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RELATIONSHIP OF MELODY AND PERCEPTUAL TYPE TO PERFORMANCE ON RECOGNITION AND RECALL TASKS

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RELATIONSHIP OF MELODY AND PERCEPTUAL TYPE TO PERFORMANCE ON RECOGNITION AND RECALL TASKS

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In partial fulfillment of the requirements for the

degree of

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By

Josephine Raburn

Norman, Oklahoma

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RELATIONSHIP OF MELODY AND PERCEPTUAL TYPE
TO PERFORMANCE ON RECOGNITION AND RECALL TASKS

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DISSERTATION COMMITTEE

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To all of you I give obeisance. I am only what you have made of me.

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RELATIONSHIP OF MELODY AND PERCEPTUAL TYPE IN RECOGNITION AND RECALL TASKS

Music in the classroom is advocated by some educators, not for itself alone, but as an adjunct to learning mathematics, foreign language, or facts. Claims are made that music reduces tension, has a therapeutic effect on the emotions, and that it increases human energy output. Film and television use it to control mood and pacing. It is matched to visual elements to heighten their dramatic effect and, thereby, intensify the message being transmitted.

This study investigated the role that music plays in remembering pictorial and verbal elements, through both recognition and free recall.

Techniques used by researchers who hoped to answer the question of spatial images versus propositions as perceptual storage elements seemed appropriate. Many researchers in the arts investigate brain theories which see the right hemisphere as nonverbal and holistic, and the left hemisphere as verbal and sequential. Their view agrees with Paivio's dual processing theory which postulates separate but interconnected information processing systems in the brain. One system is specialized for sequential processing and handles verbal material. The other is an image system which is analog and does parallel or simultaneous processing (Paivio, 1971). The image system is a sensory modality which includes visual, auditory, motor, and affective components (Paivio, 1972).

Music listening, according to Regelski, depends on perceiving and responding holistically to patterns that occur simultaneously. It is not a verbal response, and the two hemispheres interfere with each other if something verbal is going on while a person is listening to music (Regelski, 1977). The aesthetic aspects of music, listening as opposed to studying or analyzing music, are right hemisphere tasks (Fincher, 1976; Regelski, 1977).

The view that divides a human brain into two areas which process information differently is too vague or simplistic according to Kieras (1978) and has little value for explaining what occurs. Kieras concentrates on sentence memory to build his case for propositional storage of both images and verbal information, because sentences have meaning and provide their own codes. They are also composed of words, and words have high imagery potential. He and Lang (1977), as well as Pylyshyn (1973) are all advocates of the propositional conception of information storage, retrieval and processing. They assert that images are not stored as pictures in the brain, but as representations of visual experience which include the feelings and meanings associated with that experience.

Paivio (1978) argues that since pictures are processed faster than words, and since high imagery subjects react faster than low imagery subjects, nonverbal visual representations must be present and available in the brain. Studies of persons whose brain hemispheres were separated by severing the corpus callosum which connects them seem to support dual processing. If two figures are flashed on a screen, one to the left visual area, and the other to the right visual area of a person whose corpus callosum has been cut, the left hand can draw what is seen by the right eye, but when questioned about what he has drawn, the subject will say what he saw with his left eye (Restak, 1979).

Studies using sentences have attempted to investigate this question. Sachs (1962) had 96 subjects listen to a passage and then hear a sentence exactly like one in the passage and another sentence which was different. Recognition memory for the form of the sentence was shown to decline rapidly and become close to chance (50%) after 8 syllables of interpolated material. Shepard (1967) found an 89% mean recognition rate for sentences, but used only 17 subjects and a different technique. The high recognition rate demonstrated by his subjects has not been repeated when subjects have heard sentences that were very similar in either form or wording. Begg and Paivio (1969) presented a series of sentences to subjects, and then presented one of the sentences again, either changed slightly or exactly as presented before. They used both concrete and abstract sentences, and found that wording changes were noticed most in abstract sentences. There seemed to be independent forgetting of wording and meaning. Begg (1971) and Yuille & Holyoak (1974) came to the conclusion that memory of verbal material is superior to, and independent of, memory for its wording. These recognition studies and others (Brewer, 1977; Bransford, Barclay, & Franks, 1972) show that people remember meaning better than they remember the wording of sentences. Comprehension of the meaning of material is also an aid to recall (de Villiers, 1974). Material in the form of narrative or story is recalled twice as well as expository material (Cohen & Graesser, 1980), and the unfamiliar is remembered better than familiar material.

