

LAKEHEAD UNIVERSITY

THE EFFECT OF MODE OF PRESENTATION,
STIMULUS CONCRETENESS,
AND VERBALIZATION ON A PAIRED-ASSOCIATES LEARNING TASK

by

DIANE ALLEN

A THESIS

SUBMITTED TO THE FACULTY OF ARTS
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF ARTS

DEPARTMENT OF PSYCHOLOGY

THUNDER BAY, ONTARIO, CANADA

MARCH, 1972

Abstract

A 2x2x3x8 experimental design was used to investigate the effects of two levels of the concreteness dimension (i.e. concrete and abstract) of nouns; two levels of verbalization (i.e. verbalization and nonverbalization) and three kinds of input modality (i.e. auditory, visual and auditory-visual combined) over eight trials of a paired associates learning task. Two lists of fifteen noun pairs each were constructed: one list of concrete noun pairs and one of abstract noun pairs. An equal number of pairs from each list were presented in each of the three kinds of mode of presentation.

It was found that more concrete pairs were recalled than abstract pairs. The main effect of the verbalization factor was not significant.

Post-hoc analyses revealed that mode became significant during the last four trials (i.e. in later learning) and that sex of the subject was significant. Female subjects performed better than male subjects.

It is felt that mode of presentation merits further investigation in relation to mixed and unmixed modality lists. It is also suggested future research consider sex as a relevant variable to be controlled or manipulated.

TABLE OF CONTENTS

Abstract	i
List of Tables	ii
List of Figures	iii
List of Appendices	iv
Introduction	1
Method	8
Results	11
Discussion	14
Summary	19
Bibliography	21
Appendices	25

LIST OF TABLES

	Page
Table 1. Experimental design	8a
Table 2. Mean number of noun pairs recalled over Trials 1-8: 1-4: 5-8	12a
Table 3. Mean number of pairs recalled across modes over Trials 1-8: 1-4: 5-8	12a
Table 4. Mean number of concrete and abstract pairs recalled across modes over Trials 1-8: 1-4: 5-8	12b
Table 5. Mean number of pairs recalled by male and female students over Trials 1-8: 1-4: 5-8	12b

LIST OF FIGURES

	Page
Figure 1. Mean number of pairs recalled across modes over trials	12c
Figure 2. Mean number of pairs recalled by male and female subjects over trials	13a
Figure 3. Mean number of pairs recalled by male and female subjects under verbal-nonverbal conditions over trials	13b

LIST OF APPENDICES

	Page
Appendix A Concrete Word Pool	
Abstract Word Pool	
Rules for the Selection of Nouns Used	
Rules for the Construction of Noun-Pairs	
Concrete Noun-Pairs	
Abstract Noun-Pairs	25
Appendix B Randomization of the Assignment of Mode for Concrete and Abstract Noun-Pairs	
Random Orders of Presentation of Pairs	
Application of Orders to Study and Test Trials	26
Appendix C Instructions for the Verbalization Group	
Instructions for the Nonverbalization Group	27
Appendix D Summary of Analysis of Variance of Recall Data as Function of Concreteness, Verbalization, Sex, Input Modality and Trials	28

INTRODUCTION

The purpose of this study was to investigate the learning of concrete and abstract noun pairs presented under two levels of verbalization (verbalization and nonverbalization) and three kinds of input modality. Separate paired-associate lists of concrete nouns and abstract nouns were presented in a mixed mode of presentation design (i.e. five noun pairs in each list were presented aurally, five noun pairs were presented visually, and five noun pairs were presented aurally and visually combined).

Concreteness

A great deal of investigation has been carried out with regard to the effect of concreteness on the learning of paired associates. It has been demonstrated that concrete noun-pairs are learned more rapidly than abstract noun-pairs (Paivio, 1965; Paivio, Yuille, & Smythe, 1966; Yuille, 1968) and that concreteness on the stimulus side facilitated paired associate learning (Paivio & Olver, 1964; Paivio & Yarmey, 1965; Yarmey & O'Neill, 1969; Yarmey & Paivio, 1965) more so than response-term concreteness.

Paivio (1969) explained the effect of concreteness by postulating a two process theory of learning concrete and abstract noun pairs. In regard to concreteness of nouns he says: "The higher the concreteness the more likely they are to evoke sensory images that can function as mediators of associative learning". Sensory images are "symbolic processes which are linked developmentally to associative experiences involving concrete objects and events" (Paivio,

1969). The image is a nonverbal symbolic process which connects the items of a pair either by means of associative experience or by being constructed by the individual. Therefore, the concrete noun benefited from the availability of two separate codes; one being the nonverbal image and the other the verbal code.

Verbal mediators are said to be used in the learning of abstract materials. These can be verbs or prepositions or the addition of syllables which serve to facilitate a connection or association between the two nouns to be learned.

Input Modality

The investigation of input modality in relation to learning has been under intermittent investigation since the turn of the century. Prior to the present time the procedure generally has been to administer serial and paired associate lists comprised of words or nonsense syllables or numbers in a single mode (i.e. unmixed input modality) to separate groups.

The following review of the literature on input modality will restrict itself to adult subjects. Experimentation with children is in itself a very broad area for investigation.

A comprehensive review of the literature was undertaken by Day and Beach (1950). Their survey of the literature indicated that regardless of the kind of material (e.g. digits, nonsense syllables, words) presented, each modality was superior in about one-half of the studies. Superiority of mode appeared to be related to the conditions under which the experiments were conducted. This led them to the

following conclusions: (1) that combined presentation leads to more efficient learning; (2) that meaningful material is learned faster through the aural mode while meaningless material is learned more efficiently through the visual mode; (3) that unusually difficult material is more effectively received visually and easy material is more easily understood auditorily, and (4) visual presentation favors immediate recall while auditory presentation favors delayed recall.

