DOCUMENT RESUME

ED 030 108 24 AL 001 953

By-Seibert, Warren F.; And Others
Memory for Simple Sentences Printed and Spoken. Final Report.
Purdue Univ., Lafayette, Ind. Audio Visual Center.
Spons Agency-Office of Education (DHEW), Washington, D.C. Bureau of Research.
Bureau No-BR-7-E-085
Pub Date Feb 69
Grant-OEG-0-8-070085-0199-010
Note-37p.
EDRS Price MF-$0.25 HC-$1.95
Descriptors-*Cognitive Processes, Data Analysis, *Kernel Sentences, *Memory, Performance Tests, Recall (Psychological), Transformations (Language), *Verbal Learning, Verbal Tests, *Word Frequency

This verbal memory study considers only simple sentences and examines learner performance under the two conditions of audio presentation and printed presentation. Learner performance is compared when required either to recognize sentences identical to those in the original list or, alternatively, to recognize non-identical sentences incorporating the gist of the original sentences but with one or more of the original words replaced by synonyms. In addition, memory for simple, active, declarative sentences is compared with that for each of the principal transformations--from active to passive, from affirmative to negative, and from declarative to either interrogative or exclamatory. Finally, since there is growing ambiguity with respect to word frequency as a factor in remembering, three levels of sentence subject word frequency are included. Subjects used were 87 university freshmen. Results suggest that: (1) memory for spoken language and for print share much of the same effect, (2) memory for interrogatives is somewhat facilitated when such sentences are also in the active voice, but there is little effect or none when they are passive, and (3) word familiarity, indexed by frequency of use, is not always the aid in sentence recall, or at least in recognition, as was thought. (DO)

MEMORY FOR SIMPLE SENTENCES: PRINTED AND SPOKEN

FINAL REPORT
February 1969

By

Warren F. Seibert, J. Christopher Reid,
and Stephen A. Brown

Instructional Media Research Unit
Audio Visual Center
Purdue University
Lafayette, Indiana

Grant Number OEG 0-8-070085-0199-010
United States Office of Education
Department of Health, Education and Welfare

MEMORY FOR SIMPLE SENTENCES: PRINTED AND SPOKEN

FINAL REPORT

FEBRUARY 1969

By

Warren F. Seibert, J. Christopher Reid, and Stephen A. Brown

Instructional Media Research Unit

Audio Visual Center

Purdue University

Lafayette, Indiana

Grant Number OEG 0-8-070085-0199-010

United States Office of Education

Department of Health, Education and Welfare

Introduction

It seems regrettable that so little educationally relevant research or, alternatively, so little relevant educational research has developed from the view that most instruction must proceed essentially one sentence at a time. It can be well argued that most instruction, and certainly most that is found in the middle grades and beyond, is spun off as a practically endless series of more or less grammatical sentences. Whatever the specific effects of instruction are, most have their origins in a relatively few sentences which probably serve as reinforcers or as mediators-guides of learner conduct.

There is both a shortage of earlier, relevant research and until recently, a prevailing attitude which was unsympathetic toward change of the accustomed research patterns. Instructional and training research studies dealt most often with two or more broad and undefined instructional conditions, the effects of which were then compared. No matter what these comparisons showed (and overwhelmingly they showed no reliable differences), the underlying causes of the observed results could only be crudely surmised. Now, and especially in the last five to ten years, there has been some change in the prevailing attitude and a greater interest in the detailed characteristics of instruction. This interest is not yet a uniform concern with the language of instruction, nor does it always reflect the view expressed above, but it does represent an important change nevertheless.

Like so many customs which grow more intricate and ritualized with time, if the earlier patterns in instructional

research had not accumulated and sustained themselves, surely no one could have imagined them. But even though they are changing and newer conceptions are being adopted, there is a continuing need to offer constructive alternatives. Part of the recent change can probably be attributed to programmed instruction and to its related developments, which give new emphasis to details in the relationships between instructional materials or instructional procedures and their effects. The sometimes painstaking revision and evolution of materials reflects a view of instruction and learning very different from that which spawned the earlier broad comparisons. It seems fair to say that the newer procedures are not only different, but more productive both in terms of immediate instructional results and the improved understanding of variables influential in instruction.

The present intent is not just to encourage change, nor to help focus attention on the details of instructional procedure, but more specifically to foster the recognition that most instruction proceeds in small and verbal steps; this emphasizes the need to comprehend how people process and remember sentences and the need to know better the characteristics of sentences which facilitate or impede memory. The intent is similar to Underwood's (Underwood, in Melton, 1964, p. 52) when he argues the significance of verbal learning as follows:

> Perhaps it is not justifiable to view the nonsense syllable as the pedant's playmate. In any event, the position taken here is that the work in verbal learning--rote verbal learning--may stand squarely in the center of all human learning. Research in verbal learning is shooting out phenomena and theories which are touching, sometimes in a very fundamental way, all areas of human

learning from simple conditioning to
the study of the thought processes.

It is similar also to Miller's explanation of his own psycho-linguistic interests (1962, p. 761), when he writes: "I now believe that mind is something more than a four-letter Anglo-Saxon word--human minds exist and it is our job as psychologists to study them. Moreover, I believe that one of the best ways to study a human mind is by studying the verbal systems that it uses." But most of all the intent here resembles that which Rothkopf treats under the heading of "mathemagenics", i.e., activities of S which are productive of learning (see, e.g., Rothkopf, in Krumboltz, 1965, pp. 198-9). Up until the present, his interests have been implemented consistently with studies which employ written instructive materials as stimuli, but they are not necessarily so limited. Spoken language stimuli, as included and represented in the present study, can be accommodated without affecting the obvious concern with verbal learning.

Related Literature

The literature that is appropriate to the interests of the present study represents a range of work and thinking in the very general areas of language and human communication. It includes some materials which are most likely to be otherwise included under the headings of public address, composition (or "rhetoric"), instructional and training research, readability and/or journalism, verbal learning, and psycholinguistics. Of these, the last is probably the most general and includes the greater amount of apparently relevant material.

Among psycholinguists, many share interest in Miller's suspicion (1962, p. 760) that the remembering of sentences consists usually of remembering the "kernel" (i.e., the simple,

active declarative form of a sentence), plus remembering a footnote about the sentence's syntactic structure. For example, the sentence "The man was not bitten by the dog." is remembered as "The dog bit the man.", plus footnotes to represent the fact that the original sentence was negative and passive. From this, the original can be accurately reconstructed. Several consequences can be deduced from Miller's suspicion and so far these have fared rather well in a number of recent studies (e.g., Mehler, 1963; Gough, 1965; Prentice, 1966). There are of course some conflicting results and these raise doubts concerning the accuracy or completeness of Miller's arguments (Fillenbaum, 1968; Slobin, 1966; Martin and Roberts, 1966). Since Miller contends that the kernel sentence and the sentence structure are separately remembered, it can be suspected also that the transformation of one structure into another (e.g., from negative, active declarative--"He did not cut the meat."--into interrogative passive--"Was the meat cut by him?") is affected by the number of transformation rules applied and, among other things, that the time required to execute the transformation is a function of that number. It should follow also that kernel sentences have the greatest chance to be accurately remembered, since no separate and potentially unreliable memory of a syntactic footnote is needed to reconstruct them.

