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HOMOGRAPHS IN A SEMANTIC CONTEXT. STUDIES IN ORAL READINGS, VII. PRELIMINARY DRAFT.

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THE EFFECTS OF SEMANTIC CONTEXT ON THE VERBAL REACTION TIMES OF CHILDREN READING HOMOGRAPHS WERE STUDIED BY A COMPARISON OF THE EFFECTS OF WORD OR LETTER CUES PRECEDING THE HOMOGRAPHS TO BE READ. THE INVESTIGATOR DEVISED TWO EXPERIMENTAL WORDLISTS CONTAINING HOMOGRAPHS PRECEDED BY ONE-WORD, SEMANTICALLY SIMILAR NONHOMOGRAPHS AND TWO CONTROL LISTS CONTAINING THE SAME HOMOGRAPHS IN ISOLATION OR PRECEDED BY A MEANINGLESS CONSONANT. THE CUE-HOMOGRAPH COMBINATIONS WERE PROJECTED ON THE SCREEN ONE ITEM AT A TIME. THE TIME LAPSE BETWEEN THE VISUAL PRESENTATION OF THE ITEM AND THE VERBAL RESPONSE OF THE SUBJECT WAS MEASURED, AND THE REACTION TIMES FOR EACH OF THE FOUR LISTS WERE COMPARED. THE SUBJECTS REACTION TIMES FOR THE EXPERIMENTAL LISTS WERE SIGNIFICANTLY FASTER THAN FOR THE CONTROL LISTS. THE RESULTS INDICATED THAT THE SHORTER VERBAL RESPONSE TIMES RESULTING FROM THE PRECEDING SEMANTIC CUES DID NOT RESULT FROM A PRIMING EFFECT RESULTING FROM A PRECEDING STIMULUS. THE AUTHOR CONCLUDED THAT A PRECEDING STIMULUS MUST BE MEANINGFUL, EITHER GRAMMATICALLY OR SEMANTICALLY, TO FACILITATE THE READING OF WORDS. (AL)

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Studies in Oral Reading:

VII. Homographs in a Semantic Context[1]

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A homograph is a written word with at least two possible pronunciations each with its particular meaning depending on the context in which the homograph appears. For example, the homograph sow can be read as either /sow/ or /saU/ depending upon whether the context requires a verb meaning the placing of seeds in the ground, or a noun meaning a female pig. When words like sow are presented without a context and subjects are asked to read them aloud, the dual meanings and sounds are reflected in longer reaction times. It takes people longer to read the homograph than a comparable non-homograph word (Levin and Ford,1965.) When the homograph is placed in a grammatical context, e.g., the sow or to sow, subjects are able to respond to the word faster (Levin, Ford, and Beckwith, 1965), indicating that grammar is a potent cue in the resolution of the ambiguity.

Several researchers have investigated the effects of preceding semantic contexts on the reaction times to words. Ford (1952) anticipated a reduction in the latency of free associations to a word if a synonym to that word had previously been presented. However, his results indicated

1/ This research was supported by funds from the U.S. Office of Education.

that the synonym context was associated with a delay in association, as compared to a no context condition. In a later study, Cofer and Shepp (1957) found a reduction in the perceptual recognition time when the test word had been preceded by a synonym. The contradictory results in the above studies could be a function of different response measures.

Our purpose in the present study is to follow-up the preceding study (Levin, Ford, and Beckwith, 1965) in which we demonstrated the facilitating effect of a grammatical context. This study investigates the effects of semantic contexts on the reaction time to the reading of both homographs and non-homographs.

Method

Subjects. 44 female Cornell undergraduates volunteered for the experiment. All Ss were tested by one male E.

Stimuli. The basic stimuli for this study consisted of 17 homographs with a matched non-homograph control word for each form of a homograph. The control words were matched with the homographs on the following characteristics: (1) number of letters, (2) number of syllables, (3) initial consonant, and (4) frequency as defined by the Thorndike and Lorge G scale.

Following selection of control words, each member of each homograph-non-homograph pair was placed in the context of a single preceding frame word. The frame words were either synonyms of the test words or a word within the same general response class. Examples of synonyms used as frame words are, TINY-MINUTE, COIL-WIND, and OWN-POSSESS; examples of context within the same response class as the test words are, ROBIN-DOVE, CRY-TEAR, and RUN-WALK.