After 1950 and until the mid 1960's the investigation of modes of presentation lapsed. The topic was revived by Williams and Derks (1963). They presented their subjects with three modes of input (auditory, visual, auditory-visual combined) in separate unmixed modality lists along with three levels of pronounceability and association values (which were matched by the authors). The materials were high and low pronounceable CVC's and familiar words. Using the study test method and exposing the items for one second each in a paired-associate task each subject was given twelve trials or was terminated after two correct test trials. Each list was composed of twelve pairs. Their results support the Day and Beach (1950) hypothesis that a combined presentation is better than a single mode presentation. They found that the combined and the visual presentations were superior to the aural presentation. Combined presentation was consistently superior to visual but not significantly so.

Next to be investigated was the role of meaningfulness as

related to the mode of presentation (Schulz and Kasschau, 1966). Using dissyllables in a serial list of twelve items at three levels of meaningfulness which were presented at the rate of one every two seconds, they found that low meaningful material was learned best under visual conditions while medium and high meaningful material was learned better under aural conditions. In this study aural and visual presentations were also in separate lists. The result of this experiment lent support to the Day and Beach (1950) hypothesis that unfamiliar meaningless material is learned best under visual conditions while more meaningful material is learned better aurally.

Further support for the superiority of the visual mode comes from Beery (1968). His subjects learned not only nonsense syllable pairs faster visually than aurally but also word pairs.

More recently Schulz and Hopkins (1968), using a paired associate task employing dissyllables scaled for meaningfulness, constructed twelve pair lists combining high and low meaningfulness into four categories per list. Using the study-test method and an exposure duration of one second per pair subjects were given fifteen trials. The subjects did not overtly rehearse the pairs. The results indicate that input modality is not significant. However, there was a small consistent amount of maintenance of correct responses of visually presented materials. There was no interaction between S-term or R-term meaningfulness and modality.

There seems to be some contradiction in the results of ex-

periments conducted since 1950. Williams and Derks (1963) found a combined auditory-visual presentation superior. This was supported in part by Schulz and Kasschau (1966) who found visual presentation superior for low meaningful material. Beery's (1968) results indicated visual superiority for words and nonsense syllables while Schulz and Hopkins (1968) found no significant differences in mode of presentation while using dissyllables.

Murdock (1966, 1967, 1968) using a variety of tasks while investigating input modality and short term retention has demonstrated that with short lists of paired-associates or serial lists that auditory input is superior. Of interest in Murdock's studies is that he has shown that verbalization inhibited or is detrimental to the learning of aurally presented material while it enhanced the learning of visually presented material.

Verbalization

Verbalization, also called rehearsal, repetition, articulation and occasionally pronunciation has been investigated with mixed results. The bulk of the existing evidence favours its use as assisting learning. This has been demonstrated by Brelsford and Atkinson (1968), Mechanic and D'Andrea (1965) and Mechanic and Mechanic (1967). Murray (1965a) found that acquisition was improved with verbalization with a rapid rate of presentation. Further investigation by Murray (1965b) using one trial learning with an eight consonant list led him to conclude that verbalization produced more cues for recall and that

subjects were getting a preferred modality (auditory). This latter information was based on introspective evidence. He also reported a significant subject by vocalization interaction which he suggested was due to individual variability for preference of one mode over another. In this study, auditory presentation was superior in facilitating recall. Murray (1966a) redemonstrated this with consonant lists and high and low association value CVC's paired with three letter words (1966b) and suggested that voicing facilitated storage. However, in 1967, he found, again using consonant lists, that covert rehearsal was superior to overt rehearsal for recall. He has suggested that voicing takes up time thereby increasing the possibility of forgetting and that verbalization may prevent rapid subvocal rehearsal. Similarly, Brewer (1967) found that verbalization did not facilitate learning. This is further substantiated by Reynolds (1967), Schulz and Tucker (1962a&b) and Underwood (1965). Mackworth (1964) using auditory presentation also found that repetition interferes with recall.

Present Investigation

This purpose of the present study was to investigate the concrete-abstract dimension of nouns, the verbalization factor and the effect of input modality using three kinds of input modality within one list of fifteen noun pairs.

It was hypothesized that more concrete pairs than abstract pairs would be learned (Yuille, 1968); that the concreteness of the

material to be learned would interact with the mode of presentation in accordance with the Day and Beach (1950) conclusion that difficult material is acquired more efficiently visually while easy material is acquired faster aurally, so that abstract noun pairs would be acquired more rapidly under visual presentation while concrete noun pairs would be acquired faster under aural presentation. However, the Day and Beach (1950) study referred to differences between words and nonsense syllables. The present study attempted to extend their hypothesis to include concrete and abstract nouns supposing that concrete nouns could be considered as easier material than abstract nouns. Concrete nouns are assumed to arouse imagery but these images might be elicited more readily through aural rather than visual presentation (Paivio 1969). This, in turn, would facilitate acquisition of concrete pairs independent of any difficulty effect.

A survey of the literature has revealed that no one had yet used a mixed-modality design. Besides providing a test of the effect of modality within subjects, the design more closely approximated learning that may occur in a real-life situation (i.e. the classroom). Also, the evidence to date, although sketchy, suggested that verbalization inhibited the acquisition of aurally presented materials (Macworth, 1964) while it facilitated the acquisition of visually presented materials (Mechanic & Mechanic, 1966). The present study investigated whether the factor of verbalization was in any way related to the concreteness of material to be learned as well as supply data on the possible relationship of modality.

METHOD

Experimental Design

A 2x2x3x8 factorial design was employed. The between subjects variables were two levels of concreteness and two levels of verbalization. The within subjects variables were three levels of input modality and eight trials. (See Table 1)

Subjects

Sixty-seven university students naive in verbal learning were used in the present study. Data from three subjects were discarded because they were unable to follow instructions. The age range of the subjects was between nineteen and twenty-four years of age. The mean age of male subjects was 20.65 years while the mean age of female subjects was 20.00 years. No significant age differences existed between male and female subjects ($t=.644$, $p>.05$). Subjects were assigned to one of the four groups as they appeared for the experiment, sixteen per group with an equal number of male and female subjects assigned to each group.

Apparatus

An Ampex two channel cassette recorder was used to present the auditory noun-pairs and the auditory portion of the combined presentation. A Kodak 800 Carousel slide projector was used to present the visual noun-pairs and the visual portion of the combined presentation. One channel of the tape was used to present the noun-pairs while the second channel was used to activate the slide projector.