These findings seem to be support for dual coding theory, and additional support is provided by a Kinsbourne and Cook study (1971) which found that talking causes degradation in right hand dowel balancing, but not in left hand balancing.

Pictures are remembered better than verbal stimuli in recognition tasks (Paivio, Rogers, & Smith, 1968; Sampson, 1970; Standing, 1973; Snodgrass, Volovitch, & Walfish, 1974; Gehring, Toglia, & Kimble, 1976). Experiments which have addressed this issue using visual stimuli have also seemed to support dual processing theory. Standing, Conezio, and Haber (1970) showed pictures to subjects for 10 seconds each, and their performance in a forced choice task exceeded a correct response rate of 95%. Perception of pictures was so fast that time could be reduced to 1 second per picture without affecting recognition performance. Slides, although pictorial in nature, fall somewhere between pictures and real visual experiences. They should be recognized easier than pictures, but adults are often confused because of being torn between a "real world" way of perceiving and the "pictorial" way of perceiving which they use with photographic prints. This confusion causes adult perception errors, when slides are used as stimuli, to rise to a 10% or 25% error rate (Hagan, 1974).

Since normal responses are known from past research that has been done in verbal and pictorial recognition, a deviation from those norms when using the same techniques would be support for the effect of some outside influence on subjects.

Results of studies using music at the same time that subjects attempt to learn other material have been inconclusive. Fendrick (1937) found that music distracted people who were reading difficult material. Others (Henderson, Crews, & Barlow, 1945; Carlson & Hergenhahn, 1967) found that music had no particular effect on learning. Freeburne and Fleischer (1952) found that jazz had a facilitating effect on reading speed, and Whitely (1934) found that music bothered memorization of verbal material.

Background music helped 8th and 9th grade students make higher scores on a silent reading test in one study (Hall, 1952), but seriously distracted students who were taking a test in another study (Fogelson, 1973). Such conflicting results might mean that individual differences caused different responses to music when it was present.

A study which viewed individual differences and their relationship to comprehension in the presence of music, was done with American Indian high school students (Raburn, 1981). Students were tested for cognitive style (field independence/dependence) using Witkin's Group Embedded Figures Test. One group was shown a film which was in pantomime accompanied by its background music. Immediately afterward both groups were given a multiple choice test on what the film was about. There was no difference between field independents and field dependents on their understanding of the content of of the film, but there was a significant treatment effect. The group which had heard background music was much better at answering questions about the content of the film than were the no musical background group, $F(1, 28) = 4.54$, $p < .04$ (Raburn, 1981).

A pedagogical technique called suggestopedia was developed in Bulgaria by Lozanov, and reported by Ostrander and Shroeder (1970). It uses suggestion, auto-suggestion, relaxation, and rhythm. The rhythm may be supplied by music. Great feats of memory have been claimed in the learning of words of a foreign language, and in the learning of facts, but most of the favorable studies were done in Europe where experiments are not always carefully controlled. Even if suggestopedia is found to increase recall ability, yoga techniques of relaxation may be responsible for the results rather than music. Udupa and Singh (1978) found that yoga exercises and regular breathing decreased mental fatigue and improved memory in Indian students. Yoga is often used in suggestopedia, along with music, to produce the alpha rhythms necessary for its success.

The search for individual differences in response to music led to the perceptual type theory of Viktor Lowenfeld. A report by Ausburn, Ausburn, & Ragan (1980) connected this typology with memory. The report recommended consideration of the visual/haptic ability to mentally retain visual images when accomplishment of a learning task required short-term or long-term memory or recall of details of images. A person classified as having the "visual" perceptual style is better able to hold visual images in memory and to combine parts of images into a whole through memory. Haptic individuals do not do this as well. Visual individuals learn through imagery, and haptics learn by means of touch, feelings, and kinesthetic functions (Lowenfeld & Brittain, 1970).

