An expansion of the conceptual-peg hypothesis: the effect of the mode of presentation of the same information in a retention task.

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AN EXPANSION OF THE CONCEPTUAL-PEG HYPOTHESIS:
THE EFFECT OF THE MODE OF PRESENTATION OF THE
SAME INFORMATION IN A RETENTION TASK

by

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B.A. (Hons.), University of Waterloo, 1972

A Thesis
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ABSTRACT

Thirty-six grade four children participated in a study examining the influence of concrete (film) presentation and abstract (print) presentation of the same information on a retention task. One group was administered only film-film presentation, another was administered film-print presentation, a third received print-film presentation, and a fourth received print-print presentation. It was found that the print-print group yielded significantly fewer correct responses than the film-print and print-film groups. No significant differences were found between film-film and print-print groups, or between film-film and film-print and print-film groups. Task differences were attributed to the discrepancy between these results and the findings of previous studies.
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CHAPTER 1
INTRODUCTION.

Various investigators have explored the effect of modality (visual or auditory) on the acquisition and retention of verbal material (Bruininks and Clark, 1972; Heggeman, 1967; Williams, 1954; Wong and Blevins, 1966). Some of the research has been initiated in an attempt to examine the effectiveness of various teaching techniques (Gulo and Baron, 1965; Gulo and Nigro, 1966; Heggeman, 1967; Williams, 1954). Other investigators have directed their attention to the hypothesis that learning may be facilitated through the addition of relevant cues.

The "additive cue" hypothesis, as suggested by Miller (1957), is an extension of the results obtained from animal research (Eninger, 1952). Animal studies have found that discrimination learning is faster with the addition of relevant cues. Miller has suggested that a similar facilitatory effect should be obtained when the number of relevant cues is increased in the task to be learned by human subjects. Since cue is defined by Miller in somewhat general terms as "any specifiable attribute of the environment", research involving multi-modal presentation of the material to be learned would be encompassed by the "additive cue" hypothesis. For example, the addition of relevant auditory cues to a visually presented task should facilitate the process of acquisition. The addition of irrelevant auditory cues should, of course, hinder the acquisition process.
The Effectiveness of Multi-Modal Presentation

The research involving multi-modal presentation as a teaching technique has been often characterized by empirical attempts designed to simulate the actual classroom situation. The studies which follow are good examples of this approach.

In a study by Williams (1954), Ss were presented with a three thousand two hundred word lecture at a television studio. Pictures were not employed in any of the presentations. The Ss were randomly assigned to one of four treatment conditions: a) television presentation consisting of viewing and listening to a lecturer on a film, b) an auditory presentation of the lecture script, c) print, and d) lecture presentation consisting of watching and listening to a lecturer in person. The Ss were tested on a multiple choice test. Williams found that television presentation yielded significantly superior scores to auditory, and in turn, auditory was significantly superior to printed text. No significant differences were found between the print and live lecture presentation. The author concluded that the presentation through the two sense modalities was superior to one sense modality. He suggested that the inferior performance of the group administered the lecture presentation was due to the many extraneous distractions in the studio during the presentation.

A study by Gullo and Baron (1965) produced different results. Subjects were presented with a prose selection of approximately fourteen-hundred words. They were randomly assigned to one of four presentations: 1) print, 2) listening and watching a lecturer who was present in the classroom, 3) listening and watching a lecturer
through a television monitor, and 4) auditory. In contrast to the study cited above (Williams, 1954), Gulo and Baron found that, with presentation time held constant for all Ss, simply reading the printed material produced superior results on a multiple choice test. No significant differences were obtained between live lecture, television lecture, and auditory presentations. As a post hoc explanation of the discrepant findings, the authors suggested that since the duration of exposure to the material was held constant for all four groups, the print group may have had additional time to practice the material.

Gulo and Nigro (1966) compared the effectiveness of programmed text, conventional textbook and videotape lecture presentation on the performance of Ss on a multiple choice test. The material consisted of fundamental concepts of statistical analysis. Presentation time was held constant (twelve minutes) for all three groups. Gulo and Nigro found no significant differences between the three types of presentations. As a test of the hypothesis they had proposed in the earlier (1965) study, they ran a second experiment. In order to control for the possibility of differential practice effects, they manipulated the duration of exposure for the presentation of material. Subjects were presented with the same materials as in Experiment 1. They were randomly assigned to one of five presentations; 1) programmed instruction, 2) televised lecture, 3) reading the material once, 4) reading the material within a twelve minute time period, 5) reading the material for a six minute time period. All of the Ss were tested on a multiple choice test; however,
half of the Ss were tested immediately following the presentation of material, while the other half were tested one week later. Although the authors found that Ss tested immediately following presentation yielded significantly fewer incorrect responses than Ss tested in the delayed condition, no significant differences were found between the types of presentations.

Finally, Hickman (1967) compared film, live lecture, and printed instructional material as techniques for the teaching of descriptive geometry. Ss were presented with one of three types of presentations over a thirty-week period. Each group was presented with the same material, differing only in the type of presentation. Ss were tested on a multiple-choice and true-false examination immediately following the series of presentations and eight weeks later. The two tests were identical; only the order of the questions were changed. Hickman found no significant differences between the three types of presentations for the two testing conditions.

The studies outlined above have employed a purely empirical approach to the question of the effectiveness of multi-modal presentation. The results are inconclusive and difficult to compare due to the Es' arbitrary choice of conditions and the wide range of materials used in the different studies. Consequently, it appears that this approach has provided little in the way of additional information about the effectiveness of multi-modal presentation as a teaching technique.