WITHIN SUBJECT VARIABLESPRESENTATION MODALITY

		<u>Auditory</u>	<u>Visual</u>	<u>Auditory-Visual</u>	
<u>BETWEEN SUBJECT VARIABLES</u>		Trial	1 → 8	1 → 8	1 → 8
	Concrete	Verbalization	16	-	-
		Nonverbalization	16	-	-
	Abstract	Verbalization	16	-	-
		Nonverbalization	16	-	-
	Total Subjects		64	-	-

TABLE 1. Experimental Design

Control for the presentation was achieved by using a multi-channel audio-decoder device developed in the Psychology Department of Lakehead University. This decoding device consisted of several narrow band selective amplifiers. Each amplifier was connected into a relay, the terminals of which were directly connected into the projector. The auditory part of presentation was recorded by the experimenter.

Materials

The materials (fifteen pairs each of concrete and abstract nouns) were selected from Paivio, Yuille and Madigan's (1968) list of nouns rated for concreteness-abstractness. The nouns were of Thorndike-Lorge (1955) A frequency. The two pools of nouns, the noun-pairs used, the rules employed for selection of the nouns used and the rules used in the construction of the noun pairs are found in Appendix A. Mean values for the noun ratings on imagery, concreteness and meaningfulness may be found in Appendix A.

Procedure:

The study-test (recall) method was used. Eight study and eight test trials were given. On the study trials both members of the pair were presented either aurally or visually or in the combined aural-visual mode. On the test trials only the stimulus member of each pair was presented. A study trial was always followed by a test trial. Mode of presentation for each pair was constant throughout. Five pairs were presented in each mode (e.g. from the concrete list: "coin-hospital" was presented aurally through all study and all test trials; "creature-pipe" was presented visually through all study and

test trials and "dust-string" was presented aurally and visually through all study and test trials (see Appendix B for the designation of the different pairs to their assigned modes). Because of the randomization of the presentation orders, each pair was in a different ordinal position for each of four trials. Four randomizations were constructed and applied to both the concrete and abstract lists (see Appendix B). The entire procedure was run through twice, e.g. the same orders were used for study trials one and five and also for test trials four and eight, in order to obtain the eight study and eight test trials. The interpair interval was three seconds, which gives the subject sufficient time to verbalize the pairs when required. The intertrial interval was also three seconds, during which the subject was informed aurally of the type of upcoming trial, e.g. whether it was to be a study or test trial. Printed instructions were read by each subject. Questions that arose were answered by the experimenter. Slightly different instructions were given to the verbalization and non-verbalization groups (see Appendix C). All subjects were required to give responses verbally. Each subject was tested individually.

RESULTS

A 2x2x3x8 analysis of variance with repeated measures on the last two factors was performed on the data. The between subjects variables were two levels of stimulus concreteness (i.e. concrete versus abstract) and two levels of verbalization (i.e. verbalization vs. nonverbalization). The within subjects variables were three kinds of modal input (i.e. auditory, visual and auditory-visual combined) and eight trials. Three post hoc analyses were also performed on the data. One of these was an overall analysis including sex of the subjects as a fifth variable. The other two analyses, also including sex as a variable, were performed on the first four and the last four test trials to determine at which stage of learning (i.e. early or later learning) the independent variables were significant. F values cited were taken from the three post hoc analyses since the inclusion of the sex variable did not appreciably affect the results (i.e. F values in all analyses are similar). The summary of the post hoc overall analysis is found in Appendix D.

The main effect of concreteness was significant beyond the .01 level in all analyses (e.g. overall analysis ($F(1,56)=32.8, p<.01$); trials 1-4 ($F(1,56)=32.2, p<.01$); trials 5-8 ($F(1,56)=28.7, p<.01$) indicating that more concrete than abstract noun pairs were recalled at all stages of learning. (See Table 2)

The trials by concreteness interaction was significant in all analyses (e.g. overall analysis ($F(7,392)=6.6, p .01$); trials 1-4

($F(3,168)=10.3$, $p<.01$); trials 5-8 ($F(3,168)=3.916$, $p<.01$) indicating that concrete pairs were acquired more rapidly than abstract pairs.

The main effect of mode of presentation approached significance in the overall analysis. Further analyses revealed that significance occurred during the last four trials ($F(2,112)=3.69$, $p<.05$). The combined presentation is superior to the visual presentation ($F(1,60)=6.79$, $p<.05$) (See Table 3). This suggests that the combined presentation became dominant in later learning.

The mode by concreteness interaction was significant in the overall analyses ($F(2,112)=4.79$, $p<.01$). Further analyses revealed that this occurred during the last four trials ($F(2,112)=4.38$, $p<.05$). The combined presentation was significantly more effective than the visual or auditory ($F(2,60)=7.91$, $p<.01$) for recall of concrete noun pairs while the presentation modalities were not significantly different for the recall of abstract noun pairs. (See Table 4).

The trials by mode interaction was significant in the overall analysis ($F(14,784)=2.19$, $p<.01$). Further analyses revealed that this occurred during the last four trials ($F(6,336)=2.86$, $p<.01$). This suggests that, in this kind of task, mode of presentation had no effect on rate of acquisition in early learning while, in later learning, it affects acquisition. (See Figure 1).