Walter (1953) studied alpha rhythms in the brain and classified people into groups depending on how much alpha was present. His classifications corresponded roughly to Lowenfeld's. People with persistent alpha activity might be haptics because they tended toward tactile perception. Visual people have very little alpha because alpha disappears when visual processing is being done. Those in between, the indefinites, had responsive alpha which could come and go. Lowenfeld thought that haptics were more affected by sound and by emotion than visuals (Lowenfeld, 1939).

If haptics have persistent alpha rhythms and are more affected by sound and emotion than other people, then they should also be more affected by music than visuals. The review of literature for this study failed to find an investigation of the verbal ability of haptic individuals. It seemed conveivable, then, that haptics would be better than visuals at verbal tasks.

A pilot study designed to test materials that had been developed and to explore the feasibility of the hypotheses was conducted prior to the actual research. Only women students in upper division classes at Cameron University were used as subjects. It was found that haptic individuals were not better than visual individuals at verbal recognition and recall tasks. Their scores were significantly lower than the scores of visuals on the verbal recall test. An analysis of variance did not find them significantly different from visual persons at verbal recognition, but this was due to an interaction which was present. A *t* test between the "no melody" condition and the "melody at presentation time and testing time" condition of visuals showed that they were significantly distracted by music, $t(12) = 3.03$, $p < .01$. Haptics were not affected by music in recognition tasks. Music helped both visuals and haptics in pictorial recognition, but had no effect on pictorial recall (Raburn, 1980).

A recent study of the relationship between Lowenfeld's visual-haptic perceptual type and Piaget's developmental theory found that people who have been designated "visual" are also formal and abstract, while those designated "haptic" are more concrete as a rule (Butzow & Schlender, 1978).

Ozier (1980), in studies of recognition and recall, found that certain people were good at both recognition and recall, and others were not good at either. She suggested that some people form better memory traces than others, and are high organizers. Others form poorer traces and are low organizers. Haptics were poorer at both recognition and recall than were visuals in the "no melody" condition, so the pilot study indicated that visuals may be Ozier's high organizers. They may also be abstract thinkers, while haptics are more concrete and possess low organizing ability. In the present study the hypotheses were as follows:

It was expected that in the control group which would receive no melody, visuals would outperform haptics in both pictorial and verbal recognition and recall.

If music accompanies pictorial material at presentation time, recognition and recall will be improved for both haptic and visual subjects, but haptics will show a greater improvement than visuals in their ability to recognize and recall pictures presented as slides.

Music with pictorial slides at presentation time and again at testing time will also improve recognition and recall for haptic and visual subjects.

Music presented as background when a paragraph is read on tape will have no effect on recognition of orally read sentences from that paragraph, nor will it affect recall of content as determined by a multiple-choice/fill-in-the-blank test. If background music is again present at testing time, it will distract visuals, but will have no effect on haptics.

Method

Subjects. The subjects were students enrolled in freshman composition at Cameron University. They were tested for visual-haptic perceptual style tendencies with Lowenfeld's Successive Perception Test, SPT-1. To control for sex differences that might be present in recognition, recall, and brain processing, only women were chosen. Those women who made scores that represented the upper and lower 20% of 500 freshmen who were tested were picked as visual and haptic subjects. They were separated by perceptual type, handedness, and musical training, and then were randomly assigned into three matched groups. Each group had 17 haptics and 17 visuals. They were all tested in the same room at approximately the same time of day (morning).

Instrumentation. Colored slides of animals, flowers, pitchers, and landscape scenes were shown on a white surface with a Kodak carousel projector, 15 feet away. The paragraph and sentences were read on tape using a woman's voice.

All taping of voice and music was performed with professional equipment. A flute was used as the instrument, and the music chosen was folk music in a major key from the Western tonal system. The music was neither particularly stimulating nor relaxing, but was chosen for its moderate character.