The Additive Cue Hypothesis

The early research (Henmon, 1912; Munsterberg and Biggam, 1894)
provided support for the position that multi-modal presentation (audio-visual) was superior to the audio or visual alone. However, as Van Mondfrans and Travers (1964) pointed out, none of these studies reported levels of significance and many of the differences were slight.

More recently, in a study by Van Mondfrans and Travers (1964), Ss were presented with one of three types of materials: a) trigrams of low meaningfulness, b) words, and c) words with constraint. The words with constraint were composed of the list of words but were arranged in sequences of five in the order of adverb or adjective, noun, verb, and noun. Each sequence could be found in an English sentence with only the addition of connectives. Within each condition the Ss were administered the material under auditory presentation in which the words were pronounced, visual, and auditory and visual presentations. The authors found that recall was significantly poorer for the trigrams than for words and words with constraint. No significant differences were found in the amount of recall between words and words with constraint. Although the auditory mode of presentation was significantly inferior for the trigrams, no significant differences were found between the effect of visual and auditory plus visual mode of presentation for this type of material. For words and words with constraint, the authors found no significant differences between auditory, visual, and audio-visual presentations.

Thus for the low meaningfulness materials, the results partially supported the additive cue hypothesis since the auditory mode alone was significantly inferior to the visual plus auditory presentations.
The lack of a significant difference between the amount recalled under visual and visual plus auditory presentation contradicts the hypothesis as does the absence of statistically significant effects for the core meaningful material. With regard to the latter point, it would appear that task variables, such as the type of material to be learned may be an important factor in determining the applicability of the additive cue hypothesis.

In a somewhat similar study, Wong and Blevings (1966) presented Ss with CVC trigrams. One group of Ss received a visual presentation, another received visual plus auditory and a third saw and vocalized the material. Subjects involved in the visual presentation were shown cards with the trigrams printed on them. Subjects in the visual plus auditory presentation were shown the syllables while the E read them out loud to them at the same time. Subjects who saw and vocalized the material were instructed to pronounce each syllable out loud as it was shown to them. All the Ss were presented with material for three trials and were tested by means of a free recall procedure. Wong and Blevings found superior performance for the two groups involving the auditory component; however, no significant differences were found between these two groups. Since the addition of the auditory channel resulted in superior performance, the results were in partial agreement with the additive cue hypothesis. The addition of a third cue, the kinesthetic-motor element involved in vocalizing the material, did not produce recall scores significantly different from those obtained from Ss who were not required to verbalize the material.

The relationship between the type of material to be learned and
the degree of facilitation obtained with multi-modal presentation appears to be quite complicated. Menne and Menne (1972) examined the influence of bimodal presentation on the recall of four-line verses under auditory, visual and audio-visual presentation. The visual and auditory presentations were recorded on videotape. The authors found superior recall under simultaneous audio plus visual presentation. Visual presentation alone was superior to the auditory mode. Although these results again support the additive-cue hypothesis, they are difficult to understand in light of the lack of differential effects obtained with meaningful material by Van Moshfrans and Travers (1964).

Visual presentation in each of the above studies involved the presentation of printed material. In contrast, Bruininks and Clark, (1972) used drawings as the material presented in the visual mode. They again examined the effect of auditory, visual and combined auditory plus visual modes of presentation in a paired-associate task. The Ss in the study were first-grade, disadvantaged, educable, mentally retarded children (IQ 60-80), disadvantaged nonretarded children (IQ 90-112) and advantaged nonretarded children (IQ 90-112). Each child received a visual pictorial presentation consisting of line drawings on cards, an auditory presentation of the labels for the objects depicted in the drawings, and a combined auditory plus visual presentation. Bruininks and Clark found that the recall scores of the disadvantaged nonretarded Ss were significantly higher than disadvantaged retarded Ss. No significant differences were found between disadvantaged and advantaged nonretarded Ss.
All three groups performed significantly better under the auditory plus visual (picture-word) and visual (picture) conditions in comparison to the auditory presentation. But no significant differences were obtained between visual and audio plus visual presentation.

In a related, but somewhat more complicated study, Severin (1967) assigned Ss to one of six treatment conditions: a) auditory, b) print, c) auditory plus print, d) auditory with related pictures, e) auditory with unrelated pictures of the same category (e.g., the word "moose" with a picture of a bison), f) auditory with unrelated pictures of a different category (e.g., the word "moose" with a picture of a catfish). The Ss were tested on a recognition task using the same sense modality as that used for stimulus presentation. For example, Ss who learned using an auditory mode were tested in the same mode. Severin found the highest mean recognition score for the auditory plus related pictures group, followed by the auditory plus print, printed words, auditory alone, auditory plus highly unrelated pictures, and auditory plus unrelated pictures. The auditory plus related pictures presentation was found to yield significantly fewer recognition errors than auditory accompanied by print. However, similar to the results obtained by Van Mondfrans and Travers (1964) no significant differences were found between the combination of auditory and print, and print alone. Finally, Ss administered the combination of auditory and unrelated pictures were found to yield inferior recognition scores compared with Ss administered auditory and highly unrelated pictures.

It would appear that the research related to the "additive cue"
hypothesis has produced some evidence to suggest that the addition of relevant cues does facilitate the acquisition and retention of material. What remains unexplained is the lack of consistency between the various studies. One possible explanation for these inconsistencies is that the hypothesis is too general a statement. It does not specify the conditions under which the addition of relevant cues would facilitate acquisition and retention of material. According to the hypothesis, if any additional cues are relevant they should facilitate the task. This point is clearly not supported by the obtained data.