For years there has been a body of opinion which in a very limited way would appear to support Miller's view. Passive voice has been suspect and experts have cautioned against its use. No less a person than E.G. Boring has written that "The passive irritates the reader who wants clear direct diction." (Contemporary Psychology, 1968, p. 694).

Other authorities on effective writing are similarly concerned, giving such advice as "Prefer the active to the passive voice except for purposes of style or of special effect. The passive voice is appropriate when the doer of the action is unknown or irrelevant to the statement." (Woolley, Scott, and Bracher, 1951, p. 121) and "The passive voice, essentially weaker than the active, often suggests uncertainty or timidity, as though the writer lacked courage to speak out boldly. In fact, the overuse of the passive--the 'good-time-was-had-by-all' pattern--may be such a persistent characteristic of your style that you ought to lean over backwards to avoid this outward sign of amateurishness." (Pence and Bergmann, 1956, p. 26). Experts on speaking share the opinion and recommend that we "Prefer active to passive verbs. Passive verbs are useful, even indispensable, or they would not exist in the language. Use them for special effects. But for regular duty use active verbs...You might be startled at the higher percentage of active verbs used by masters of language." (Brigance, 1952, p. 312).

The advantage which will result from the occasional and judicious use of passives is not precisely indicated by the experts. Instead, they make more general suggestions that, used-as-directed, passives "flavor" and lend variety to messages and that passives don't harm sentences which are secondary to the writer's or speaker's purpose. They suggest also that audiences will make unfavorable judgments about those who use passives to excess. It seems, then, that the prediction with the clearest instructional relevance is Miller's, since it is consistent with his view to believe that sentences in <u>active</u> voice are more likely to be remembered accurately.

The clearest prediction with respect to queries or interrogative sentences seems also to come from Miller. Since he holds that kernel sentences--the simple, active declaratives--are remembered separately and independently of their syntactic footnotes and that non-kernels are reconstituted from this information at the time of recall, it should be predicted that interrogatives, like passives, will be less well remembered than otherwise comparable kernel sentences. Doubts (or should we say, "questions"?) concerning this can be justified on the basis of some of Rothkopf's mathemagenic studies and of related, earlier work (e.g., Rothkopf, 1966; Carmichael and Dearborn, 1947; Hershberger, 1963). At least some experts in oral communication represent a similarly skeptical view (e.g., Baird and Knower, 1957, p. 143). The "test-like events" which Rothkopf and others have investigated reveal several apparently distinctive consequences. The length of time that S will spend efficiently scanning or inspecting training materials seems to be extended simply by the insertion of a few qu ies into the materials. Also, the inspection time per unit of material appears to decrease (i.e., reading speed apparently increases) immediately following the inserted queries. Furthermore, a rather general facilitation of learning from the materials seems to result, not just facilitation directly related to the questions asked. Finally, such facilitation has been observed to occur even in the absence of feedback or confirmation of Ss' responses to queries. These observed consequences of test-like events do not directly indicate that queries per se are faithfully remembered, but they suggest strongly that people in the role of receivers deal with queries in unique ways. Some of the evidence resembles

that of a Zeigarnik effect, which essentially is memory for interesting, uncompleted tasks. In a query sentence sets a task which is not likely tc concluded. If the task, which is represented in is of some interest to the reader or listener anc is not completed, which in some sense would alwa case, then Zeigarnik effects can be expected.

There is a further and loose chain of reasor relates to the determinants of memory for verbal and which emerges best from the extensive researc of readability (see, e.g., Klare, 1963, or Mille In typical readability formulas which have been c over the years, two main elements appear. Althou be and each has been indexed in many ways, varyir particular interests and opportunities of the in the two elements essentially represent grammatica and word difficulty; the evidence indicates that which are grammatically complex and/or those com long, hard, and rare words are also those which t difficult to learn from or to understand. "Long, rare" are not synonyms when applied to words, yet of each are found to correlate substantially and thus approach synonymy. In fact, Zipf (1935) has the longer words are virtually forced out of comm and replaced with contractions or other short wor for "gasoline") whenever the longer word becomes frequently required.

The findings of readability research seem cl and might be taken as indications that common, hi words are easiest to remember and rare words harc is plausible on other grounds also, such as the f words will exhibit fewer associates, are thus les

and should thus be more difficult to remember. Nevertheless, two recent studies cast doubt on such plausible predictions. Shepard's study (1967), which includes a concern with the recognition memory for words, finds that "rare" words for him, which are represented in word occurrence frequencies of less than one per million, were recognized more successfully on second presentation than were "common" words (i.e., those at least 100 occurrences per million). A similar result is reported by Thorndike and Garrettson (1968), who found that no significant contribution to their word difficulty criterion was made by word frequency differences. There is some possibility that both Shepard's and the Thorndike-Garrettson results could be artifacts of the studies' methods and may not generalize reliably to the principal situations in which human verbal memory is employed. However, there is obviously some possibility also that their results are not just artifactual and that relatively rare words gain some consistent, if also modest, advantage in memory. As will be seen later in the results of the present study, this possibility is gaining strength, even though readability evidence and studies of meaningfulness and codability suggest otherwise. Shepard speculates that his result could stem from "...a greater immunity of the rare words to proactive interference from words seen by Ss prior to their experimental session" (Shepard, 1967, p. 159) or from a von Restorff effect--the facilitated memory for the strange or atypical.

Problem

As the foregoing has already suggested, the present exploratory study originates in the increasingly prominent

view that the most human of human activities are predominantly verbal, in the additional view that instruction relies heavily on sequences of and memory for sentences, and furthermore, that such memory has been too rarely examined to date. It will be apparent too that the casual equating of education and "book learning" is not only crude but dangerously deceptive; speech, listening, and memory for such typically verbal experiences must be treated as equally significant.

If the extent and limitations of human memory for verbal materials or verbal experiences are of broad and general significance, as both Underwood and Miller have indicated and are of more specific importance in instructional-training contexts, essentially as Rothkopf and many readability researchers imply, and if present evidence is sketchy, as it is invariably safe to contend, where should the further research efforts be immediately applied? Obviously, there is no single and simple answer, but the question serves at least as background to the choices made in the present study.

The few decisions required to constitute the design of the present small study begin with the decision to consider only simple sentences and to examine learner performance under the two conditions of audio (spoken) presentation and print. Similarly, it is of interest to compare performance when learners are required either to recognize sentences identical to those in the original list or, alternatively, to recognize non-identical sentences incorporating the gist from original sentences, but with one or more original words replaced by synonyms. In addition, memory for simple, active declarative sentences (i.e., kernels) is to be compared with each of the principal transformations--

from active voice to passive, from affirmation to negation, and from declaration either to interrogation or exclamation. Finally, since there is growing ambiguity with respect to word frequency as a factor in remembering, three levels of sentence subject word frequency are included. With these few decisions and with only a few additional procedural refinements, the requirements for implementing the study are met.