Procedure. Subjects in each group were shown three practice slides. They completed a practice recall test and forced choice recognition test. When they understood what was expected of them, 15 slides in the same order for all groups were shown for 10 seconds each. In the groups which had music at presentation time, melody would begin, the slide would appear for 10 seconds, then melody would end the presentation. Immediately afterward subjects were asked to recall as many of those 15 slides as they could in 10 minutes. Next they were shown the same 15 slides combined with 15 similar but different slides. In the "music at testing time" condition, the 15 slides were accompanied by their original melodies. The similar slide for each of the originals also had the original's melody to accompany it. For example, if an antique pitcher with pink flowers was shown in the first 15 slides, the melody accompanying it would also accompany it when it was mixed in with 30 slides. In that 30 would also be another pitcher, a modern one with purple grapes, which would be shown with the same melody. A forced choice recognition test was taken at the time that subjects viewed the 30 slides.

Next, a short, narrative paragraph was read on tape and practice tests were completed. When everyone understood what would be expected of them, the test paragraph taken from an unfamiliar French folktale was played on tape. The groups with music had a background of flute music (one folk melody) as this was read. Immediately afterward a recall test of 21 questions on content was given. Then 15 sentences from the paragraph and 15 similar, but slightly changed, sentences were read on tape and the subjects checked old or new in a forced choice recognition test. The group which had music at testing time had the same melody accompany the sentences as they were read. The entire procedure took between 50 and 55 minutes. The 17 visual subjects and the 17 haptic subjects of the "no melody" treatment condition served as a control group. Their scores were compared with the scores of visual and haptic subjects who heard music as they saw the slides and heard the paragraph on tape, and scores of a third group which had music at presentation time and again while they were being tested for recognition and recall.

Results

The two effects, perceptual type with visual and haptic levels; and melody with "no melody", "melody at presentation time", and "melody at both presentation and testing time" levels were as follows in verbal and pictorial recall tasks:

Haptics scored significantly lower than visuals at both pictorial and verbal recall. The analysis of variance for verbal recall produced an $F\ (1,\ 96) = 5.64$, $p < .01$. The ANOVA for pictorial recall was $F\ (1,\ 96) = 6.89$, $p < .01$. A pairwise comparison performed on visual versus haptic means in the "no melody" condition of verbal recall was not significant, $t\ (32) = 1.77$. Another comparison performed on "no melody" means in pictorial recall also did not reach significance, $t\ (32) = 1.88$. The difference between these perceptual types is an over-all difference which becomes apparent when the means are graphed. See Figures 1 and 2.

Insert Figure 1 and Figure 2 about here

Haptics did not perform as well as visuals at verbal or pictorial recall under any condition.

In addition to haptics being less efficient than visuals at all recall tasks, there was a significant melody effect operating in pictorial recall. The analysis of variance showed an F value of $F\ (2,\ 96) = 17.63$, $p < .0001$. Pairwise comparisons were performed on the means, and Type 1 error rate for these was controlled per experiment by using Dunn's multiple comparison procedure. There was a difference in haptic means between the "no melody" condition and the "melody at presentation time" (MP) condition of $\underline{t}$ (32) = 3.27, $\underline{p} < .05$. The difference between "no melody" and "melody at both presentation time and testing time" (MPT) was $\underline{t}$ (32) = 4.46, $\underline{p} < .05$. Visual comparisons were also significant. Between "no melody" and "MP" conditions was $\underline{t}$ (32) = 3.18, $\underline{p} < .05$, and between "no melody" and "MPT" conditions was $\underline{t}$ (32) = 3.44, $\underline{p} < .05$.

Verbal recall did not show a significant melody effect, but it approached significance, F (2, 96) = 2.64, $\underline{p} < .07$. Examination of the standard deviations revealed an increasing variability in the scores of visual individuals when music was present. Normally the scores of haptic individuals are more variable than are the scores of visual individuals, but, in this case, the variability of subjects who had been designated visual was greater than that of haptic subjects. To find out what was causing this phenomenon, a Student's t-test was performed on the scores of visuals in the "no melody" condition and scores of visuals in the "MPT" condition. A one-tailed t-test, $\underline{t}$ (32) = 1.71, $\underline{p} < .05$ showed that the recall scores of visual subjects were lowered enough when music was present to be able to consider music a distracting effect on verbal recall.