The main effect of trials was significant in all analyses (i.e. in the overall analysis ($F(7,392)=215.8$, $p<.01$); analysis of

TRIALS

	1 - 8	1 - 4	5 - 8
Concrete	2.79	1.90	3.67
Abstract	1.56	.83	2.97

TABLE 2: Mean number of Concrete and Abstract noun pairs recalled over Trials 1-8: 1-4: 5-8

TRIALS

	1 - 8	1 - 4	5 - 8
Auditory	2.15	1.27	3.02
Visual	2.07	1.34	2.81
Combined	2.30	1.49	3.10

TABLE 3: Mean number of noun pairs recalled across modes over Trials 1-8: 1-4: 5-8

TRIALS

	1 - 8			1 - 4			5 - 8		
	A	V	AV	A	V	AV	A	V	AV
Concrete	2.65	2.64	3.07	1.71	1.83	2.16	3.58	3.45	3.98
Abstract	1.65	1.50	1.52	.83	.85	.82	2.46	2.16	2.23

TABLE 4. Mean number of Concrete and Abstract pairs recalled across modes over Trials 1-8; 1-4; 5-8

TRIALS

	1 - 8	1 - 4	5 - 8
Male	1.95	1.20	2.69
Female	2.40	1.53	3.26

TABLE 5. Mean number of noun pairs recalled by male and female subjects over Trials 1-8; 1-4; 5-8

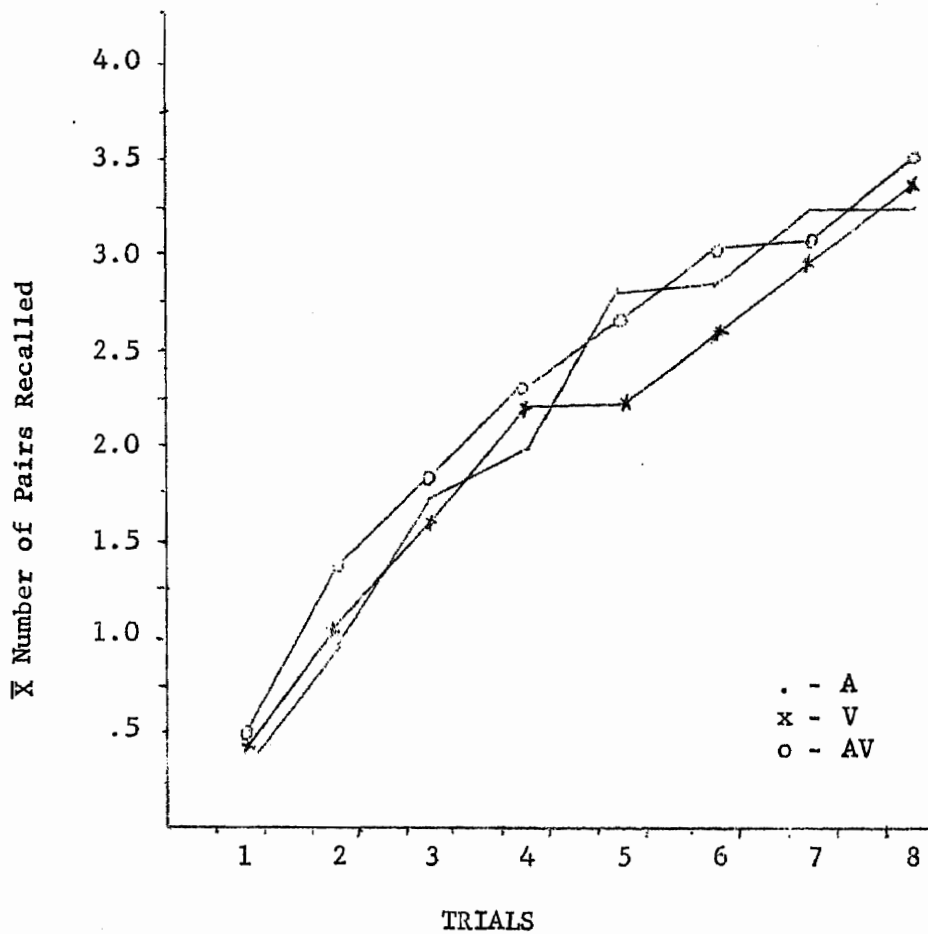


FIGURE 1. Mean number of pairs recalled across modes over trials

trials 1-4 ($F(3,168)=137.41, p<.01$) and trials 5-8 ($F(3,168)=35.80, p<.01$) indicating that learning had occurred.

The post hoc analysis which included the sex of the subjects as a variable revealed a significant main effect of sex. This was present in the overall analysis ($F(1,56)=4.36, p<.05$). Further analyses revealed that this occurred during the last four trials ($F(1,56)=4.68, p<.05$). Female subjects acquired more noun pairs in later learning than did male subjects. (See Table 5).

The trials by sex interaction was significant in the overall analysis ($F(7,392)=2.19, p<.05$). Further analyses revealed that this occurred during the first four trials ($F(7,392)=2.26, p<.05$). This suggests that female subjects acquired the noun pairs faster in early learning than did male subjects. These differences in rate of acquisition appear to diminish in later learning. (See Figure 2).

The final significant interaction was that of trials by sex by verbalization ($F(7,392)=2.26, p<.05$). This complex interaction (See Figure 3) cannot be interpreted at the present time, and therefore, will not be discussed any further.