Two word lists were compiled from the 34 homograph non- homograph word pairs. A list contained a homograph in one form only; the other form appeared in the second list. When completed a list consisted of 17 homographs and 17 non-homograph controls all placed in separate semantic frames. This made the total number of words in each list 68.

Two other word lists were constructed for control purposes. In a previous study (Levin, For, and Beckwith, 1965), we found a faster latency for words presented in grammatical frames. It is possible that the first member of a pair, i.e. the grammatical frame, served as a ready signal for the test word and was instrumental in lowering the latency. To control for this possibility, the test words in one of the semantic lists were placed in a meaningless frame, consisting of one of the following consonants: N, L, W, X, F, S, M, or H.

The second control list contained the same test words as were used in the consonant frame list, but no context was provided in this list. The test words were presented in isolation.

In summary, four word lists were constructed each consisting of 17 homographs and 17 matched non-homograph control words. Two of the lists contained the test words placed in a meaningful context (MFC1 and MFC2). A third list contained the same test and control words as were used in MFC2 but with a context consisting of a "meaningless" consonant (MLC). The last list contained the same homographs and non-homographs as were used in lists MFC_2 and MLC but with no context (NC).

Test procedure. Each stimulus word was typed on a separate 2 x 2 slide in upper case pica and presented with a Kodak Carousel Projector. Ss were assigned to one of the four word lists in the order in which they appeared for the experiment. All testing was done individually and tape recordings were made of the complete session.

The test words were presented in random order with each homograph and non-homograph immediately preceded by the appropriate frame word. Order was the same for all lists. A constant interstimulus interval of three seconds was used in word list NC while two different interstimulus intervals[1/] were used in the other three lists. A two second interval was used between pairs. Prior testing had disclosed that when stimuli were presented at a constant interval, Ss found it difficult to keep track of the pairs. The two and three second intervals enabled Ss to read the words in pairs and still left them enough time to respond without being pressed.

During the presentation of stimuli the Ss were seated ten feet from the screen and three feet directly behind the projector. The front of the projector was six feet from the screen which made it possible to project stimulus words 2 1/2 inches in height. The experimenter sat on a line even with the projector and about three feet to the right of the S.

Once S was seated, the following instructions were given:

> I am goint to project some words on this screen. The words will be real. They will be words that you have probably used or could use in everyday conversation. As each word appears, please say it. The words will be presented in pairs with one word following

1/ Two interval timers in series were used to activate the projector.

the other. For example this could be a pair. (At this point MALE was presented and then two seconds later MAN was projected.) Your task will be to say each word as it appears keeping in mind that the words go together. I'll project two pair of words this time at the pace that will be used throughout the remainder of the list. Please say each word as it appears. (At this point TELL was projected and two seconds later SAY was projected. After SAY had been displayed for three seconds during which S had responded, HUGE the frame word for the next pair was presented. After two seconds BIG was presented.) The pace throughout the remainder of the list will be the same as it was with the two pair I just projected. Remember, all you have to do is say each word as it appears, keeping in mind that the words go together in pairs.

For Ss assigned to the NC list the following instructions were given: "I am going to project some words on this screen. The words will be real. They will be words that you have probably used or could use in everyday conversation. As each word appears, Please say it." S was then shown three demonstration words MAN, SAY and BIG. S was also informed that the pace was the same as would be used throughout the remainder of the list.

When certain that S understood the instructions, E proceeded through the list without stopping.

The tapes were later played through a rectifier into a Brush Recorder. Auditory input from the tape recording activated a recording pen producing a visual representation on graph paper. When no sound was present the pen was inactive and traced a straight line on the recording paper. By measuring the straight line between onset of visual stimulus[2] and onset of S's vocal response, it was possible to determine the latency to each stimulus word. All false starts, vocal segregates, etc. were included

2/ Onset of stimulus was indicated by a characteristic sound (and later visual pattern) made by the projector when the slide dropped into place.

as part of the response latency. Latencies were recorded in millimeters and later transformed according to the following formula: $x = \log(y-8)$, where x = transformed score, and y = latency in millimeters.