An analysis of variance of raw scores showed no significant difference between haptics and visuals in verbal recognition ability, although significance was approached, $F(1, 96) = 2.97$, $p < .088$. Since there is always a possibility of guessing when only two choices are offered, the scores were corrected for this factor using a theory of recognition developed by Green and Swets (1966) and known as the signal detection approach. It is thought to be more accurate than other methods in common use for the correction of guessing. This approach designates "old" answers in a forced choice test as one distribution, and the "new" answers as another. The difference between the means of these two distributions is the d' (d prime) of signal detection theory, and is considered to better represent true recognition memory. Raw scores were converted into d primes using tables of d' developed by Elliott (1964). When an analysis of variance was performed on these d' numbers, the difference between visual subjects and haptic subjects became significant, $F(1, 96) = 3.91$, $p < .05$. Visuals were significantly better than haptics at verbal recognition. The melody effect was not significant, $F(2, 96) = .67$, $p < .51$, but an interaction was still present in the corrected verbal recognition scores. This interaction was not significant, $F(2, 96) = 2.14$, $p < .12$, and it had changed from the disordinal interaction present with the raw scores into an ordinal one, but its persistence made it a factor of possible importance. It had appeared in the study, in the pilot study, and when scores were corrected for guessing. Since interactions present with natural data sometimes disappear when scores are converted into their natural logarithms, it was decided to make that conversion on these scores to be sure that this interaction was not simply a linear one. Again, it persisted. See Figure 17.

Since it seems to be a characteristic of the way visuals and haptics perform verbal recognition in the presence of melody, and since care needs to be taken in interpreting results of an analysis of variance when interaction is present, another statistical test was performed on the data. A Student's t was done on visual scores in the "MP" condition and the "MPT" condition. It showed that there was a significant drop in those scores, $t\ (32) = 2.10$, $p < .05$. The same test done on the corrected scores (d's) was also significant, $t\ (32) = 2.16$, $p < .05$.

Pictorial recognition was high for visuals in the "no melody" condition as expected. It ranged from 80% accuracy to 100% accuracy with an average of 91.6%. Haptic accuracy ranged from 66.6% to 100% with an average of 86.7%. An analysis of variance found the two perceptual types significantly different, $F\ (1, 96) = 4.09$, $p < .046$. Visuals were better than haptics at pictorial recognition as was expected since the test dividing the two was a visual test.

A pairwise comparison done for haptics between "no melody" and "MP" conditions was significant, t (32) = 4.22, $p < .05$. Another one done between "no melody" and "MPT" was also significant, t (32) = 3.29, $p < .05$. A pairwise comparison on visual means at the largest difference point ("no melody and "MP" conditions) was not significant, t (32) = 2.47, $p > .05$. However, when scores were corrected for guessing and an analysis of variance was done on the d's, F values remained much the same, but pairwise comparisons on visual means showed that they, too, were significantly helped by music if it were used at presentation time only. The test between "no melody" and "MP" was t (32) = 2.90, $p < .05$, and the test between "no melody" and "MPT" was t (32) = 2.33, which was not significant. See Figure 4 for plot of the means.

Insert Figure 3 and Figure 4 about here

Discussion

Subjects in the "no melody" treatment condition performed about the same as others from past experiments in recognition and recall, except that visuals were better than haptics on every test. This study supports the hypothesis generated by the pilot study that Ozier's high organizers were visuals, and the low organizers were haptics. In the present study, scores of visual subjects had a low standard deviation in all of the "no melody" condition tests. Visuals seem to be able to efficiently perform both verbal and pictorial recognition and recall.

Haptics are slightly distracted by music when they are being tested for verbal recall, but music significantly distracts visuals when they are performing all verbal memory tasks. They become disorganized so that their performance is almost as low as haptic performance. In verbal recognition, haptics are somewhat distracted by music, but recover to their normal level if music persists through testing time. They react differently to music as a background for orally presented verbal material than do visuals. When music is present during a test of sentence recognition, haptics can tolerate it, but visuals cannot. This occasion, music at testing time for verbal recognition, is the only time that haptics surpass visuals in scoring.

Music improves the organizing ability of haptics in visual tasks. They become almost as efficient as visuals. Music brings haptics almost up to the "no melody" level of visuals, but, since visuals are improved by music, too, haptics did not catch up with them.