Procedures

The 87 subjects (Ss) for the study were University freshmen and were recruited from among enrollees in English composition courses. A recruiting appeal was distributed in the classes and it indicated that study participants would need to participate in a very brief "sign-up" session, then in a later instructional session lasting about three hours. In return for full participation, Ss would receive $7.00. When volunteers reported for the first brief session, a 24-item vocabulary test was administered and they were informed that the details of the second and final session would be indicated in a later, mailed announcement. The vocabulary test scores were then used to form matched "quadruplet" sets of Ss. In each quadruplet set, two members were assigned randomly to Group I and the others randomly either to Group II or Group III. (Initially, Group I was to have been two distinct groups, but practical considerations later precluded that.)

The three groups of Ss identified above represent treatments in which the following general conditions were employed:

Group I: (n=47)	The original or instructional stimulus sentences and the later

sentences comprising the recognition test were presented in audio form and at a speech rate of approximately 70 words per minute.[1] The recognition test included twice as many sentences as had been originally presented and, of these, half were rephrased sentences equivalent in meaning to sentences in the original set, while the other half served essentially as distractors. The speech rate during presentation of the audio recognition test was about 50-55 words per minute, not counting the time allowed for Ss' responding. The distractor sentences had been constructed at the same time as the other sentences, but had then been assigned randomly to their distractor role. As each sentence of the recognition test was presented, Ss were to indicate whether a sentence of the same meaning had appeared in the original set.

Group II:
(n=24)

The original or instructional stimulus sentences and the later sentences comprising the recognition test were presented in mimeographed form. As in both other groups, the recognition test included twice the number of sentences originally presented and, of these, half were identical to those in the original set, while the other half were the same set of randomly selected distractor

---

[1]This is slower than normal speech rate. Most estimates place normal speech rates in the range of 160-175 words per minute (see, e.g., Carroll, 1964, p. 60)

sentences used in recognition testing of the two other groups.

Group III: (n=16)

Conditions for this group combine features from both of the two groups above. The conditions associated with presentation of the original or instructional stimulus sentences were designed to be the same as those for Group II and the recognition test was presented in mimeographed form, also as in Group II; however, the recognition test contents consisted of the set of distractor sentences used throughout, plus rephrased sentences used in the recognition test of Group I.

The principal materials required for the main or instructional session with Ss consisted of 1080 simple sentences which were specially constructed for the purpose. To investigate memory for sentences which have more or less frequent nouns as sentence subjects, three samples of 360 nouns were first drawn from the standard source of such information, the Thorndike-Lorge Word Book (1944). One of these samples consisted of "low frequency" nouns, those with reported frequencies of occurrence of three per million words or less. The "medium frequency" nouns have reported frequencies in the range of 10 to 18 per million and the "high frequency" nouns occur 50 times or more per million. Referring next to a Webster's Seventh New Collegiate Dictionary, 1080 verbs were drawn for pairing with the selected nouns. The pairings were accomplished and, from them, the simple declarative sentences were then written.

In each of the three groups of 360 sentences, representing the three levels of noun frequency, each sentence was

assigned randomly to one of the twelve categories of a 3 x 2 x 2 "cube". The cube represents three sentence types, declarative, interrogative, and exclamatory; two voices, active and passive; and two valences, affirmative and negative. Sentences were then transformed as necessary to conform to the requirements of their assigned category. The 30 sentences in each of these smallest categories were then evenly and randomly divided to constitute the set of 15 sentences which would appear in the original or instructional set and a second set of 15 which would serve as the distractors during recognition testing. Two further procedures were required to prepare the necessary sentence materials and these were, first, to prepare rephrasings of the 15 original or instructional sentences in each category in order to provide sentences equivalent to the originals in meaning; this was done by systematically substituting either synonymous verbs or synonymous sentence objects. Finally, three orderings of the original sentences were prepared and duplicated both as mimeographed material for Ss to read and as audio tape recordings.

To review, then, the principal materials consist of 1080 specially constructed sentences which were developed on a base, first, of equal numbers of nouns selected to represent high, medium, and low frequencies of normal occurrence. There were 360 nouns representing each frequency. Nouns were then matched with selected verbs and the simple, active declarative ("kernel") sentences were thus constructed. Each sentence at each frequency level was assigned to one of twelve classes, in effect determining whether or what transformation(s) would be applied. These were then applied and each resulting set of 30 sentences was further divided into two sets of 15, one of which constituted the original

or instructional set and the other the recognition test's distractor set. In addition, the sentences of each original set were rephrased to preserve the gist or semantic equivalence, but to be not verbatim. The sentences were arranged in three orders for original presentation, then duplicated, either in mimeographed or audio recording. A trained broadcaster voiced the audio materials. A sample of the sentences is presented in Appendix B.

As Ss reported for the second and principal study session, they were directed to their assigned rooms. Groups II and III met together in one room, since the differences in their materials did not require their physical separation, but Ss of Group I were assigned to three rooms, representing the three orderings of their materials. The experimenter (E) or proctor in each room gave brief oral instructions to his group and these consisted at the outset of little more than a statement that Ss would read or hear a list of sentences, that they should read or listen carefully, and that they would be asked questions about the sentences later. The presentation of the "instructional" sentences then began. In the audio rooms, the pacing was such that presentation of the 540 sentences required 45 minutes, which is an average rate of 12 sentences per minute. In the other room, the rate was paced by E, who signaled the times for advancing to the next page of sentences. His pace also achieved the average rate of 12 sentences per minute.

At the end of the 45 minute instructional session, Ss were given a five minute intermission, then the brief instructions for the recognition test were presented. The Ss were informed that they would read or hear a list of sentences. If a sentence seemed familiar, i.e., if it was identical or similar to one which they had just encountered,

they should mark an "A" on the response card provided. If not, they should mark a "B". Each S was provided a packet consisting of instructions, a pencil, eleven mark sense cards, and for Ss not in the audio condition, a mimeographed 1080 sentence recognition test. The recognition test proceeded for just less than an hour, then a five minute intermission was given and the Ss then returned and completed the task in approximately one additional hour. In all, the session thus had a duration just less than three hours.

Results

The dependent variable which has been employed throughout and in terms of which the following results are presented consists of a score representing the number of stimulus sentences and of distractor sentences of a given class which were correctly differentiated by S. Correct differentiation means only that sentences from the previously encountered "stimulus" set were designated as such by S and conversely for sentences from the distractor set. For ease in interpreting and comparing these scores, they are reported in Tables 1, 3, and 5 as proportions. It should be borne in mind also that, on the average, chance responding yields one correct response out of two.

In the tables which follow, Tables 1, 3, and 5 summarize the scores of Ss in Groups I, II, and III. These are, respectively, the audio group, which was required to recognize sentences which had meanings equivalent to those sentences in the stimulus set; the print group, which was required to recognize sentences identical to those in the original stimulus set; and the print group which was required to recognize non-identical but semantically equivalent sentences,

essentially as in Group I. For each group, recall though that the stimulus sentences and the recognition test sentences were presented in the same mode or same channel. The inherent and prudent differences in the conditions of criterion testing detract from direct comparisons of the groups' performances, so these are not attempted. Tables 2, 4, and 6 summarize the tests for main effects and interactions in the data from Groups I, II, and III, respectively.

