DOCUMENT RESUME

ED 117 146 TM 005 000

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TITLE Speed of Oral and Written Responding.
SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE [75]
NOTE 10p.
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EDRS PRICE MF-$0.76 HC-$1.58 Plus Postage
DESCRIPTORS College Students; Comparative Analysis; *Handwriting; Memory; *Oral Communication; *Response Mode; *Task Performance; *Time; Verbal Learning

ABSTRACT

Subjects were given three trials to speak and to write as fast as they could both the alphabet and a set of two-digit numbers. The speed or oral responding was approximately 6 syllables per second for letters and 7 syllables per second for digits. The speed for writing was approximately 2 items per second for both digits and letters. Correlations between tasks within the same mode were all significant; correlations between modes on the same task were usually not. Implications for research in verbal learning and memory are discussed. (Author)

Speed of Oral and Written Responding

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Running Head: Speed of Oral and Written Responding

In research on verbal learning and memory, responses are usually oral or written. A number of experiments have provided information about the maximum speed of these responses. For oral responses, average speeds of 5 to 8 syllables per second have been reported when instructions have been to say the alphabet as fast as possible (Landauer, 1962; Weber and Bach, 1969; Weber and Castleman, 1970; Weber, Kelly and Little, 1972), and approximately 10 syllables per second when instructions have been to speak aloud two-digit numbers as quickly as possible (Landauer, 1962). In addition, Landauer (1962), Weber and Bach (1969) and Weber and Castleman (1970) have all demonstrated that saying the alphabet to oneself occurs no faster than saying it aloud. Results such as these have been used to estimate the rate at which subjects are able to process information (cf. Neisser, 1967, p. 43; Posner, 1974, p. 112; Sperling, 1967, P. 287).

Information about the rate of written responding has been reported by Provins and Glencross (1968) and by Weber, Kelley and Little (1972). Both experiments showed that when subjects were instructed to write the alphabet as fast as possible, an average speed of approximately 2 items per second was attained.

In the present study, we obtained data for each subject for both written and oral responding on the alphabet and on a set of two-digit numbers (viz. 31-60). This enabled us to compare directly, as did Weber, Kelley, and Little (1970), the speed of responding in the two modes and to determine both the extent to which performance in one mode is related to performance in the other, and the relationship between performance on the two tasks within the same mode. Three trials were given on each task in each response mode.

Method

Subjects and Design. The subjects were twenty-six male undergraduates enrolled in the introductory psychology course at North Carolina State University. For 14 subjects (Group W), the written mode was first on each task and for 12 subjects (Group O), the oral mode was first. For all subjects, the alphabet task preceded the digit task. Data are not included for six additional subjects who did not follow instructions (e.g., who omitted or added items) or who did not use the same writing style (i.e. lower-case print or script) on all trials.

Procedure. Subjects were run individually. Each was given three trials to produce the alphabet, and then the digits 31-60 as fast as he could. There were intervals of 10 sec. between trials on each task, about 30 sec. when modes within a task were changed, and about 30 sec. when tasks were changed. The oral responses were tape-recorded.

For the written mode, each subject was instructed to produce the alphabet (either in print or script) on a single line using lower-case letters and to produce the digit pairs in a column from top to bottom, one two-digit number per line. A stopwatch was used to record the time to the nearest .1 sec.

Results

Half the subjects (5 in Group W and 8 in Group O) wrote the alphabet in script and half (9 in Group W and 4 in Group O) printed it. Since there were no differences in performance within a response mode for these subjects, their data have been combined. Table 1 presents the mean and standard deviation for each group on each trial.

Insert Table 1 about here

These data show that for both groups, the mean speaking speed on the third trial (usually the fastest) was approximately 6 syllables per second for the alphabet and approximately 7 syllables per second for digits. The writing speed on the third trial for both groups was approximately 2 items per second with letters and with digits. For each subject on each task, the speaking rate was faster than the writing rate.

To study the relationship between performance on the two tasks within each mode, as well as performance between modes within each task, rank-order correlations were done for each group. For each subject, the fastest of his three trials on each task-mode combination was used. Data for all subjects within a group were used in determining the correlations for the group.