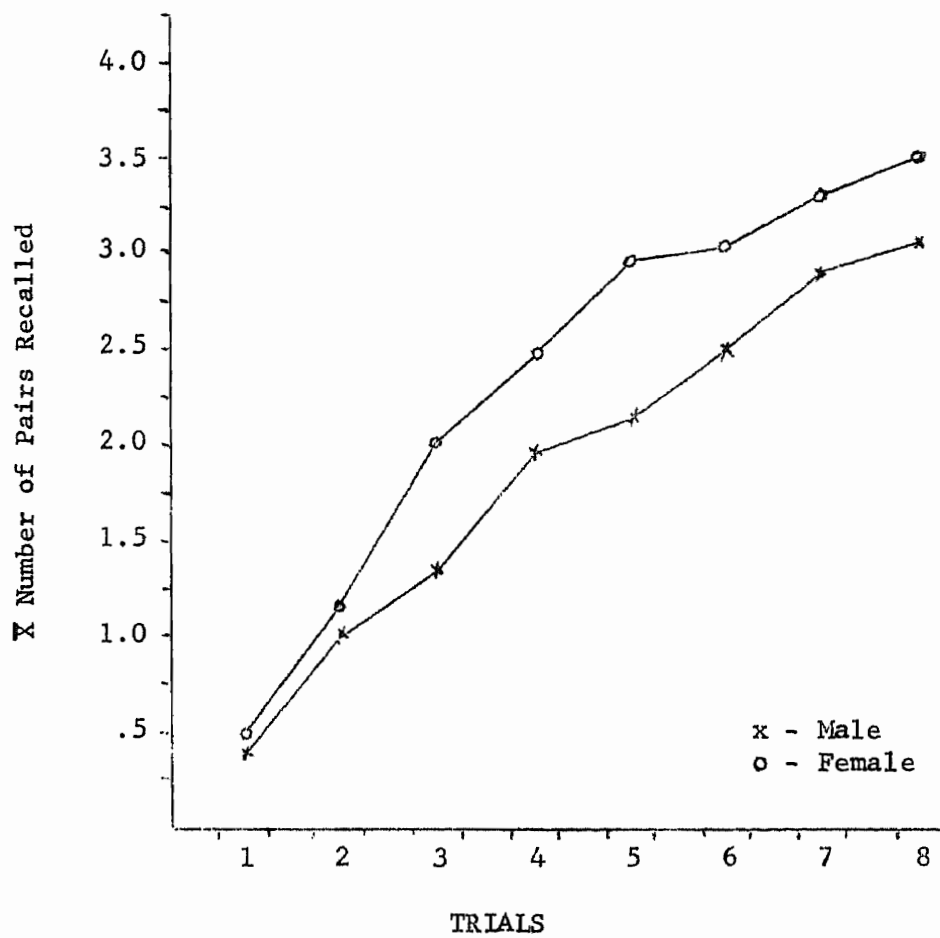


FIGURE 2. Mean number of pairs recalled by male and female subjects over trials

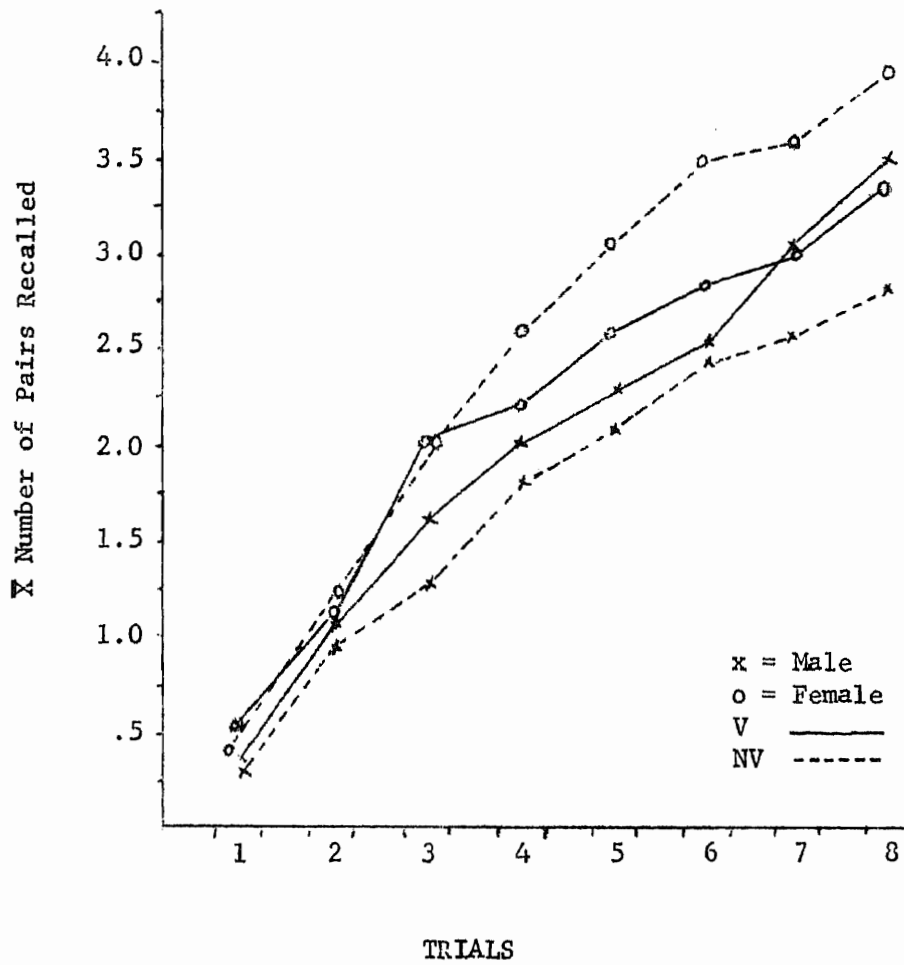


FIGURE 3. Mean number of pairs recalled by male and female subjects under verbalization-nonverbalization conditions over trials

DISCUSSION

The use of mixed modality input (i.e. three modes of presentation within a single list) as a within subjects variable appeared to have given the subjects a very difficult task to perform. Below average performance can be seen by noting overall recall on the final (eighth) trial. On the concrete list a mean of 11.78 pairs of a possible fifteen pairs were recalled. On the abstract list a mean of 8.63 pairs of a possible fifteen pairs were recalled. This type of performance does not usually occur in a paired associates learning task when nouns are used as learning materials. The number of trials given and the interitem interval of three seconds should have produced a larger amount of learning. Below average performance would seem to be attributable to the tri-modal presentation within each list because the other variables (e.g. concreteness and verbalization) have been used frequently in the past with much more learning taking place. (e.g. Paivio (1965) in a study where a mean number of 11.41 of a possible sixteen concrete pairs were recalled after only four trials. In the same study a mean number of 6.05 of a possible sixteen abstract pairs were recalled after the same number of trials). This multi-modal presentation may have led to some confusion or interference for the subjects (e.g. receiving information in different ways). This confusion was possibly due to the sorting out of incoming signals (e.g. Hopkins et al (1971) have reported cross-modality interference effects in a short-term memory task). It is probable that a single mode of presentation would have resulted in more rapid acqui-

sition of the pairs. It was also possible that the interitem interval interacted in some way with the multi-modal presentation to produce this slow learning effect. It may be that the three second interitem interval was too short a duration when the subject was required to process information received in three different ways. Subjects were generally required to alter their set for incoming information because of the random order of presentation of the pairs. The time interval allotted may not have been sufficient for them to receive, process and store a given pair.