In order to make a more precise prediction, a consideration of such conditions as, for example, the type of material being presented seems to be needed. An area of investigation that has taken this approach is the research involving imagery. These studies have been directed toward explaining the influence of concrete material, or material which readily evokes visual imagery. (Paivio, Yuille and Madigan, 1968) on learning and recall. One feature of the research, in contrast to the studies involving multi-modal presentation, has been the greater consistency in the findings. Thus, whole series of experiments have demonstrated, in tasks involving single items and pairs of items, that material which was concrete and, presumably conducive to visual imagery was recalled better than abstract material.

Concrete-Abstract Dimension

The distinction between the psychological effects of concrete and abstract material has been postulated to be dependent on the differences in the arousal of visual imagery (Paivio, 1971). While
concrete material is characterized by its capacity to evoke images or pictures in one's mind, abstract material is characterized by the arousal of verbal associations, with the probability of visual images being proportionately less. Thus, the probability of an image being aroused is assumed to increase from abstract words to concrete words to pictures and objects.

The concrete-abstract continuum is important since imagery has been found to facilitate a variety of tasks involving learning and memory. Although imagery as a storage and a retrieval device was advocated by the mnemonists or memory experts as early as about 500 B.C. (Yates, 1966) it has been only during the twentieth century that imagery has been subjected to systematic investigation. One of the earliest studies examining the effects of concreteness was performed by Roseman (cited in Reed, 1918, page 141). He found that concrete noun pairs were learned better than abstract noun pairs, adjectives, verbs and meaningless word pairs.

More recently, several investigators have demonstrated superior recall for more concrete material, such as pictures, as compared to more abstract material, such as words which were the labels for the pictorial items. Paivio, Rogers and Smythe (1968) compared free recall of coloured and uncoloured sets of both pictures of their noun labels. The results showed a higher recall for pictures than for words. The effect due to the added colour cue was not significant. The authors suggested that the added colour cues were perhaps irrelevant and that concreteness, in the sense of object character was sufficient to facilitate recall since the more concrete pictorial
material could be stored in memory in a dual way, i.e., in a verbal form as well as pictorially. It would be expected, therefore, that recall would be superior for pictures because the appropriate verbal label could be retrieved from storage through either symbolic mode. Although concrete nouns can bring about images as well, the authors have suggested that the probability of dual coding would be lower than in the case of pictures.

In a similar study, Wicker (1970) presented Ss with a list of twenty paired-associates. The Ss were randomly assigned to one of three treatment conditions: a) colour photographs, b) simple line drawings, and c) their noun labels and were tested by the study-test procedure. Superior recall was predicted for picture-pairs as compared to word-pairs and superior recall for photographs as compared to line drawings due to their greater degree of detail. The results of the study partially confirmed the author's predictions. Although recall was significantly superior for pictures as compared to words, no significant differences were obtained between the two types of presentations. Again the results demonstrated that the addition of details or cues was not an effective procedure, in contrast to the effects of concreteness.

Sampson's (1970) investigation of verbal and pictorial stimuli in a free recall condition lends further supportive evidence. His Ss were shown twenty-four items, half as words and half as drawings. They were tested either immediately after stimulus presentation, thirty minutes later or one day later. Picture recall was superior to word recall in all conditions.
Using only verbal material, Tulving, McNulty and Ozier (1965) examined the effect of vividness of words in a free recall condition. Vividness was defined as "the ease with which you can picture something in your mind" which corresponds to the definition of imagery employed by Paivio, Yuille and Madigan (1968). Three lists of sixteen words each were used. All of the words were equated for frequency-of-occurrence value and meaningfulness, but each list varied in vividness. The results showed that Ss recalled the list of higher vividness items more readily than the list of low vividness items.

Finally, Rowe (1972), and Rowe and Paivio (1971) investigated the influence of concreteness in verbal discrimination learning. In a study by Rowe (1972) grade four children were presented with either picture-pairs or noun pairs which were the labels of the pictures. Learning proceeded by the anticipation method. The Ss were given feedback by the presentation of each pair with the correct item underlined after each response. The study demonstrated the effect of concreteness on rate of acquisition since pictures were learned significantly more rapidly than words.

Conceptual-Peg Hypothesis

The studies above appear to have demonstrated the influence of concreteness in tasks involving single and paired items. In attempting to determine more specifically the effect of concreteness, Lambert and Paivio (1956) manipulated the noun-adjective order of words in a modified serial learning task. The Ss were presented with a list which consisted of seven groups of four words each. The groups
consisted of a noun with three modifying adjectives. For one group of Ss the noun preceded the adjectives; for the other group of Ss the adjectives preceded the nouns. Although one might predict that adjective-noun order would produce superior learning since it follows English word order, the list containing noun-adjective order was learned significantly more easily.

The results of the study led to the development of the "conceptual-peg hypothesis." The hypothesis assumes that when the stimulus and response are presented together, the subject integrates them to form an image. During recall, the stimulus is presented by itself. Its imagery arousing value will then be important since it will provide the link in calling forth the image from which the response can be retrieved and recorded as a word. For example, if the subject were presented with a pair of nouns such as elephant-car or idea-car, the former pair should be easier to learn since the concrete noun stimulus "elephant" should be more likely to evoke an image into which the response "car" could be incorporated. During recall, the presentation of the stimulus elephant would re-arouse the image which would aid in retrieving the response, car. On the other hand, the pair idea-car would not evoke an image as readily and consequently provide a less effective peg for the retrieval of the response.