For each group, the correlation between tasks within each mode were all significant ($p < .01$). For Group W, the correlation for written responding was .691 and for oral responding .770; for Group O, the corresponding values were .811 and .787. The relationship between response modes within subjects was substantially lower. For Group W, the correlation on the alphabet task was .094 and on the digit task -.015, whereas for Group O, the comparable values were .459 and .727. Only the last is significant ($p < .01$).

Discussion

The results of this experiment combined with those of Provins and Glencross (1968) and of Weber, Kelley and Little (1972) indicate that the writing

speed for the alphabet and for digits is approximately 2 items per second. Faster speeds for digits might have been obtained in this experiment, had subjects been permitted to write more than two digits on a line. Faster speeds may also have been obtained for letters, had highly familiar words been used since their letter sequences may have been easier to produce than some of those of the alphabet.

The speaking speed for letters obtained in this experiment falls within the range of those obtained in other experiments (i.e. 5 to 8 syllables per second). For digits, however, the speed (i.e. 7 syllables per second) is somewhat less than the 10 syllables per second reported for Landauer's typical subject.

In both this and Landauer's experiment, oral performance was somewhat faster on digits than on the alphabet. The greater speed for digits could derive from greater repetition on the digit task (e.g. in counting from 40 to 49, "forty" is spoken 10 times), and perhaps concomitantly longer sequences between pauses (larger chunks?) than on the alphabet task. We have no suggestions other than possible population differences to account for the differences in speed between experiments either for letters or for digits.

The significant correlations between tasks for each mode suggest that speaking speed and writing speed are each relatively stable. The remaining correlations suggest, however, that speed of writing and speed of speaking may be relatively independent of one another.

The procedure and the results of this study appear to have implication for research on memory, particularly where responses are paced. The information about writing speed could prove useful in deciding on the time to allow

on tasks requiring written responding and in interpreting the results of experiments using such tasks. For example, in a free recall experiment (Shapiro and Ponce, 1970), some subjects were paced at a 2-sec rate during the written recall tests. Since the words on the list varied from 4 to 10 letters, the results of the present experiment suggest that some of their subjects may have had difficulty completing the longer words during the 2-second interval. The same may have been true for some of the subjects in the experiment of McCullers and Haller (1972) in which list items varied in length from 3 to 9 letters.[1]

It may be desirable to use a procedure like that described here to obtain information about how long it takes to write or speak the items to be chosen for a particular experiment. For example, when several lists are to be used in the same experiment, whether within- or between treatments, the time to speak or write each list might be obtained and its relationship to the major dependent variables might then be determined. It is possible that response-speed would be a useful measure for matching lists to be used in an experiment, or in helping explain the results of an experiment in which the list for one treatment took longer to produce than the list for another treatment (cf. Newman and Williams, 1967).

A final suggestion derives from the positive correlations observed between the two tasks within each response mode. If response speed is found to be related to performance on a particular task, it might be desirable to assign subjects to treatments in experiments in which that task is to be used, on the basis of their response speed in the mode to be used in the experiment. Study of the relationship between response speed for each mode and performance on various experimental tasks in which that mode is to be used seems indicated.

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Footnotes

This research was supported by the National Science Foundation under Grant GB-6044. The paper was prepared by the senior author during tenure of an Honorary Research Fellowship at Birkbeck College, University of London. We appreciate discussion with and comments by George Allen, Margaret Cooper, Jeffrey Frederick, Michael Goodman, David Legge, Mary McGraw and Donald Mershon.

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[1]Differences between items in production time may be used by subjects as a basis for deciding both on the order in which items are to be learned, and on the order the items are to be produced on test trials.

Table 1

Speed (in sec.) of Oral and Written Responding on Each Trial

Group[a]		Alphabet						Digits					
		Written Trials			Oral Trials			Written Trials			Oral Trials		
		1	2	3	1	2	3	1	2	3	1	2	3
W	M	14.8	13.3	12.7	5.3	4.9	4.8	29.4	28.7	28.8	13.0	13.1	12.6
	S.D.	2.80	1.54	1.45	1.21	1.07	1.15	2.06	2.31	2.52	2.14	1.89	1.67
O	M	15.8	14.0	13.4	5.8	5.2	5.0	30.9	30.8	30.7	12.9	12.6	12.6
	S.D.	3.23	1.72	1.45	1.54	1.06	1.04	4.67	5.38	4.88	1.53	1.30	1.46

[a]Please see text for explanation.