As in previous studies, the faster acquisition of concrete over abstract noun pairs is once again confirmed (Paivio, 1965; Paivio, Yuille and Smythe, 1966; Yuille, 1968). Even though this task appeared more difficult than the typical paired-associates learning task involving these stimulus materials, this task in no way altered the concreteness effect demonstrated before.

Although the main effect of mode of presentation was not significant in the overall analysis, it did show significance on the last four trials. The combined auditory-visual presentation was superior to the visual presentation providing support for the hypothesis that the combined mode of presentation would be superior. This demonstrated superiority of the combined presentation, supports the conclusion of Day and Beach (1950) and also supports the finding of Williams and Derkes (1963) about superiority of the combined presentation. The present study did not find differences between auditory and visual presentations. This is contradictory to findings suggesting superior-

ity of the visual presentation over the auditory presentation (Beery, 1968; Williams and Derkes, 1963). Their studies employed lists presented in one modality and it is suggested that, in the present study, cross modality interference effects could have possibly confounded these modality differences. Because the auditory and visual modes of presentation did not differ significantly from each other in the present study, no further information can be contributed about the superiority of either mode of presentation in regard to this type of learning task; therefore the hypothesis that abstract (i.e. more difficult) pairs would be learned faster under the visual modality while concrete (i.e. easier) pairs would be learned faster under the auditory modality is not confirmed. It is suggested that the concreteness-abstractness dimension did not provide a sufficient dichotomy of easy and difficult material to elicit a significant difference between the auditory and visual presentations. Cooper and Gaeth (1967) feel that any differences in modes of presentation are a function of habit rather than any qualities of the materials used. If such modality habits exist, they could provide another source of uncontrolled variance.

The significance of the concreteness by mode of presentation interaction occurred in the overall analysis and in the analysis of the last four trials suggesting that modality had its effect in later learning. It was revealed that the combined mode of presentation significantly facilitated the acquisition of concrete pairs but not abstract pairs. This supports the previous suggestion that the concreteness-abstractness dimension of nouns did not provide a wide enough

range of easy and difficult material to produce an effect on modality.

The significance of the trials by mode of presentation interaction occurred in the overall analysis and in the analysis of the last four trials. As the number of trials increased the audio-visual presentation became superior to the visual presentation. The nonsignificance of mode of presentation during early learning could possibly be attributed to time taken to adapt to this particular task.

The present study has revealed an unexpected sex difference in performance of this kind of verbal learning task. The experimental design was not originally created to measure any such differences. However, a post hoc analysis revealed this difference which indicated that female subjects did better than male subjects. This significant result was present in the overall analysis and in the analysis of the last four trials. It is possible that females adapted faster to the task or that this task is more suited to females (females are faster at learning this kind of task than males).

Little has been reported on this type of finding. Generally speaking, most researchers ignore this variable. Beery (1968) did, however, report that he found better performance among female subjects than male subjects. He offered no suggestions as to why this occurred. This same effect was found by Allen (1969). In this case also, no explanation was attempted. In that study, only abstract noun-pairs were used and age of subjects was not controlled. In the present study, age of the subjects was controlled, as previously reported, no significant age difference existed between male and female subjects.

Therefore holding age constant does not eliminate differences in performance by male and female subjects.

An attempt to discuss sex differences has been made by Cofer (1967) who found in a series of experiments evidence for differences in the same direction as the present study, as well as equality in performance under various conditions (e.g. materials, time intervals, recall methods). He reports that the differences occurred in experiments using nonsense syllables. He suggested this type of task requires an integration factor found more predominantly in females than in males. He also suggested that superior performance by female subjects may be due to the possibility that they: "have greater knowledge of letter frequencies ... or that girls have stronger letter associations than boys". However, it is not felt that in the present study explanations about studies using nonsense syllables are applicable. Integration may be a factor if one defines it as the ability to put two supposedly unrelated nouns (words) together and to recall one of them on cue.

Tyler (1965) reviewing sex differences in tested abilities cites several studies in which female subjects were superior to male subjects in verbal fluency (p.244). She also states that studies have shown females to be superior in rote memory (p.246). The combination of better verbal fluency and better rote memory skills may serve as a better explanation of their superior performance in this kind of task.

The significance of the trials by sex interaction shows that female subjects acquired more noun pairs over the eight trials than

did male subjects. It is possible that female subjects adapted more quickly to the task. This gained some support when it was found that this occurred during the first four trials. The evidence for female superiority in verbal fluency and rote memory (Tyler, 1965) may serve to explain the more rapid rate of acquisition. Noninteraction during the last four trials suggests that the male subjects were learning at the same rate as the female subjects.

Mention should be made of the nonsignificance of the verbalization factor. It is not significant by itself but interacts with trials and sex of the subjects. It is possible that the complexity of the task may have served to mask the main effect of the verbalization dimension.

Summary

The complexity of the design of the present study which employed the use of three modes of presentation within one list appears to have given the subjects a difficult task to perform. As has been the case in previous research more concrete than abstract noun pairs were recalled even under the difficult conditions imposed in this experimental design. More noun pairs were recalled under the combined modality presentation than the visual presentation but only in later learning (i.e. the last four trials).

Female subjects recalled more pairs overall and, in early learning, acquired them more rapidly than male subjects.

Future Research

It is suggested that investigation of a single mode of presentation within one list using the same materials as in the present study be undertaken to determine if three modes of presentation in one list confound or mask the effects of other variables.

It might be of interest to examine the effect of varying the duration of the interitem interval in the task used in the present study to discover whether increasing it facilitates acquisition.

The present study, as well as others, point out the potential value of looking at sex differences as a source of variance in verbal learning tasks.