The statistical analyses summarized in Tables 2, 4, and 6 and the corresponding summaries of Ss' correct response proportions, which are presented in Tables 1, 3, and 5, merit two immediate and brief comments. First, significant main effects are indeed rare and in fact appear only in connection with the word frequency variable (i.e., that based on the noun which serves as the sentence subject and on the frequency with which the noun occurs in ordinary English). This result is especially interesting since it reveals an effect which is contrary to most expectations. Nevertheless, in two groups out of three, word frequency is associated with a significant main effect and both reflect a trend in which sentences with high frequency nouns are typically less well remembered than those with medium frequency nouns and they, in turn, are less well remembered than sentences constructed on low frequency nouns. Secondly, significant interaction effects appear throughout the analyses and with at least some pattern to them. Each of the significant interactions and, where appropriate, the comparable non-significant interactions are plotted and presented in Figures 1 - 4.

The most apparent feature of the several significant interaction effects is that all involve the "D" or declarative-

TABLE 1

Cell-by-Cell Proportions of Correct Responses for Ss in Group I (n=47): Stimulus and Test Sentences Presented as Audio; Tested for Recognition of Sentences Semantically Equivalent to Originals

		ACTIVE VOICE (A_1)		PASSIVE VOICE (A_2)	
		AFFIRM (B_1)	NEG (B_2)	AFFIRM (B_1)	NEG (B_2)
"COMMON" NOUN (C_1)	DECLAR (D_1)	.6142	.5326	.5851	.5298
	INTER (D_2)	.6376	.6035	.5738	.6333
	EXCLAM (D_3)	.5730	.6348	.5872	.5830
"MEDIUM" NOUN (C_2)	DECLAR (D_1)	.6213	.6120	.5617	.6574
	INTER (D_2)	.7000	.6440	.6106	.5617
	EXCLAM (D_3)	.5886	.5929	.5922	.5695
"RARE" NOUN (C_3)	DECLAR (D_1)	.6816	.6262	.6546	.6099
	INTER (D_2)	.6553	.6894	.5596	.6823
	EXCLAM (D_3)	.6163	.6035	.7340	.6702

TABLE 2

Summary of the Analysis of
Main Effects and Interactions:
Data from Group I

Source	df	MS	F	P
ABCD	4	52.1706	1.0986	
ABC	2	2.5311	.0533	.9481
ABD	2	180.2941	3.7966	.0228
ACD	4	126.0339	2.6540	.0318
BCD	4	298.3025	6.2816	.0000
AB	1	13.7431	.2894	.5907
AC	2	83.6744	1.7620	.1722
AD	2	262.9617	5.5374	.0040
BC	2	33.2228	.6996	.4970
BD	2	71.3797	1.5031	.2229
CD	4	89.9428	1.8940	.1093
A	1	138.1197	2.9085	.0884
B	1	23.2693	.4900	.4841
C	2	695.0103	14.6354	.0000
D	2	107.4138	2.2619	.1047
Error	1044	47.4883		

A = Active-Passive
B = Affirmative-Negative
C = "Commonness" (Frequency) of Noun
D = Declarative-Interrogative-Exclamatory

TABLE 3

Cell-by-Cell Proportions of Correct Responses for Ss i
Stimulus and Test Sentences Presented as Print; Teste
of Sentences Identical to the Origina

		ACTIVE VOICE (A_1)		PASSIVE VOI
		AFFIRM (B_1)	NEG (B_2)	AFFIRM (B_1)
"COMMON" NOUN (C_1)	DECLAR (D_1)	.7056	.5944	.6639
	INTER (D_2)	.7139	.6333	.6236
	EXCLAM (D_3)	.6153	.6833	.6333
"MEDIUM" NOUN (C_2)	DECLAR (D_1)	.7125	.7069	.6306
	INTER (D_2)	.7556	.6694	.6680
	EXCLAM (D_3)	.6528	.6222	.6847
"RARE" NOUN (C_3)	DECLAR (D_1)	.7319	.7097	.7306
	INTER (D_2)	.7125	.7208	.6472
	EXCLAM (D_3)	.6097	.6611	.7375

TABLE 4

Summary of the Analysis of
Main Effects and Interactions:
Data from Group II

Source	df	MS	F	P
ABCD	4	8.5042	.6579	.6214
ABC	2	16.3802	1.2672	.2820
ABD	2	41.5826	3.2169	.0405
ACD	4	15.5038	1.1994	.3094
BCD	4	50.9658	3.9428	.0035
AB	1	1.0186	.0788	.7789
AC	2	23.7133	1.8345	.1602
AD	2	104.6280	8.0942	.0003
BC	2	23.2958	1.8022	.1654
BD	2	26.4562	2.0467	.1297
CD	4	25.7556	1.9925	.0935
A	1	8.3051	.6425	.4230
B	1	12.8410	.9934	.3192
C	2	106.3990	8.2312	.0003
D	2	22.6469	1.7520	.1739
Error	1044	12.9263		

A = Active-Passive

B = Affirmative-Negative

C = "Commonness (Frequency) of Noun

D = Declarative-Interrogative-Exclamatory

TABLE 5

Cell-by-Cell Proportions of Correct Responses for Ss in Group III (n=16): Stimulus and Test Sentences Presented as Print; Tested for Recognition of Sentences Semantically Equivalent to Originals

		ACTIVE VOICE (A_1)		PASSIVE VOICE (A_2)	
		AFFIRM (B_1)	NEG (B_2)	AFFIRM (B_1)	NEG (B_2)
"COMMON" NOUN (C_1)	DECLAR (D_1)	.6354	.6062	.6271	.5979
	INTER (D_2)	.6396	.6708	.6333	.6604
	EXCLAM (D_3)	.5604	.6833	.6396	.6021
"MEDIUM" NOUN (C_2)	DECLAR (D_1)	.6896	.6271	.6333	.6688
	INTER (D_2)	.6521	.6479	.6417	.6229
	EXCLAM (D_3)	.6188	.6604	.6312	.5979
"RARE" NOUN (C_3)	DECLAR (D_1)	.6396	.6938	.6729	.7042
	INTER (D_2)	.6625	.7021	.6167	.6667
	EXCLAM (D_3)	.5979	.5979	.7125	.6375

TABLE 6

Summary of the Analysis of
Main Effects and Interactions:
Data from Group III

Source	df	MS	F	P
ABCD	4	12.1612	1.4517	
ABC	2	4.8596	.5801	.5600
ABD	2	26.3597	3.1466	.0434
ACD	4	9.1990	1.0981	.3561
BCD	4	12.9981	1.5516	.1851
AB	1	3.4003	.4059	.5242
AC	2	7.9818	.9528	.3860
AD	2	9.1211	1.0888	.3370
BC	2	5.4795	.6541	.5201
BD	2	2.9429	.3513	.7038
CD	4	7.3099	.8726	.4797
A	1	.6157	.0735	.7863
B	1	4.5220	.5398	.4627
C	2	19.7425	2.3567	.0952
D	2	15.2834	1.8244	.1618
Error	1044	8.3772		