Music at presentation time only is better than music at both presentation and testing time for both haptics and visuals in pictorial recognition and recall. Music is not recommended at testing time, even though drops in efficiency are not large enough to appear serious. Music during testing time certainly did not <u>help</u> performance. Music is not recommended as an accompaniment for narrative verbal material presented orally. It is of no advantage to haptics, and it distracts visuals significantly. The inconsistent results of past research on the effects of music on learning and memory can be explained by this study. Some of the results could have been due to individual differences between subjects. Studies which showed music to have a distracting effect on verbal tasks such as reading may have had a preponderence of visuals as subjects, while studies which showed no effect of music on verbal tasks may have had more haptics as subjects. According to this study, perceptual type may be a definite factor in the response of people to music.

Although this research applies only to females, males may be even more visual than females. If they are, music would be an even greater distraction for verbal learning in the classroom than this study indicates. This study should be replicated using males as subjects.

Statistical tests used to analyze data when visuals and haptics are being tested together can make a difference in the results of a study. Haptic variability can hide what is happening to visuals in an analysis of variance. The Student *t* may be a better test to use in perceptual type research on recognition and recall. It might be useful to compare visual and verbal abilities of the subjects in a study through the use of multivariate analysis. This was impossible in this particular case because the pictorial test had different melodies with each slide while the verbal narrative had only one melody as background. Possible effects of those differences in presentation are unknown. The normal way to present narrative prose is with background music, so it was thought to be the best way to determine the effects of music in actual learning situations. A different melody with each sentence might be an unusual, and perhaps, overly distracting experience. It was also thought that more would be learned about the effects of music with pictorial material if a different melody accompanied each slide rather than having one background melody with all of them. The rationale was that if music was having an effect on recognition and recall, the repetition of the same music with the same slide would make it possible to draw more definite conclusions about what was happening. Future studies should use background music with both slides and a narrative, and different melodies with different sentences at the same time that different melodies are used with different slides. This would compare effects of the two types of presentation on the one hand, and would enable comparison of the pictorial and verbal ability of each perceptual type on the other.

Support for Paivio's dual processing theory seems to have been provided by this research. Both visuals and haptics improve in recognition and recall when the task is visual. Encoding is more efficient when two stimuli come into the brain from different sensors to be processed by the same nonverbal system. Both melody and pictures have been shown by the literature to be perceived holistically and instantaneously and this study supports that expectation. Since the music began a few seconds before each slide was shown, it may have served to alert the viewer and to make her more keenly aware of details in the visual presentation. Such a blend of images could have heightened visual sensitivity to provide support for the report of Russian research by London (1954) in which auditory stimuli improved vision.

When two stimuli come into the brain from the same sensor, in this case the ear, and one needs to be encoded sequentially and the other holistically, both systems, verbal and nonverbal, are forced to operate. One of them cannot be turned off, and efficiency drops--at least for visuals. It may be the encoding process which is involved. Inefficient encoding remains inefficient, but efficient encoding is made less so. Sequential sounds of speech must be put together into meaning before they are stored. Haptics do not do this well to begin with, perhaps because of chemical reactions in the brain failing to occur, or because of inattention, or perhaps some other unknown distracting effect. A further distraction caused by the simultaneous operation of the nonverbal part of the brain while the verbal part is functioning does not make them any worse at verbal tasks.

Visuals are adversely affected. They seem to try to process both sets of information at the same time, but are unable to do it well. Their performance is degraded. The worst performance of visual individuals is still better than the best performance of haptic individuals except in the one condition of verbal recognition when music is present at both presentation and at testing time.

To summarize, music is an effective addition to pictorial presentations when females are the audience. Both visual individuals and haptic individuals are improved in recognition and recall tasks. Music is not useful as an addition to verbal narrative if efficient recognition and recall of the material is required. It has no particular effect on haptics, but distracts visuals significantly if present during testing time.

Figure Captions

Figure 1. Plot of the means for pictorial recall.

Figure 2. Plot of the means for verbal recall.

Figure 3. Plot of the means for verbal recognition.

Figure 4. Plot of the means for pictorial recognition.