RESULTS

It will be remembered that two word lists with a meaningful context were included in this investigation. Both lists were the same except for the form of the homograph included and some control word which were different because of matching difficulties. The adequacy of our homograph-non-homograph matching was evaluated by an analysis of variance, with the classifications, MFC1 vs MFC2 and Homograph vs Non-homograph (Cf. Table 1 for relevant means). The only significant effect is that attributable to Homographs vs Non-homograph ($F = 14.437$; 1/32 df, $p < .001$).

This significant homograph effect replicates our earlier findings and also suggests that our matching procedures were reliable. The absence of a difference between MFC1 and MFC2 suggests that our selection of a meaningful context for each form of a homograph and its control word, was equivalent for both meaningful lists. Because of this equivalence and since the same homograph forms were used in the MFC2, MLC and NC word lists, the NFC1 list was dropped from further analyses.

The effect of context was initially evaluated using two analysis of variance classifications, word type (homograph and non-homograph) and context. There were three levels of context, meaningful (MFC), meaningless (MLC), and none (NC). Again as in previous studies, non-homograph are responded to faster than homographs ($F = 8.73$; 1/32 df, $p < .01$).

The effect attributable to context was also significant ($F = 9.92$; 2/64 df, $p < .001$) with MFC latencies lower than those in the MLC condition which in turn were lower than the NC latencies. The interaction between the two main effects was not significant ($F = 1.08$; 2/64 df). (Cf. Table 1 for relevant means.)

Following the above analysis, it was discovered that the mean log. latencies for the present NC condition were almost the same as the means for the same condition used in a previous study (Levin and Ford, 1965). In fact, the homograph means were the same while the non-homograph means were 91.88 in the present study and 91.30 in the earlier study (Cf. Table 1). The earlier isolation study had been conducted concurrently with our previous grammatical context study (Levin, Ford, and Beckwith, 1965) and had in fact been used as a control for the effects of grammar. Since the two earlier studies had been considered comparable and since the earlier isolation study and the present NC condition appeared to be comparable, it seemed reasonable to compare the grammatical context with the three context conditions used in the present investigation. This post hoc comparison is further supported by the fact that the two earlier studies simultaneously drew Ss from the same subject pool and one subgroup from each study consisted of females tested by the same E of the present study.

Two other factors supply additional support to the comparability of the two types of context. First, although the previously mentioned subgroup of 11 females in the grammatical frame study received 24 test homographs and control words, the same 17 homograph forms that were used in the present investigation appeared among the previous 24 and in the same order as they appeared in the present study. Only two control words were different and these satisfied the same criteria of selection. Secondly, rank-order correlations of latencies between the earlier investigations and the present study were all significant. The correlation between the MFC homographs and the same words previously placed in a grammatical context was .49 ($p < .05$). For non-homograph control words the correlation was .68 ($p < .01$). The present NC condition and the previous isolation condition correlated .64 ($p < .01$) for homographs and .69 ($p < .01$) for the 17 non-homographs.

Table 1

Means (Log.)

	MFC1	MFC2	MLC	NC	G 1/	I 2/
Homo.	98.12	95.35	97.06	100.88	91.79	100.88
Non-h.	86.65	87.35	91.29	91.88	86.80	91.30

1/ Grammatical context (Levin, Ford & Beckwith, 1965)
2/ Isolation (Levin & Ford, 1965).

Weighing both the pros and cons of a post hoc comparison, we felt justified in comparing the earlier grammatical context condition with the present context conditions. The supplemented data were analyzed by analysis of variance using the same model as was previously used, the only change being 4 levels of context instead of the previous three. As expected the results were the same as were found in the previous analysis.

Non-homographs are again responded to faster than homographs ($F = 8.96$; 1/32 df, $p < .01$). Type of context was also significant ($F = 11.89$; 3/96 df, $p < .001$) while the interaction between the two main effects does not reach a significant level ($F = 1.06$; 3/96 df). The means, as would be expected from the non-significant interaction, are ordered in the same direction for both homographs and non-homographs (cf. Table 1). For both word types the shortest latencies are under the grammatical (G) condition with MFC next in order and followed by the MLC context which is in turn followed by the slowest condition, NC. The Tukey method was used to test the significance of the differences among the appropriate means (cf. Table 1). These differences and the results of the Tukey test are presented in Table 2.