A = Active-Passive
B = Affirmative-Negative
C = "Commonness" (Frequency) of Noun
D = Declarative-Interrogative-Exclamatory

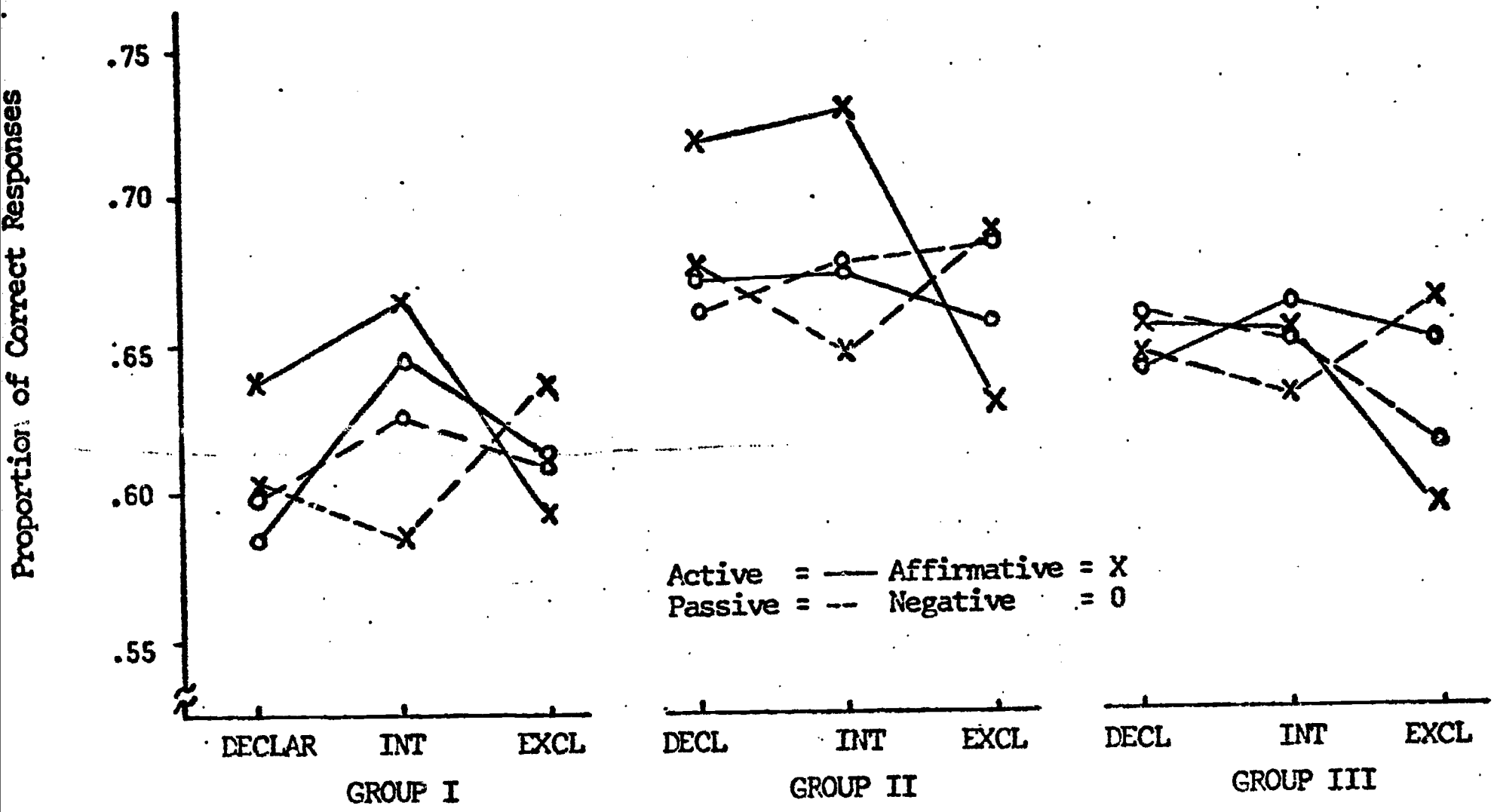
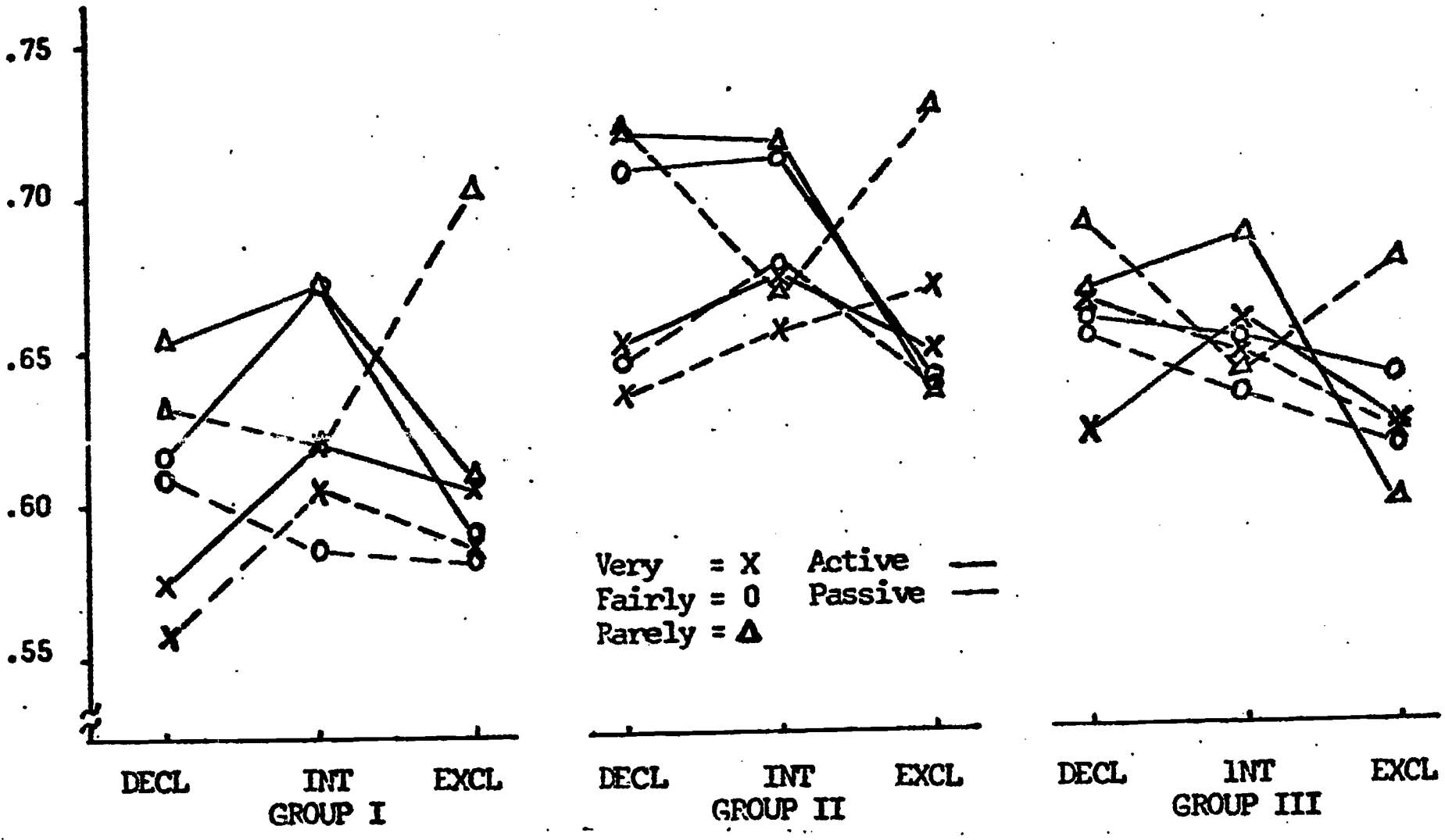