In a test of the hypothesis, Paivio (1963) presented children with a paired-associate task containing noun-adjective pairs in which the following was varied: a) noun-adjective order and b) the abstractness-concreteness of the nouns. Paivio predicted that
learning would be superior as the concreteness of the nouns increased and the effect would be enhanced on the stimulus side of the pairs since the stimulus would function as a peg on which the response would be hooked and retrieved during recall. Results of the study confirmed the prediction. Superior recall was found when nouns were stimulus items rather than response items. Furthermore, the pairs were easier to learn with concrete noun stimuli as compared to abstract noun stimuli.

In a subsequent study Paivio (1965) again examined the abstract-concrete dimension, employing 16 pairs of nouns in a paired-associate task. The following four conditions were presented: concrete-concrete, concrete-abstract, abstract-abstract and abstract-concrete. The Ss who were presented with lists containing concrete nouns showed superior recall as compared to Ss who were presented with abstract nouns. In keeping with the conceptual-peg hypothesis, Ss presented with concrete noun stimuli recalled significantly more words than Ss presented with abstract noun stimuli.

In addition, Gupton and Frinke (1970) have shown the importance of concreteness of the stimulus variable in a modified paired-associate task which required a free recall retention test. The study examined the effect of randomly paired nouns and verbs. The focus of investigation was on the effect of instructions to use imagery as an aid to memory, as well as the effect of noun position on the recall of noun-verb and verb-noun pairs in which either high or low imagery nouns were presented. The authors predicted that noun-verb pairs containing high-imagery nouns would be easier to recall than pairs containing low-imagery nouns. It was also expected
that learning benefits gained through instructions to use imaginal mediators would only be evident in pairs of low-imagery nouns, since Ss would probably use images in learning pairs with high-imagery nouns without such instructions. Finally, in accord with the "conceptual-peg hypothesis" it was expected that performance would be dependent upon noun position relative to the verb in a noun and verb pair. Since production of an image was expected to be more difficult for verb-noun pairs, it was predicted that reversing noun-verb pairs into verb-noun sequences would hinder performance.

Results of the study confirmed their predictions. There was significant memory facilitation due to high-imagery noun members, instructions to use imaginal mediators, and noun-verb ordering. The instructions to use imagery, however, only facilitated pairs with high-imagery nouns but not for low-imagery nouns. The authors suggested that the latter finding was due to the rapid presentation rate which did not allow for the development of imagery.

The findings outlined above have demonstrated that imagery as produced by concreteness is an important factor in learning pairs of words. In addition, there have been a few recent studies in which the influence of imagery has been examined within a more complex context, that is sentence learning and prose learning.

Anderson and Hadde (1971) examined the influence of imagery instructions on sentence learning. The Ss were presented with sentences, one at a time consisting of a noun, verb and noun. Half of the Ss received imagery instructions and half received pronunciability instructions. The Ss who comprised the imagery group were required to form an image of the event described in each
sentence. The Ss in the pronunciability group were instructed to repeat the sentence aloud three times. Following on presentation of the sentence, a surprise recall test was administered. The Ss were given the subject noun and were required to write the correct verb and object which was appropriate for the noun. The results of the study showed the effectiveness of imagery instructions. Subjects who were instructed to form images recalled significantly more words than Ss who pronounced the sentences.

A considerably longer sequence of connected material was used by Anderson and Kulhavy (1972). The Ss were presented with a two thousand, one hundred and ninety word story. One group was instructed to form a mental picture of everything described in the story whereas the control group was told only to read the story. On completion of reading the material, the Ss times were recorded. They were then administered a short answer test and a multiple choice test. In addition they were required to complete a questionnaire regarding the use of imagery. No significant effects were found for instructions, test mode or study time. However, the questionnaire revealed that over half of the control group employed imagery while studying the passage. In addition, the authors found that about one-third of the group that received imagery instructions reported not using imagery. Furthermore, it was found that performance on the tests was positively related to imagery reports. The authors concluded that an individual remembers more from a prose passage if he forms images of the events in the passage. However, they suggest that for a lengthy passage, the tendency for people to employ imagery is perhaps inadequately controlled by simple instructions.
The studies cited above present a good deal of evidence regarding the effectiveness of imagery as a technique for memory. In addition, the conceptual-peg hypothesis specifies the locus of the effect, that is, primarily on the stimulus side.

Present Study

In the school setting, children are often presented with information involving multi-modal presentation of material. For example, printed textual material may be supplemented with pictorial materials such as films. The research on multi-modal presentation has not produced any convincing evidence to support such teaching procedures. One reason for such a failure may lie in the fact that investigators have often ignored task dimensions, such as concreteness of the material and have used the terms visual and auditory to cover many different procedures ranging from print to pictures, lecture to television presentation. Furthermore, some studies in which the concreteness of the task was considered, for example Bruminks and Clark (1972), have found that the addition of cues did not produce any facilitatory effects beyond those that one would have expected from manipulating the concreteness variable alone.

On the other hand, studies involving imagery have consistently demonstrated that imagery, as defined by the concreteness-abstractness dimension, does facilitate recall. Images have been assumed to be most available in the case of pictures; somewhat less available with concrete words and least available with abstract words.

In an attempt to extend these findings from the paired-associate
laboratory task to a more general learning situation; the present study was designed to examine the effect of a concrete (film) presentation of information versus abstract (printed text) presentation of the same information. The concrete material was expected to evoke images more readily and, consequently, the film presentation was expected to produce better performance on a retention test than the more abstract printed material.