Table 2

Log. Differences[1/] Among the Four Context Means

	Homograph					Non-homograph			
	G	MFC	MLC	NC		G	MFC	MLC	NC
G	--	3.59	5.30*	9.12**	G	--	.59	4.53	5.12*
MFC		--	1.71	5.53*	MFC		--	3.94	4.23
MLC			--	3.82	MLC			--	.59
NC				--	NC				--

1/ A difference of 4.77 is necessary to attain the .05 level of significance while a difference of 5.84 is significant at .01.

*p < .05 **p < .01

It is immediately apparent that either of the meaningful contexts are sufficient to reduce the decoding latency to homographs. Both meaningful contexts are superior to no contexts while only the G context is effective when compared to homographs placed in a meaningless context (MLC). The MLC condition is not significantly different from the NC condition, but the difference is large enough to be suggestive. The same situation holds for the difference between the two meaningful context conditions. Although not significant, the difference is suggestive.

When non-homographs are considered, grammar is the only context that significantly reduces the latency. There is obviously no significant difference between the two meaningful conditions nor is there any difference between a meaningless context and the no context condition. Neither of the meaningful contexts are significantly different from the meaningless context but both approach statistical significance and are in fact significant when the less conservative Dunnett test is used. The MFC - NC difference is also significant using the Dunnett test.

The differential effects of the various context conditions on homographs and non-homographs was assessed by conventional t-tests. Although the interaction between context and word type was not significant, the graph presented in Figure 1 does suggest a differential effect between context and the two word types. For example, the slope of the homograph curve between the MFC and G conditions appears to be steeper than the slope for non-homographs. This in fact is the case ($t = 2.14$; 16 df, $p < .05$) which suggests that grammar more effectively reduces the latency to homographs than to non-homographs. The difference between the two curve slopes between the isolation and CP conditions was also tested. The difference does prove to be significant ($t = 2.46$; 16 df, $p < .05$) suggesting that homographs are more affected by the single consonant context than are the non-homograph control words.

DISCUSSION

It is apparent that both grammatical and semantic contexts facilitate the reading of words. The results from the meaningless context condition demonstrate that this facilitation does not result from a "priming" effect resulting from any preceding stimulus. The preceding stimulus must be meaningful, either grammatically or semantically.

The semantic context used in this experiment is comparable to the synonym context utilized by Cofer and Shepp (1957). As mentioned earlier, these investigators demonstrated facilitation in the recognition of the second member of a word pair if the first member was a synonym to the word to be recognized. On the basis of this result Cofer and Shepp inferred that "facilitation of recognition will occur in stimuli other than a practiced stimulus if there is some direct associative and/or meaningful connection." We feel that our semantic context proved to be facilitating for essentially the same reason. It will be remembered that either synonyms or words in the same general response class as the test word were used as context words.

Although "associative and/or meaningful connections" are apparent in the semantic condition, these relationships are less obvious in the grammatical condition. An associative mechanism does not seem applicable to grammatical facilitation. Cofer (1965) has commented on this problem as it is related to the free-recall of categorized adjective-noun word pairs and concludes that "we need more information."

We agree with Cofer but also feel that Braine's (1963 and 1966) work on contextual generalization is related to this problem. Braine finds that ten-year old subjects, after a relatively brief exposure period to an artificial language, are able to generalize the correct temporal position of the words used in the language. When Braine asked his subjects why they gave the correct response, a common reply was "that it sounded right." Although the subjects had never heard the particular utterance before, they were able to respond correctly if the temporal position of the words remained constant.

This is precisely the case in our grammatical frame condition. Subjects were presented with word sequences that maintained the temporal order normally found in English. The pairs, if you wish, "sounded right", the pairs conformed to common words sequences.