FIGURE 1. Graphic representation of the three-term ABD interaction involving declarative-interrogative-exclamatory, sentence voice (active-passive), and sentence valence (affirmative-negative); interaction significant in Groups I, II and III.



IGURE 2. Graphic representation of the three-term ACD interaction involving declarative-interrogative-exclamatory, sentence voice (active-passive), and sentence subject's occurrence frequency (very, fairly, rarely); interaction significant in Group I only.

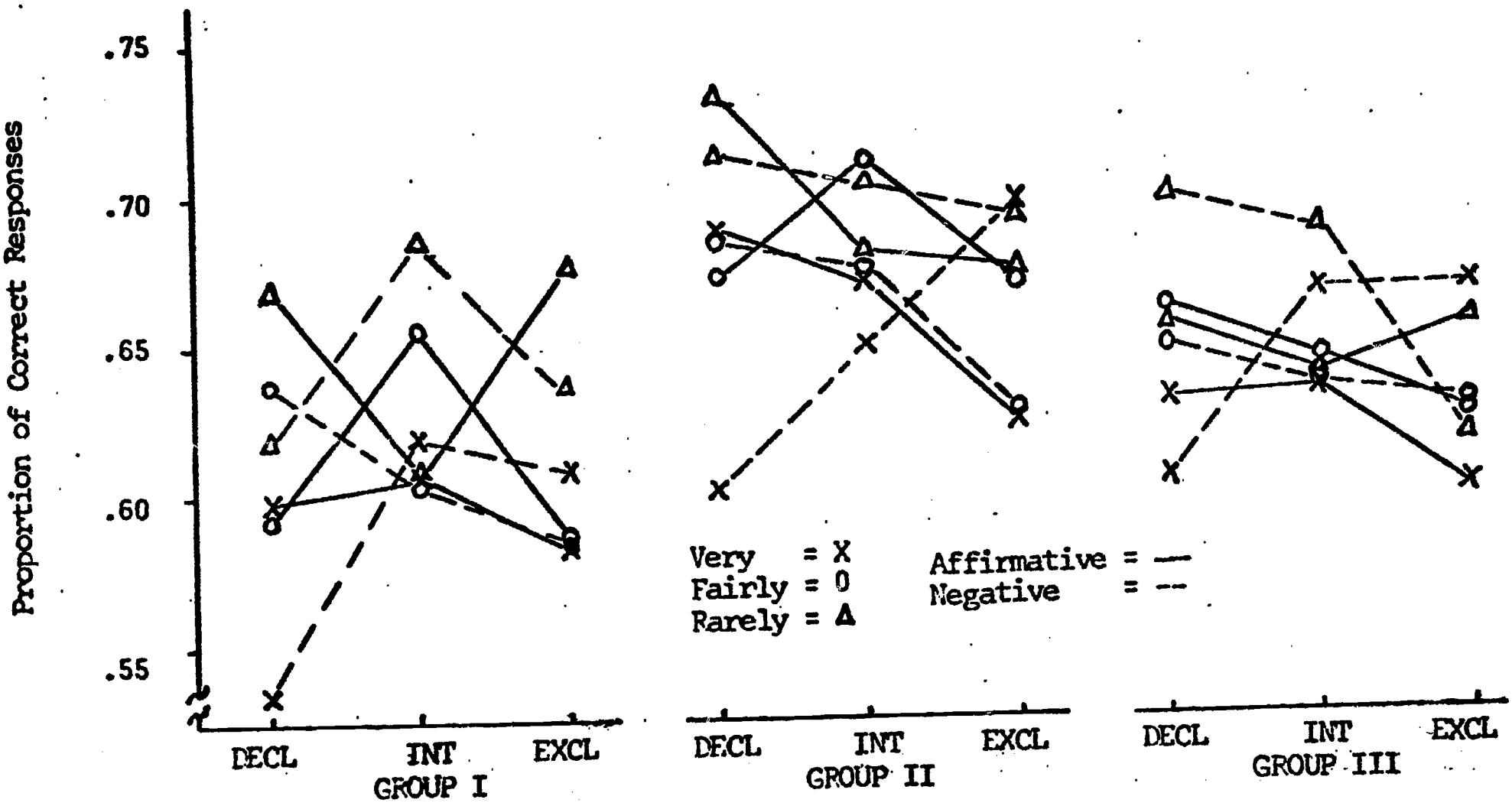


FIGURE 3 Graphic representation of the three-term BCD interaction involving declarative-interrogative-exclamatory, sentence valence (affirmative-negative), and sentence subject's occurrence frequency (very, fairly, rarely); interaction significant in Groups I and II only.

