions in each condition are the four possible vowels that can be used in each condition. The order of presenting the $6 \times 4 = 24$ conditions was random in blocks of 24, and there were 5 blocks in the experiment, making a total of 120 experimental lists. Each experimental list contained six different initial consonants chosen from the following set of 13 consonants: b, d, f, g, k, l, m, n, p, s, t, v, z. Scattered at random through the experimental lists were 15 lists with some initial consonants appearing in more than one item in the list: 5 with one item repeated once, 5 with two items repeated once, and 5 with three items repeated once. The purpose of this was to prevent any strategy based on a belief that no initial consonant was ever repeated. Subjects were 39 M.I.T. undergraduates taking psychology courses who participated in the experiment as a part of their course requirements.

As given by Fletcher² the duration of the different short and long vowels and consonants is as follows: a (0.306 sec), e (0.219 sec), i (0.211 sec), u (0.280 sec), ā (0.305 sec), ē (0.341 sec), ī (not given), ō (0.325 sec), k (0.075 sec), z (0.230 sec). The average duration for these short vowels is 0.254 sec and for the long vowels is 0.324 sec. Obviously, the absolute duration of each sound depends on the rate of talking; what is important for our purpose is the relative durations of the sounds.

Scoring each item in each list as one opportunity for error yielded the ordered recall error rates for each condition that are reported in Table 1. The results are quite clear. Neither terminal vowel duration nor terminal consonant duration had any effect on recall. Increasing the number of terminal phonemes from two to three by adding a single terminal consonant consistently increased

Table 2. ‘k’ AND ‘z’ INTRUSIONS (% OF OPPORTUNITIES FOR ERROR)

Type of intrusion	Terminal phonemes					
	SV	LV	SV + k	LV + k	SV + z	LV + z
‘k’	2.3	3.2	2.6	3.1	2.7	3.5
‘z’	2.7	1.4	2.2	3.3	2.5	1.6

1 Selzer, L. K., and Wickekgren, W. A., *Nature*, 200, 1239 (1963).
2 Fletcher, H., *Speech and Hearing in Communication* (Van Nostrand: Prince-
ton, 1953).

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produces the interference.

consonant phoneme, not its temporal duration, that
However, it is clear that it is the presence of an extra
to decide between these possibilities at the present time.
sonants at the time of recall, or both. It is not possible
trace which competes with the traces for the initial con-
the initial consonants, or it may establish its own memory
terminal consonant may weaken the memory traces for
terminal consonant, they cannot do so completely. The
Even though subjects know they are to ignore the
consonant.

consonant is not reflected primarily in intrusions of that
It is clear that the stimulus interference of the terminal
or the 'z' intrusion rate between 'k' and 'z' conditions.
respectively. There is no significant difference in the 'k'
and 'z' intrusions is not specific to 'k' and 'z' conditions,
by about 5.2 per cent. Furthermore, the increase in 'k'
about 0.8 per cent, whereas the total error rate increases
LV to SV + k, LV + k, SV + z, and LV + z amounts to
increase in the rate of 'k' and 'z' intrusions from SV and
shows that this is definitely not the case. The tiny
initial consonants and greatly increases the frequency of
'k' or 'z' intrusions in 'k' or 'z' lists, respectively. Table 2
that in the lists with terminal consonants the terminal
'k' or 'z' keeps popping into mind during recall of the
initial consonants and greatly increases the frequency of
'k' or 'z' intrusions in 'k' or 'z' lists, respectively. Table 2
One possible explanation of the foregoing result might be

0.001 level.
a terminal consonant was significant at well beyond the
overall difference between conditions with and without
($P < 0.001$) and less than that in LV + z ($P < 0.001$). The
condition LV was significantly less than that in LV + k
less than that in SV + z ($P < 0.02$). The error rate in
was significantly less than that in SV + k ($P < 0.05$) and
to the 39 difference scores. The error rate in condition SV
the Wilcoxon Matched-Pairs Signed-Ranks test applied
differences between any two conditions were tested using
each condition was computed for each subject, and
the error rate for initial consonants. The error rate for