In addition, according to the "conceptual-peg hypothesis" of Raivio, the initial presentation of a concrete stimulus item should facilitate the arousal of an image into which the subsequent information could be integrated. It was hypothesized, therefore, that the initial presentation of a film would promote the use of imagery to store the information presented in the film. Such use of imagery would tend to continue on the part of the Ss if they were presented with the same information in a more abstract form such as the printed text. When the order of presentation is reversed so that the initial abstract presentation of printed text is followed by film the amount retained would be expected to be less since the subjects would not have been provided with the initial preparation for the use of imagery.

The design of the study involved four treatment groups: a) film followed by film which was expected to produce the best performance due to the initial presentation of the film and the highly concrete nature of the following pictorial material; b) film followed by printed text which was expected to produce better performance than c) printed text followed by film for the reasons outlined above
and (d) print followed by print which was expected to produce the poorest performance on the retention test due to the abstract nature of both tasks. The abstract presentation, administered twice in succession was expected to reduce the likelihood of the use of imagery by the Ss and therefore provide the least beneficial condition for storage and retrieval.
CHAPTER II
METHOD

Subjects

Thirty-six children (twenty boys and sixteen girls), participated in the study. All of the children (CA 9-10) were from the fourth grade of a rural public school. These children were chosen because they appeared to be old enough to read the printed material on their own.

Materials

An eleven minute, sixteen millimeter colour film, was presented entitled, "Animal Town of the Prairies". The printed material was drawn from the film script (Appendix A).

The test consisted of fill-in-the-blank questions. Supplementary information was obtained from a free recall test and a questionnaire regarding a) the use of imagery while learning the task, b) the number of television programmes watched in a week (Appendix B).

Procedure

The task was administered to four groups of subjects consisting

1. Originally twenty female subjects participated in the study.

However, since one of the girls could not read the test, one female from each of the four treatment groups was randomly discarded from the experiment.
of nine Ss within each treatment group. Prior to the task, each group was told that we were interested in how children learn. To introduce the topic, the Ss were shown a picture of a squirrel followed by a picture of a prairie dog. All of the Ss were told that they would be learning about a prairie dog. Four types of presentations were employed: a) film-film, b) film-print, c) print-film and d) print-print. Each group was administered only one of the four sequences (Appendix C).

In the film-film presentation, Ss were told that they would see the same film twice in succession and then we would find out how much they remembered.

For the film-print presentation, Ss were informed that they would be shown a film followed by a story about a prairie dog which they would read. The Ss were instructed to read the story once and then place it on the floor beside them when they had finished, after which we would try to find out how much they remembered. Each of the Ss was timed with a stop-watch, while reading the script, by one of two Es.

In the print-film presentation, the Ss were informed that they would be given a story to read about a prairie dog and then shown a film about him. They were instructed to read the story once, and then place it on the floor beside them when they had finished. After they had finished the film, we would find out how much they remembered. Each of these Ss was also timed with a stop-watch while reading the script.

For the print-print presentation group, the Ss were told that
they would be given a story to read about a prairie dog. They were instructed to read the story once, put up their hands when they had finished, and then read it again. After they had finished reading the story a second time they were instructed to place it on the floor. The time spent in reading the script was also noted for these Ss.

Following the presentation of material, each S was administered a thirty-five minute test consisting of three parts. The first part involved a fill-in-the-blank retention test which required twenty-five response of a factual nature. A free recall test followed which asked the Ss not to return to the previous test, and to record any additional information that they remembered. Finally, the Ss were asked to complete a two part questionnaire. The first part of the questionnaire asked whether or not the Ss had pictured the material while learning the story. If the answer was yes, a subsequent question asked what they had pictured. The second part of the questionnaire asked the Ss whether they watched television at home. If Ss answered yes, they were asked to write down the television programmes that they watched last week.
CHAPTER III

RESULTS

Retention Test

The total number of items recalled correctly by each S on the fill-in-blank retention test was determined. The mean number of responses were 8.33 for the print-print group, 13.55 for the film-film group, 14.77 for the print-film group and 14.88 for the film-print group. A one way analysis of variance revealed a significant effect due to treatment (p < .05; see Table 1); however, due to a departure from homogeneity of variance, a nonparametric test, the Mann-Whitney U test, was then employed to evaluate group differences. The test revealed that the predicted differences between the four groups were only partially confirmed. The Ss within the print-print group yielded significantly fewer responses than Ss in the film-print and print-film groups (p < .05, two-tailed test). No significant differences were found between the film-film group and the film-print, print-film groups, or between the film-film group and the print-print group (see Table 2). However, there was a trend for Ss in the film-film group (p < .10) to yield more responses than Ss in the print-print group.

Task Time

The length of time for the film presentation was known to be eleven minutes. For the children who were administered the printed material, the amount of time spent in reading the material was noted for
Table 1
One Way Analysis of Variance on Items Recalled on the Retention Test

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>3</td>
<td>86.30</td>
<td>3.94</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>Within</td>
<td>32</td>
<td>21.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 2

Mann-Whitney U Test on the Number of Items Recalled on the Retention Test

<table>
<thead>
<tr>
<th>Group</th>
<th>U</th>
<th>P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Film-Film VS Film-Print</td>
<td>37</td>
<td>N.S.</td>
</tr>
<tr>
<td>Film-Film VS Print-Film</td>
<td>33</td>
<td>N.S.</td>
</tr>
<tr>
<td>Film-Film VS Print-Print</td>
<td>19.5</td>
<td>N.S.</td>
</tr>
<tr>
<td>Film-Print VS Print-Film</td>
<td>36.5</td>
<td>N.S.</td>
</tr>
<tr>
<td>Film-Print VS Print-Print</td>
<td>16</td>
<td>&lt; .05 (two-tailed test)</td>
</tr>
<tr>
<td>Print-Film VS Print-Print</td>
<td>15.5</td>
<td>&lt; .05 (two-tailed test)</td>
</tr>
</tbody>
</table>
Table 3
Mann-Whitney-U Test on the Total Amount of Time Spent by the Subjects
in Reading the Material