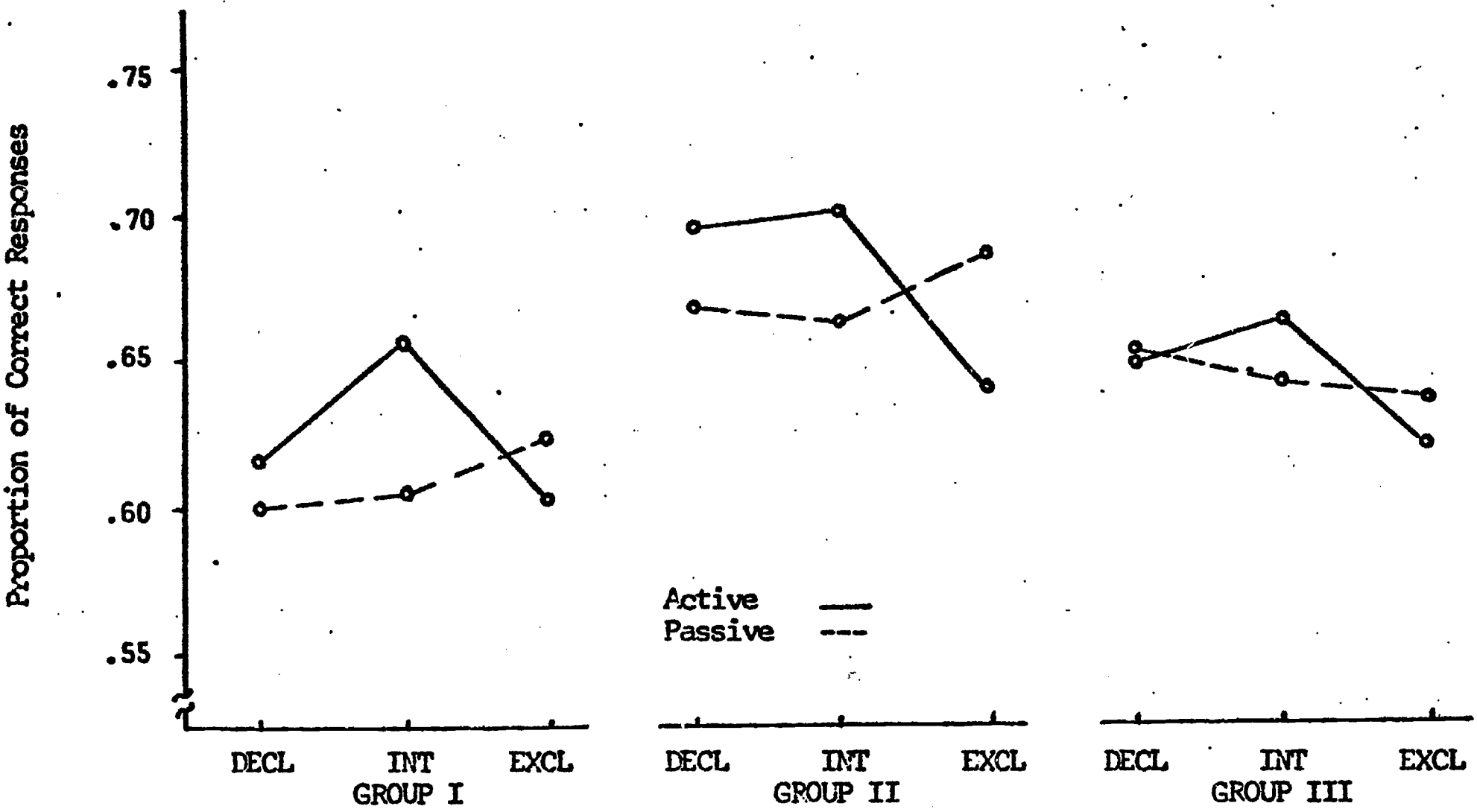


FIGURE 4. Graphic representation of the two-term AD interaction involving declarative-interrogative-exclamatory and sentence voice (active-passive); interaction significant in Groups I and II only.

interrogative-exclamatory sentence variable. In the data from each of the three treatment groups and as plotted in Figure 1, "D" interacts jointly with sentence voice (active-passive) and with valence (affirmative-negative). Also, in the data from Group I and as plotted in Figure 2, "D" interacts jointly with sentence voice and with the word (i.e., the noun) frequency variable. Note too that although this particular interaction is significant only for Group I, Figure 2 shows many similarities in the plots for all three groups. It at least suggests that the same interaction might be found under the other groups' conditions, if somewhat greater care were exercised.

Figure 3 shows also that "D" interacts jointly with sentence valence and with the sentence subject's word frequency variable. The interaction is significant in data from Groups I and II, but not in III. Whether the failure of the interaction in Group III is inherent or essentially a procedural problem is not at all easy to predict. Suffice it to say that there would appear to be as many differences in the plots from Groups I and II, both of which represent significant interactions, as between them and Group III, for which the interaction is not significant. Finally, the "D" variable interacts with sentence voice and this is plotted in Figure 4, which also indicates that the interaction achieved significance in data from Groups I and II, but not III.

Discussion

It is unclear whether to begin with a consideration of results which relate to the interests of Miller, of Rothkopf, of investigators concerned with text readability-comprehensibility, or perhaps in terms of the web-like interaction effects which have appeared. It is clear though that this at least

is not the time or place for spreading and incorporating these few results into prescriptions for educators. It is not even certain that the learning task represented in the present study has important elements in common with those of education, although it is highly plausible that such is the case.

Interactions, especially those at the three-term level or higher, represent a very difficult task of interpretation and they usually are at least somewhat disturbing to consider, so those from the present work might as well be examined now and, to the extent possible, disposed of. The ABD interaction represented in Figure 1 would seem to implicate passive interrogative affirmative sentences as a principal basis for the observed effect. Sentence voice alone shows a very mixed effect and sentence valence also shows facilitation under some specific conditions but not under others. Consistently, though, there is at least a modest drop in correct responses for interrogative sentences which are also affirmative and passive, even though other interrogative sentences show no such drop, but rather a tendency in the opposite direction. This ABD interaction achieved significance for all three treatment groups, it reveals a similar pattern of effects in each of the three, and it suggests that memory for spoken language and for print share much of the same effect.

The ACD interaction represented in Figure 2 is only significant for Group I, the audio condition, and the important features of the interaction can hardly be described, much less interpreted. Perhaps it should be noted, though, that the plots representing active and passive sentences which are also constructed on high frequency, or "common" nouns are thoroughly comparable plots; the plot for passives is simply at a slightly lower performance level than the one for active voice. There is an apparent parallel also in the plots for

those active voice sentences based on medium frequency and on rare nouns. The most distinctive feature of the Group I plot represents performance in the recognition of "rare noun" passive sentences; for them, the exclamatory sentences show distinct facilitation, not an inhibition of performance, as with the others.

The BCD interaction, as plotted in Figure 3, gives further indication that memory for sentences consists of something more than an accumulation of main effects. Some facilitation of the memory for interrogative sentences is again suggested, as it has been under other combinations of conditions, but obvious exceptions are also in evidence. For example, the apparently facilitated performance associated with interrogatives involving common nouns and negatives, with rare nouns and negatives, and with medium frequency nouns and affirmatives, is opposite the apparent effects with interrogatives which are based on rare nouns and affirmatives. Such results arouse suspicions concerning the adequacy of the "kernel-plus-footnote" idea of Miller. The Ss do not consistently handle declaratives better than interrogatives, for example, nor do they appear to handle footnote information independently, but instead, some combinations of footnotes seem more manageable than others. Finally, the AD interaction, shown graphically in Figure 4, seems only to say that memory for interrogatives is somewhat facilitated when such sentences are also in active voice, but there is little effect or none when they are passive.

On the whole, it must be said that Rothkopf's recent findings seem better preparation for results like those observed here than are Miller's findings and interpretations. Especially, it is noted that interrogatives, queries, or "test-like events", as Rothkopf seems to prefer to call them, are prominently

involved in many of the more interesting of the observed effects; there are many instances in which the highest relative level of performance is associated with some combination involving interrogatives and in view of some of the "mathemagenic" effects which Rothkopf reports, results like those of the present study seem at least generally consistent. Because of the recurrence of interactions, it must be an oversimplification to indicate only that queries give rise to Zeigarnik effects (see pp. 6-7), such an interpretation seems at least crudely correct.