BIBLIOGRAPHY

- Allen, S. D., The effects of controlled directionality and verbalization on forward and backward recall in paired-associate learning. Unpublished Honors Thesis: Thunder Bay, Ontario: Lakehead University, 1969.
- Beery, K. E., Auditory versus visual learning of words. Perceptual and Motor Skills, 1968, 26, 862.
- Brelsford, J. W., Atkinson, R. C., Recall of paired associates as a function of overt and covert rehearsal procedures. Journal of Verbal Learning and Verbal Behavior, 1968, 7, 730-736.
- Brewer, C. L., Presentation time, trials to criterion and total time in verbal learning. Journal of Experimental Psychology, 1967, 73, 1959, 1962.
- Cofer, C. N., The specificity of individual differences in learning. In Individual Differences and Learning, R. M. Gagne, ed., Columbus, Ohio: Charles E. Merrill Book Inc., 1967.
- Cooper, J. C. Jr., Gaeth, J. H., Interactions of modality with age and meaningfulness in verbal learning. Journal of Educational Psychology, 1967, 58, 41-44.
- Day, W. F., Beach, B. R., A survey of the research literature comparing the visual and auditory presentation of information. United States Air Force Technical Report No. 5921, United States Air Force, Air Material Command, Wright-Patterson Air Force Base, November, 1950.
- Hopkins, R. N., Edwards, R. E., Gavelek, J. R., Presentation modality as an encoding variable in short-term memory. Journal of Experimental Psychology, 1971, 90, 319-325.
- Mackworth, J. F., Auditory short term memory. Canadian Journal of Psychology, 1964, 18, 292-303.
- Mechanic, A., D'Andrea, J., The role of articulation in response learning. Proceedings of the 73rd Annual Convention of the American Psychological Association, 1965, 61-62.
- Mechanic, A., Mechanic, J., D'Andrea, Response activities and mechanisms of selectivity in incidental learning. Journal of Verbal Learning and Verbal Behavior, 1966, 6, 389-397.

- Murdock, B. B. Jr., Visual and auditory stores in short term memory. Quarterly Journal of Experimental Psychology, 1966, 18, 206-211.
- Murdock, B. B. Jr., Auditory and visual stores in short term memory. Acta Psychologica, 1967, 27, 316-324.
- Murdock, B. B. Jr., Modality effects in short term memory: storage or retrieval. Journal of Experimental Psychology, 1968, 77, 79-82.
- Murray, D. J., Vocalization-at-presentation and immediate recall with varying presentation rates. Quarterly Journal of Experimental Psychology, 1965, 17, 47-56(a).
- Murray, D. J., Vocalization-at-presentation, auditory presentation and immediate recall. Nature, 1965, 207, 1011-2(b).
- Murray, D. J., Vocalization-at-presentation and immediate recall with varying recall methods. Quarterly Journal of Experimental Psychology, 1966, 18, 9-18(a).
- Murray, D. J., Vocalization-at-presentation and recall of lists varying in association value. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 488-91 (b).
- Murray, D. J., Overt vs. covert rehearsal in short term memory. Psychonomic Science, 1967, 7, 363-4.
- Paivio, A., Abstractness, imagery and meaningfulness in paired associate learning. Journal of Verbal Learning and Verbal Behavior, 1965, 4, 32-38.
- Paivio, A., Mental imagery in associative learning and memory. Psychological Review, 1969, 76, 241-263.
- Paivio, A., Olver, M., Denotative-general'ity, imagery and meaningfulness in paired associate learning of nouns. Psychonomic Science, 1964, 1, 183-184.
- Paivio, A., Yarmey, A. D., Abstractness of the common element in mediated learning. Psychonomic Science, 1965, 2, 231-232.
- Paivio, A., Yuille, J. C., Mediation instructions and word attributed in paired associate learning. Psychonomic Science, 1967, 8, 65-66.

- Paivio, A., Yuille, J. C., Madigan, S. A., Concreteness, imagery and meaningfulness for 925 nouns. Journal of Experimental Psychology, Monograph Supplement, 1968, 76 part 2, 1-25.
- Paivio, A., Yuille, J. C., Smythe, P. C., Stimulus and response abstractness, imagery and meaningfulness and reported mediators in paired-associate learning. Canadian Journal of Psychology, 1966, 20, 362-77.
- Reynolds, J. H., Confirmation, contiguity and response practice in paired associate learning. Journal of Experimental Psychology, 1967, 73, 394-400.
- Schulz, R. W., Hopkins, R. H., Presentation mode and meaningfulness as variables in several verbal learning tasks. Journal of Verbal Learning and Verbal Behavior, 1968, 7, 1-13.
- Schulz, R. W., Kasschau, R. A., Serial learning as a function of meaningfulness and mode of presentation with audio and visual stimuli of equivalent duration. Journal of Experimental Psychology, 1966, 71, 350-354.
- Schulz, R. W., Tucker, I. F., S-Familiarization and length of anticipation interval in PAL. Psychological Record, 1962, 12, 341-344(a).
- Schulz, R. W., Tucker, I. F., Supplementary report: stimulus familiarization in P-A learning. Journal of Experimental Psychology, 1962, 64, 549-50(b).
- Thorndike, E. L., Lorge, I., The Teachers Handbook of 30,000 Words. New York: Teachers College, Columbia University, 1944.
- Tyler, L. E., The Psychology of Human Differences. New York: Appelton-Century-Crofts, 1965.
- Underwood, B. J., Articulation in verbal learning. Journal of Verbal Learning and Verbal Behavior, 1964, 3, 1946, 149.
- Williams, J. M., Derkes, P. L., Mode of presentation and the acquisition of paired associates that differ in pronounceability and association value. Journal of Verbal Learning and Verbal Behavior, 1963, 2, 453-456.
- Yarmey, A. D., O'Neill, B. J., S-R and R-S paired-associate learning as a function of concreteness, imagery, specificity and association values. Journal of Psychology, 1969, 71, 95-109.

Yarmey, A. D., Paivio, A., Further evidence on the effects of word abstractness and meaningfulness in paired associate learning. Psychonomic Science, 1965, 2, 307-303.

Yuille, J. C., Concreteness without imagery in P-A learning. Psychonomic Science, 1968, 11, 55-56.