<table>
<thead>
<tr>
<th>Group</th>
<th>U</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print-Print VS Print-Film</td>
<td>22</td>
<td>N.S.</td>
</tr>
<tr>
<td>Print-Film VS Film-Print</td>
<td>24</td>
<td>N.S.</td>
</tr>
<tr>
<td>Film-Print VS Print-Print</td>
<td>28</td>
<td>N.S.</td>
</tr>
</tbody>
</table>
each child. A Mann-Whitney U test revealed no significant differences on the total amount of time spent in the task for the print-print, film-print and print-film groups (see Table 3).

Freq-Recall Test

In an attempt to further explore the effect of mode of presentation on performance, Ss were asked to provide any additional information that they remembered on a free recall test which followed the formal retention test. The mean scores for additional responses that pertained to the information provided by the script were 1 for the film-film group, 1 for the print-film group, .66 for the film-print group and .55 for the print-print group (see Table 4a). A one way analysis of variance revealed no significant main effect (F=.68, NS; see Table 4). For the Ss administered the film presentation, six of the Ss in the film-film group reported the same additional piece of information which was presented only in the film. Three of the Ss in the film-print group reported this same piece of information and none of the Ss in the print-film group noted the supplementary material.

Use of Imagery

Since the usefulness of imagery as a technique for memory was of major concern in the research, Ss were asked whether they employed imagery while learning the story. Nine of the Ss reported no use of imagery. Three of these Ss were within the print-print group. These Ss also gave the fewest number of correct responses on the fill-in-the-blank test for all of the groups, obtaining scores of 1, 2, and 5, respectively.
Table 4

One Way Analysis of Variance on the Additional Responses Recalled on the Free Recall Test

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>3</td>
<td>.47</td>
<td>.68</td>
<td>NS</td>
</tr>
<tr>
<td>Within</td>
<td>32</td>
<td>.69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4a.

Means and Standard Deviations for the Additional Responses Obtained on the Free Recall Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Film-Film</td>
<td>1.00</td>
<td>0.70</td>
</tr>
<tr>
<td>Print-Film</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Film-Print</td>
<td>0.66</td>
<td>1.00</td>
</tr>
<tr>
<td>Print-Print</td>
<td>0.55</td>
<td>0.53</td>
</tr>
</tbody>
</table>
Table 5
One Way Analysis of Variance on the Number of Television Programmes Viewed Per Week

<table>
<thead>
<tr>
<th>Source</th>
<th>$\eta^2$df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>3</td>
<td>.54</td>
<td>.07</td>
<td>N.S.</td>
</tr>
<tr>
<td>Within</td>
<td>32</td>
<td>7.22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3a
Means and Standard Deviations for the Television Programmes Viewed Per Week

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Film-Film</td>
<td>6.55</td>
<td>3.08</td>
</tr>
<tr>
<td>Print-Film</td>
<td>6.33</td>
<td>2.12</td>
</tr>
<tr>
<td>Film-Print</td>
<td>6.66</td>
<td>3.12</td>
</tr>
<tr>
<td>Print-Print</td>
<td>6.41</td>
<td>2.26</td>
</tr>
</tbody>
</table>
Television Viewing

In order to examine the amount of exposure to film within the school milieu, teachers were asked to report the number of films shown to the students throughout the year. An average of six films was reportedly shown to the Ss, therefore, all of the Ss were exposed to approximately the same amount of film at least within the school setting.

To determine whether differences in scores on the retention test were possibly influenced by differences in the amount of television viewing, Ss were asked to report a) whether they watched television at home and b) the number of television programmes viewed in a week. All of the Ss indicated that they watched television at home. The mean number of programmes viewed in a week were 6.1 for the print-print group, 6.3 for the print-film group, 6.5 for the film-film group, and 6.6 for the film-print group (see Table 5a). A one way analysis of variance indicated that there was no significant main effect (F = .07, NS; see Table 5).

To summarize the results, Ss administered film-print and print-film presentation retained significantly more information than Ss administered print-print presentation. However, the film-film presentation group did not differ significantly from the print-print, or film-print and print film presentation groups.

Subjects administered the printed information were timed while reading the material. No significant differences in time were found between the print-print, film-print and print-film presentations. The mode of presentation did not influence performance on the free recall test. No statistically significant differences were obtained
between the film-film, film-print, print-film, or print-print presentations.

One quarter of the Ss reported that they did not use imagery during the presentation of material. Within the print-print group, three of the Ss reported no use of imagery. With regard to this particular group, these Ss demonstrated the poorest performance of all of the Ss on the retention test.

Finally, no significant differences were found between the groups regarding the number of television programs watched per week. Consequently, the differences between the scores on the retention test could not be attributed to differences in prior exposure to films.
CHAPTER IV
DISCUSSION

The research involving the presentation of single items has demonstrated that imagery as produced by concrete material facilitates recall (Paivio, Rogers and Smythe, 1968; Sampson, 1970). In paired-associate tasks, Paivio (1965), Gupton and Frinke (1970), have shown the importance of concreteness with particular emphasis on its effect on the stimulus side of the pair. The purpose of the present study was to apply these results to a more complex task by examining the effect of a concrete (film) presentation of information versus abstract (printed text) presentation of the same information.