The last of the results to be considered is that represented in the only significant main effect, one which achieved significiance in the data from Groups I and II. The variable is the noun frequency variable, which happens also to be implicated in two of the four significant interaction effects. This rules out simple interpretations. It can be noted, though, that the sentences constructed on relatively rare nouns as sentence subjects frequently appear in the evidence as those which were readily recognized by Ss and that sentences constructed on relatively high frequency, commonly occurring nouns were also not readily recognized in many instances. These recurring signs from the data seem consistent with the findings of Shepard and of Thorndike and Garrettson, cited earlier, and they fail to conform to expectations based on the majority view from readability research. One statement of that view comes from Miller (1951, p. 134) and says that:

> All studies seem to agree that short, familiar words make a passage easy, while long, unfamiliar words make it difficult. The major disagreement has been which measure of familiarity should be adopted. In some cases lists of easy words have been compiled, where 'easy' is defined

> in terms of use and familiarity to grade school children....

There is now some possibility that word familiar: by frequency of use, is not always the aid in ser or at least in recognition, that we seem to have

References

Baird, A.C. and Knower, F.H., General Speech. New York: McGraw-Hill Book Company, Inc., 1957.

Boring, E.G., Quoted in Contemporary Psychology, 1968, 13.

Brigance, W.N., Speech, Its Techniques and Disciplines in a Free Society. New York: Appleton-Century-Crofts, Inc., 1952.

Carmichael, L. and Dearborn, W.F., Reading and Visual Fatigue. Boston: Houghton Mifflin, 1947.

Carroll, J.B., Language and Thought. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964.

Fillenbaum, S., Sentence similarity determined by a semantic relation: learning of "converses". Proceedings of the 76th meeting of American Psychological Association, 1968.

Gough, P.B., Grammatical transformations and speed of understanding. Journal of Verbal Learning and Verbal Behavior, 1965, 4, 107-111.

Hershberger, W.A., Learning via programmed reading and cue versus response in programmed reading. Technical Report AIR-C28-7/63-TR, July 1963, American Institute for Research, Palo Alto, California.

Klare, G.R., The Measurement of Readability. Ames, Iowa: Iowa State University Press, 1963.

Martin, E. and Roberts, K.H., Grammatical factors in sentence retention. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 211-218.

Mehler, J., Some effects of grammatical transformations on the recall of English sentences. Journal of Verbal Learning and Verbal Behavior, 1963, 2, 346-351.

Miller, G.A., Language and Communication. New York: McGraw-Hill Book Company, Inc., 1951.

Miller, G.A., Some psychological studies of grammar. American Psychologist, 1962, 17, 748-762.

Pence, R.W. and Bergmann, F.L., Writing Craftsmanship. New York: W.W. Norton & Company, Inc., 1956.

Prentice, Joan L., Response strength of single words as an influence in sentence behavior. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 429-433.

Rothkopf, E.Z., Learning from written instructive material: An exploration of the control of inspection behavior by test-like events. American Educational Research Association, 1966, 3, 241-250.

Rothkopf, E.Z., Some theoretical and experimental approaches to problems in written instruction. In J.D. Krumboltz (Ed.) Learning and the Educational Process, Chicago: Rand-McNally & Company, 1965, 193-221.

Shepard, R.N., Recognition memory for words, sentences, and pictures. Journal of Verbal Learning and Verbal Behavior, 1967, 6, 156-163.

Slobin, D.I., Grammatical transformations and sentence comprehension in childhood and adulthood. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 219-227.

Thorndike, E.L. and Lorge, I., The Teacher's Word Book of 30,000 Words. New York: Bureau of Publications, Teachers College, Columbia University, 1944.

Thorndike, R.L. and Garrettson, Judith, "What makes a word difficult?". Paper presented at the meeting of the American Psychological Association, San Francisco, September 1968.

Underwood, B.J., The representativeness of rote verbal learning. In A.W. Melton (Ed.) Categories of Human Learning. New York: Academic Press, 1964, 48-78.

Woolley, E.C., Scott, F.W., and Bracher, F., College Handbook of Composition. Boston: D.C. Heath and Company, 1951.

Zipf, G.K., Psycho-Biology of Language. Boston: Houghton Mifflin Company, 1935.

APPENDIX A
Vocabulary Test

DIRECTIONS: Please read the questions below carefully. Answer each one by blackening in the appropriate spot on the IBM card. Be sure you write your name on the card and respond to every item.

1 Disguised means
A crooked
B argued
C uncovered
D hidden

2 Disproved means
A scolded
B dislike
C false
D denied

3 Implicate means to
A involve
B remove
C retaliate
D suggest

4 Calamitous means
A unpopular
B noisy
C rude
D disastrous

5 Intricacy means
A closeness
B confusion
C complexity
D delicacy

6 Eject means to
A throw out
B command
C restore
D sadden

7 Contort means to
A argue
B deny
C answer
D twist

8 Synopsis means a
A farewell
B chapter
C summary
D set of rules

9 Fatigued means
A sick
B tired
C sweaty
D overweight

10 Emergence means
A laziness
B going together
C coming forth
D sudden need

11 Autonomy means
A self-government
B mechanical
C branch of learning
D physical strength

12 Decadence means 20
A decision
B out of step
C every ten years
D decline

13 Clique means
A a game
B a social group
C a noise
D knife

14 Arrogant means
A stubborn
B haughty
C disobedient
D angry

15 Berate means
A to judge
B discount
C to cover
D scold

16 Cursory means
A hasty
B gloomy
C insulting
D traitorous

17 Laudable means
A extraordinary
B commendable
C apparent
D absurd

18 Lucrative means
A blunt
B profitable
C heroic
D undue

19 Rotund means
A plump
B decomposed
C backward
D sane

20 Avid means
A eager
B vivid
C arid
D morbid

21 Redundant means
A poisonous
B peculiar
C superfluous
D repudiate

22 Effete means
A informal
B thievish
C emotional
D useless

23 Impecunious means
A poor
B tolerant
C wealthy
D permanent

24 Churlish means
A happy-go-lucky
B surly
C servile
D courtly

APPDENDIX B

A Sample of Stimulus and Distractor Sentences

The attack abets the victory.
The attempt culminates in success.
The advantage does not heighten the opposition.
The appeal does not guarantee freedom.
The audience is stimulated by the address.
Routine is disrupted by anger.
The incident is not dramatized by the act.
Youth is not darkened by age.
Does the violin emanate melody?
Does the volcano emit lava?
Does the word not precede the phrase?
Does the indignation not transfuse society?
Is the victim chased by the villain?
Is the branch alighted on by the wren?
Is the tray not bumped by the waiter?
Are the guilty not trapped by the web?
The spotlight guides the plane!
The placard specifies the writ!
A lacquer does not restore a floor!
Rabies does not disable the kitten!
The diet is dictated by an ulcer!
The young are cared for by the progenitor!
The origin is not orbitted by the projectile!
The man is not squirted by the grapefruit!