Concrete Word Pool

bar	beast	bottle	boulder	bowl	brain
breast	cabin	cattle	cell	clock	clothing
coast	coffee	coin	corn	creature	diamond
dust	engine	factory	flag	flesh	flood
fur	furniture	hospital	hotel	lad	library
magazine	metal	nail	palace	pipe	pole
prison	professor	pupil	string	temple	tower
troops	vegetable	vessel	wine		

Abstract Word Pool

advantage	advice	anger	attitude	charm	confidence
custom	development	devil	discovery	excuse	expression
fate	fault	freedom	fun	glory	happiness
instance	justice	memory	moral	necessity	occasion
opportunity	passion	pride	quality	safety	science
shame	situation	style	theory	victory	virtue

Rules for the Selection of Nouns Used:

- (1) no two words of the same length and beginning with the same letter or sound were used
- (2) no two words beginning with the same sound were used
- (3) no three letter nouns were included
- (4) since the concrete pool contained several nouns which denoted buildings, some of these were eliminated

Rules for the Construction of the Noun-Pairs:

- (1) no one pair in either list begins with the same letter(s) or sound(s)
- (2) no one pair in either list ends with the same letter(s) or sound(s) - exception - silent 'e'
- (3) in each list the pairs were constructed so that no apparent associations could be made between the nouns of a pair
- (4) an attempt was made to have an equal number of the nouns beginning with the same letter as stimulus and response items

Concrete Noun Pairs

1. dust-string	6. prison-vessel	11. boulder-cell
2. creature-pipe	7. factory-pole	12. tower-diamond
3. pupil-flood	8. furniture-beast	13. clothing-nail
4. coin-hospital	9. engine-bottle	14. wine-cattle
5. brain-troops	10. magazine-coast	15. library-metal

Abstract Noun Pairs

1. charm-justice	6. safety-happiness	11. pride-opportunity
2. custom-situation	7. virtue-instance	12. fault-confidence
3. advice-passion	8. quality-devil	13. necessity-fate
4. memory-attitude	9. discovery-moral	14. expression-style
5. theory-freedom	10. occasion-glory	15. science-anger

Appendix A (continued)

	Imagery	Concreteness	Meaningfulness
concrete nouns	6.276	6.769	6.824
abstract nouns	3.606	2.191	5.426

Mean values for noun ratings for imagery, concreteness and meaningfulness used in the present study (from values given by Paivo, Yuille and Madigan, 1968)

APPENDIX BRandomization of the Assignment of Mode for Concrete and Abstract Noun Pairs

1. AV	6. V	11. V
2. V	7. V	12. AV
3. AV	8. AV	13. A
4. A	9. AV	14. V
5. A	10. A	15. A

Random Orders of Presentation of Pairs

I	II	III	IV
4	13	11	7
1	8	6	10
11	7	15	1
9	3	4	15
12	1	5	3
14	10	3	8
6	5	2	4
5	9	14	13
7	2	9	12
8	12	13	2
13	6	8	5
15	11	10	6
10	15	7	14
3	14	1	9
2	4	12	11

The above numbers refer to the numbers assigned the pairs in Appendix A

Application of Orders to Study and Test Trials

	<u>Orders</u>			
	I	II	III	IV
<u>Trials</u>	S ₁	T ₁	S ₂	T ₂
	T ₃	S ₃	T ₄	S ₄
	S ₅	T ₅	S ₆	T ₆
	T ₇	S ₇	T ₈	S ₈

APPENDIX CInstructions for the Verbalization Group

Each pair of words that you are requested to learn for this experiment will be presented either by hearing them, seeing them or both ways. You are required to repeat the pairs aloud. Please give both words aloud at all times. You will be given an opportunity to study the pairs of words and then to test your knowledge. This process will be repeated several times. Are there any questions?

Instructions for the Nonverbalization Group

Each pair of words that you are requested to learn for this experiment will be presented either by hearing them, seeing them or both ways. Do not repeat the pairs aloud. Please give the second word aloud on each test trial. You will be given an opportunity to study the pairs of words and then to test your knowledge. This process will be repeated several times. Are there any questions?

APPENDIX D

Summary of analysis of variance of recall data as a function of concreteness, verbalization, sex, input modality and trials

Source	ss	df	ms	f	p
Subjects	1747.578	63			
Concrete-Abstract	580.168	1	580.168	32.809	.01
Verbalization-Nonverbalization	0.023	1	0.023	0.001	ns
C-AxV-NV	32.664	1	32.664	1.847	ns
Sex	77.043	1	77.043	4.357	.05
C-AxS	0.207	1	0.207	0.012	ns
V-NVxS	36.262	1	36.262	2.051	ns
C-AxV-NVxS	30.941	1	30.941	1.750	ns
Error (C-A:V-NV:S)	990.270	56	17.683		
Mode	13.215	2	6.607	3.008	ns
MxC-A	21.055	2	10.527	4.792	.01
MxV-NV	5.730	2	2.865	1.304	ns
MxC-AxV-NV	0.426	2	0.213	0.097	ns
MxS	5.836	2	2.918	1.328	ns
MxC-AxS	8.117	2	4.059	1.847	ns
MxV-NVxS	1.656	2	.828	0.377	ns
MxC-AxV-NVxS	2.406	2	1.203	0.548	ns
Error	246.043	112	2.197		
Trials	1400.000	7	200.000	215.584	.01
TxC-A	42.621	7	6.089	6.563	.01
TxV-NV	8.496	7	1.214	1.308	ns
TxC-AxV-NV	2.836	7	0.405	0.437	ns
TxS	14.227	7	2.032	2.191	.05
TxC-AxS	2.500	7	0.357	0.385	ns
TxV-NVxS	14.676	7	2.097	2.260	.05
TxC-AxV-NVxS	7.977	7	1.140	1.228	ns
Error	363.664	392	0.928		
MxT	17.941	14	1.282	2.189	.01
MxTxC-A	12.063	14	0.862	1.472	ns
MxTxV-NV	9.531	14	0.681	1.163	ns
MxTxC-AxV-NV	10.293	14	0.735	1.256	ns
MxTxS	6.301	14	0.450	0.769	ns
MxTxC-AxS	10.145	14	0.725	1.238	ns
MxTxV-NVxS	7.250	14	0.518	0.884	ns
MxTxV-NV	5.707	14	0.408	0.696	ns
Error (M:T:C-A:V-NV:S)	459.023	784	0.585		
Total	2699.734	1472			