The results obtained in the study partially confirmed the predications. Subjects administered the print-print presentation recalled significantly fewer responses on the retention test than Ss in the print-film and film-print groups. This seems to suggest that a concrete (film) presentation did facilitate the retention of factual material.

Although Ss in the print-print group spent less study time on the task than Ss in the film-print and print-film group, the differences were not statistically significant. Therefore, the inferior performance of Ss in the print-print group should not be attributed to differential practice time.

Contrary to expectation, the Ss in the film-film group did not produce the best retention results. Their scores were slightly
inferior to the film-print and print-film groups; however, there was a trend for their scores to be somewhat superior to the print-print group. The responses on the free recall test may explain these results. Since six of the nine Ss reported additional information which pertained exclusively to the film, perhaps these Ss stored more information than other groups.

In contrast to the results of Paivio (1965), the conceptual-peg hypothesis did not account for the present set of findings, since the film-print and print-film sequences produced the same amount of information on the retention test. These discrepant results are probably due to the differences in the type of task presented to the Ss. Whereas Paivio had presented Ss with only single items and pairs of items, the Ss in this study were presented with an extended passage of approximately eight hundred and ten words.

Some evidence for the facilitative effect of imagery, however, came from responses obtained from the Ss regarding their use of imagery. One third of the Ss within the print-print group indicated that they did not employ imagery while learning the task. Since these Ss also made the fewest number of responses on the retention test, additional support is provided for the importance of imagery on retention.

Paivio, Rogers and Smuthe (1968) have suggested that pictures are recalled better than words because they can be coded and stored in memory in a verbal form as well as pictorially. However, recall for pictures may be superior to words for another reason. In examining Ss' responses to the question, "What did you picture while
learning the story?" those that responded seemed to use imagery as a means of actively integrating information. The responses were comments which did not appear anywhere in the story. For example, one subject reported, "I pictured that a skunk would spray the prairie dog but he didn't." Another child stated that he pictured that the dogs were just babies and were fighting with the magpie babies and the dogs won. Therefore, pictures may be superior to words because they may stimulate an active integration of images.

The present study demonstrated that concrete (film) followed by abstract (printed) material containing the same information, and print followed by film facilitate the performance of Ss. However, Ss in the present study were tested immediately following task presentation. Sampson (1970) has shown that concreteness has influenced performance immediately following stimulus presentation, thirty minutes later and one day later. Since children in schools are often tested as much as a week following the presentation of material, further research is needed to examine the influence of the retention interval before generalizing from the results obtained in the present study.

As mentioned earlier, some of the Ss who obtained the lowest scores on the retention test reported that they did not employ imagery while learning the material. Gupton and Frinke (1970) have found that imagery instructions facilitated performance in tasks involving pairs of words. This seems to suggest that instructing Ss to use imagery, may provide a potentially useful tool for the improvement of retention. It would be fruitful, therefore, to examine
the influence of imagery instructions on performance, given a complex kind of learning task, such as the one that was used in the present study.
APPENDIX A

PRINTED MATERIAL
Animal Town of the Prairie

All over the North American Prairie lives the friendly, furry prairie dog. Although he is called a dog he is not a dog at all. He is really a large ground squirrel; his name was given to him by the pioneers because he chirped or barked whenever anyone got near.

Prairie dogs live in large colonies called prairie dog towns. Prairie dog towns are scattered across the North American prairie. Wherever prairie dogs live they make changes in the landscape. One big change comes from their eating habits. They eat plants all during the summer and autumn until they store up enough fat to last them through the winter. But prairie dogs do not chew plants only for food. Because they are only a foot tall it seems that they do not like to have plants grow so high so that they cannot see over them. In this way prairie dogs, by their eating habits, change the ground cover from tall grasses to shorter plants.

The prairie dog is a tireless builder. He usually works on his burrows after the rain because then the wet dirt can be moulded more easily. First he scratches some dirt loose. Then he bulldozes the dirt into place and taps it firm with his nose. He does most of the tapping just above the entrance to his burrow where it helps prevent cave-ins. Like other animals that dig burrows the prairie dog helps to make the soil richer by loosening and turning it over. Sometimes the burrows are up to fourteen feet deep. Mounds help to keep the burrows dry and provide a high spot from which prairie dogs can look out.

There are many abandoned prairie burrows; however a variety of creatures make their homes in them. For example, skunks use the burrows
for shelter. Black widow spiders sometimes spin their webs in the abandoned holes. Also small birds like the Horned Lark nest in or near the prairie dog towns.

A cousin of the prairie dog is the Thirteen Lined Ground squirrel. In the prairie dog town most animals live together peacefully but the Thirteen Lined ground squirrel eats eggs and will rob the nest of a neighbour if he has the chance.

Sometimes the prairie dog investigates some of the other creatures, for example, the Horned Lizard, the strangest looking creature in the prairie dog town. Although the lizard is harmless and able to do little more than bluff, the frightened reptile acts fierce. The prairie dog will not leave him until he squirts blood from his eyes which is the lizard's strange way of defending himself.

Prairie dogs live in groups called wards. They are friendly with most of their ward neighbours but sometimes a male prairie dog will chase away a rival from another ward.

Magnies occasionally visit the prairie dog town to look for scraps of food. They are members of the same bird family as crows and jays and like them are scavengers. Cottontail rabbits also visit prairie dog towns. They often make their homes in the empty burrows.