In summary, this study has shown that single words can be read faster if they are preceded by another semantically or grammatically related word. The same results were found with both homographs and non-homographs, with a greater effect demonstrated using homographs. The facilitating effect of semantics was discussed in terms of "associative and/or meaningful connections", and the effect of grammar was discussed in terms of familiarity with normal English word order.

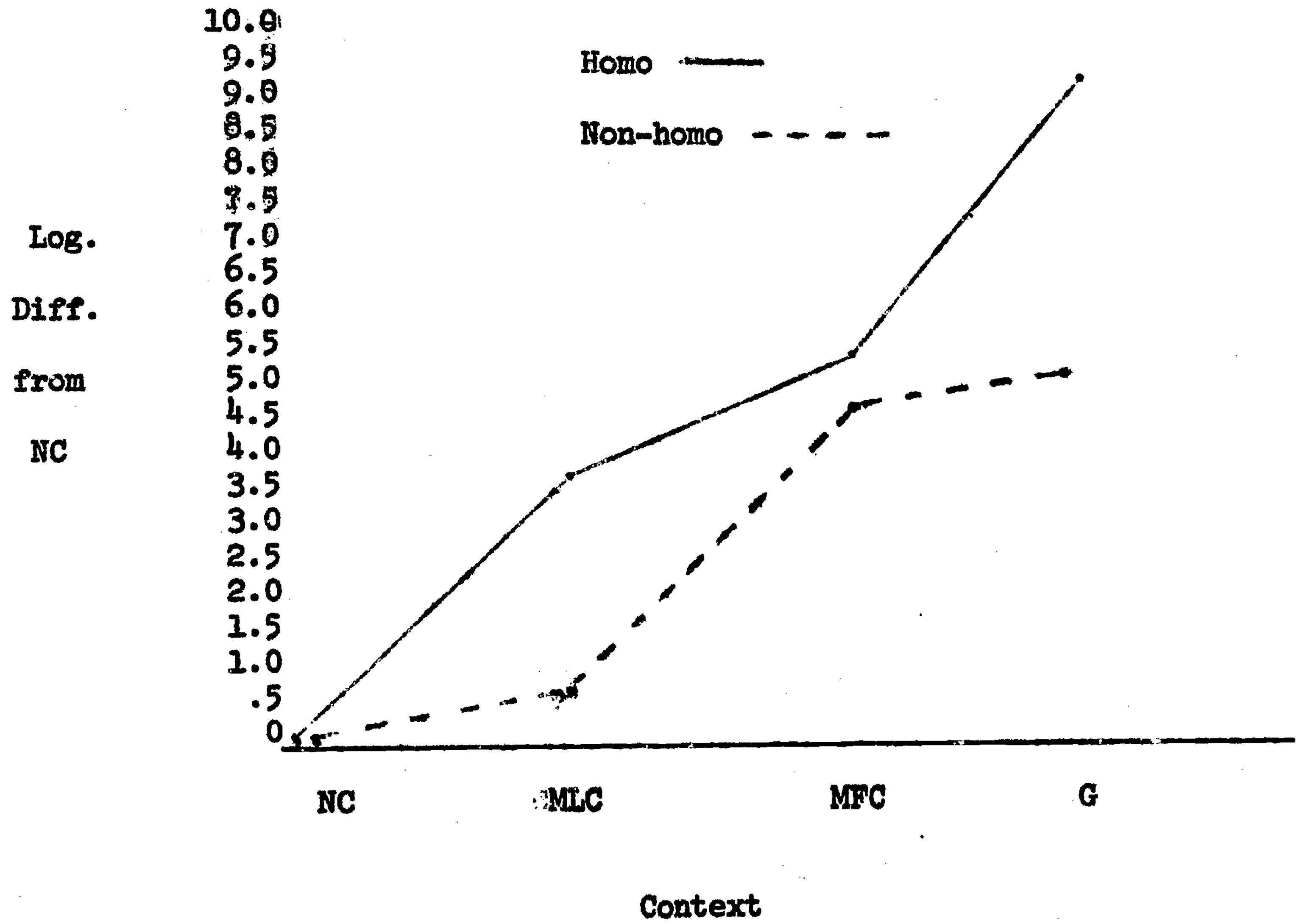

Figure 1.

Logrithm differences of each context condition from the NC condition.

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