Burrowing owls settle in prairie dog towns using the abandoned burrows for homes. Because they live so closely together there is a legend that prairie dogs, burrowing owls and rattlesnakes live happily together in the same burrow. But the prairie dog finds that there is no truth in that legend. The owl is frightened of the prairie dog. Being naturally curious and friendly the prairie dog tries
to be nice but the owl will not have anything to do with him.

Unlike most owls, burrowing owls hunt during the daytime as well as at night. From the height of the prairie dog mound, the owl searches for prey. The baby owls sit near the nest most of the day while their parents hunt for food. The father bird generally gives what he catches to his mate. Then she feeds it to one of the babies. Burrowing owls eat mice, ground squirrels, and insects. But prairie dogs are too large for them to prey upon.

The third member of the legendary triangle is the rattlesnake. When he sees the prairie dog he makes a warning buzz which causes the prairie dog to freeze. Like all reptiles, the rattlesnake cannot regulate his body temperatures so when the day becomes hot he must hide from the sun. In the treeless prairie the burrow is a welcome hiding place.

Winter comes and the wall of coldness fills the air. The prairie dog eats little and lives mostly on his fat. On days when the winter winds blow snow across the plains, the prairie dog lets the snow drift into the crater of his mound, thus shutting out the cold air. All over the prairie dog community life continues underground. The prairie dogs snuggle deep in their burrows waiting until the earth is warm again.
APPENDIX B

TEST MATERIAL
Questions

1. These animals are called prairie dogs because they

2. Prairie dogs eat plants for two reasons. What are they? 1. ______

                2. ______

3. Some burrows are ______ feet deep.

4. An old legend tells that three animals can live peacefully in
   Prairie Dog Village. Name the three animals. 1. ______

                2. ______

                3. ______ Is the legend true?

5. Name three other creatures that live in Prairie town other than
   those in question four. 1. ______ 2. ______ 3. ______

6. A cousin of the prairie dog is ______.

7. The strangest looking creature in Prairie Village is ______.
   He protects himself by ______.

8. Prairie dogs live in groups called ______.

9. The Burrowing Owl is different from other members of the owl family
   because ______.

10. Name two creatures that Burrowing Owls eat. 1. ______
    and 2. ______

11. The rattlesnake enters the prairie dog burrow to escape from the
    ______.

12. The prairie dog lives on the ______ continent.

13. During the winter the prairie dog eats little so he mainly lives
    on his ______.

14. Snow in the opening of the burrow shuts out the ______.

15. How tall is the prairie dog? ______

16. Name two reasons why prairie dogs build a raised mound around the
    opening to their burrow. 1. ______ 2. ______
1. Do not go back to page one. Write down anything else that you remember about the story.

2. When you learned the story, did you picture it in your mind? Yes or No.

3. If yes, what did you picture?
1. Do you watch television at home?

2. If you answered question one, yes, write down the television programmes that you watched last week.
ANSWERS

1. chirp or bark

2. a) for food, to store up fat
   b) they do not like to have plants grow so high that they cannot see over them.

3. fourteen

4. a) Prairie dogs, burrowing owls, rattlesnakes
   b) No

5. Thirteen Lined Ground Squirrel, Horned Lark, Horned Lizard, Magpies, Cottontail Rabbits, Black Widow Spiders.

6. Thirteen Lined Ground Squirrel

7. a) Horned Lizard
   b) squirts blood from his eyes

8. wards

9. Hunt during the daytime as well as at night

10. mice, ground squirrels, insects

11. hot sun

12. North American

13. fat

14. cold air

15. one foot

16. a) to keep the burrows dry
   b) provide a high spot from which they can look out.
APPENDIX C

ADMINISTRATION PROCEDURES
ADMINISTRATION PROCEDURES

The E began by stating to each group: "I am from the University of Windsor. I am interested in how children learn." The E held up a picture of a squirrel and stated, "Who will tell me what you call the animal in this picture?" The experimenter then held up a picture of a prairie dog and stated, "Now this is a cousin to the squirrel and he is called a prairie dog." Finally the experimenter held up a picture of the prairie and stated, "This is where the prairie dog lives."

The experimenter then gave instructions to each of the four groups:

a) film-film

The experimenter stated, "This prairie dog is not really a dog, but you will find out why he is called a dog by watching a film. You will also find out some other interesting things. The film will be shown to you twice. Watch it very carefully; when it is finished I will see how much you remember." Before the film was shown for the second time the experimenter stated, "Watch it again very carefully."

b) print-print

The experimenter stated, "This prairie dog is not really a dog, but you will find out why he is called a dog by reading this story. You will also find out some other interesting things. Read the story once very carefully. When you have finished reading it once put up your hand and I will mark off your name. You will then read it again. When you have finished place it on the floor beside you.
Then I will see how much you remember." When the children were finished reading the story once, the experimenter stated, "read it again carefully."

c) film-print

The experimenter stated, "This prairie dog is not really a dog but you will find out why he is called a dog. You will also find some other interesting things. First I will show you a film and then I will give you a story to read about him. Watch the film carefully and then read the story once, carefully. When you have finished the story place it down on the floor beside you. Then I will see how much you remember." When the film was finished the experimenter stated "read the story once, very carefully."

d) print-film

The experimenter stated, "This prairie dog is not really a dog but you will find out why he is called a dog. You will also find out some other interesting things. First I will give you a story to read about him and then I will show you a film. Read the story once very carefully and place it on the floor when you have finished. Then I will show you the film. I will then see how much you remember." When the children were finished reading the story the experimenter stated, "watch the film very carefully."
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