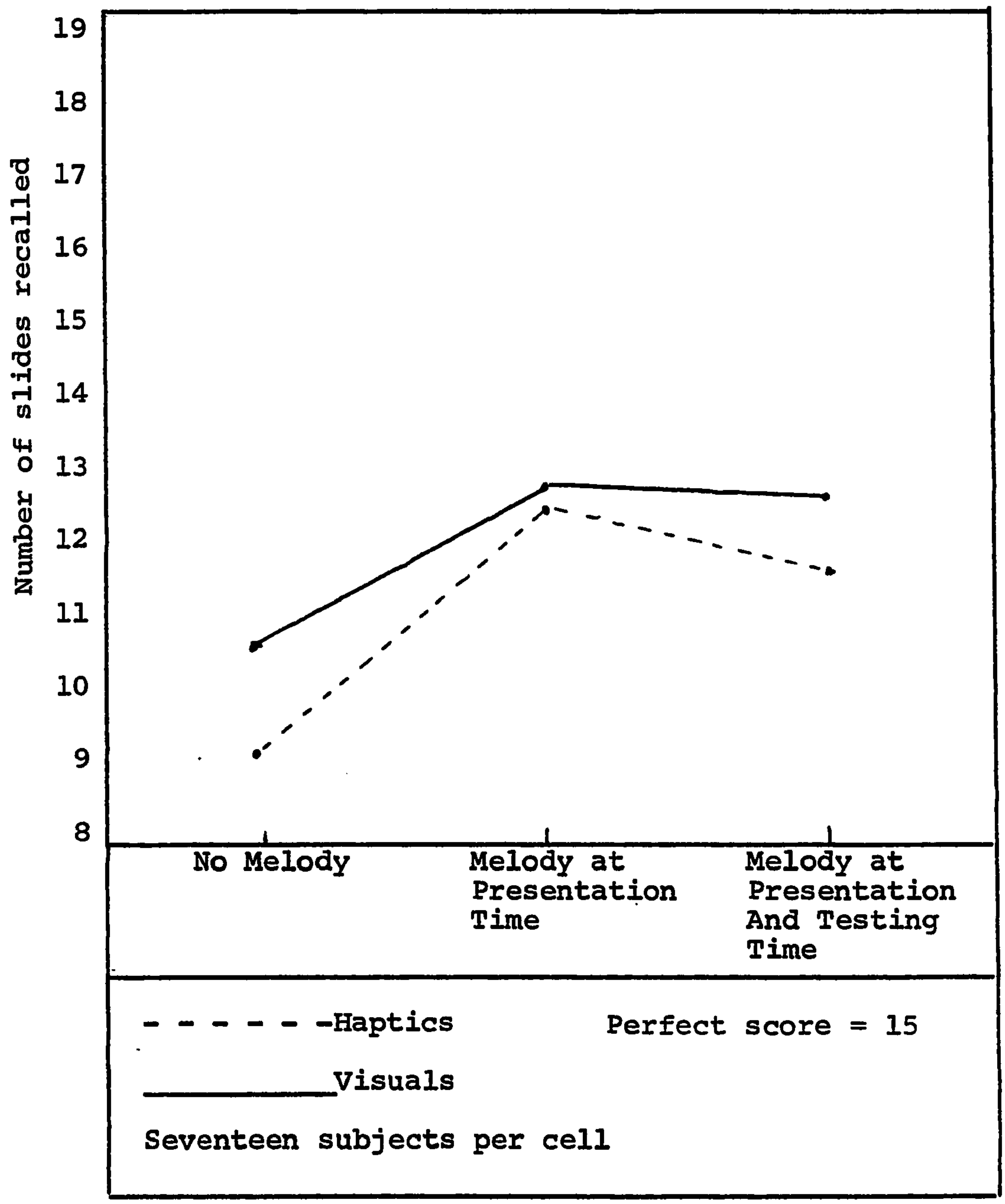

Number of slides recalled
19
18
17
16
15
14
13
12
11
10
9
8
No Melody
Melody at Presentation Time
Melody at Presentation And Testing Time
- - - - - -Haptics
Perfect score = 15
Visuals
Seventeen subjects per cell

Figure 1

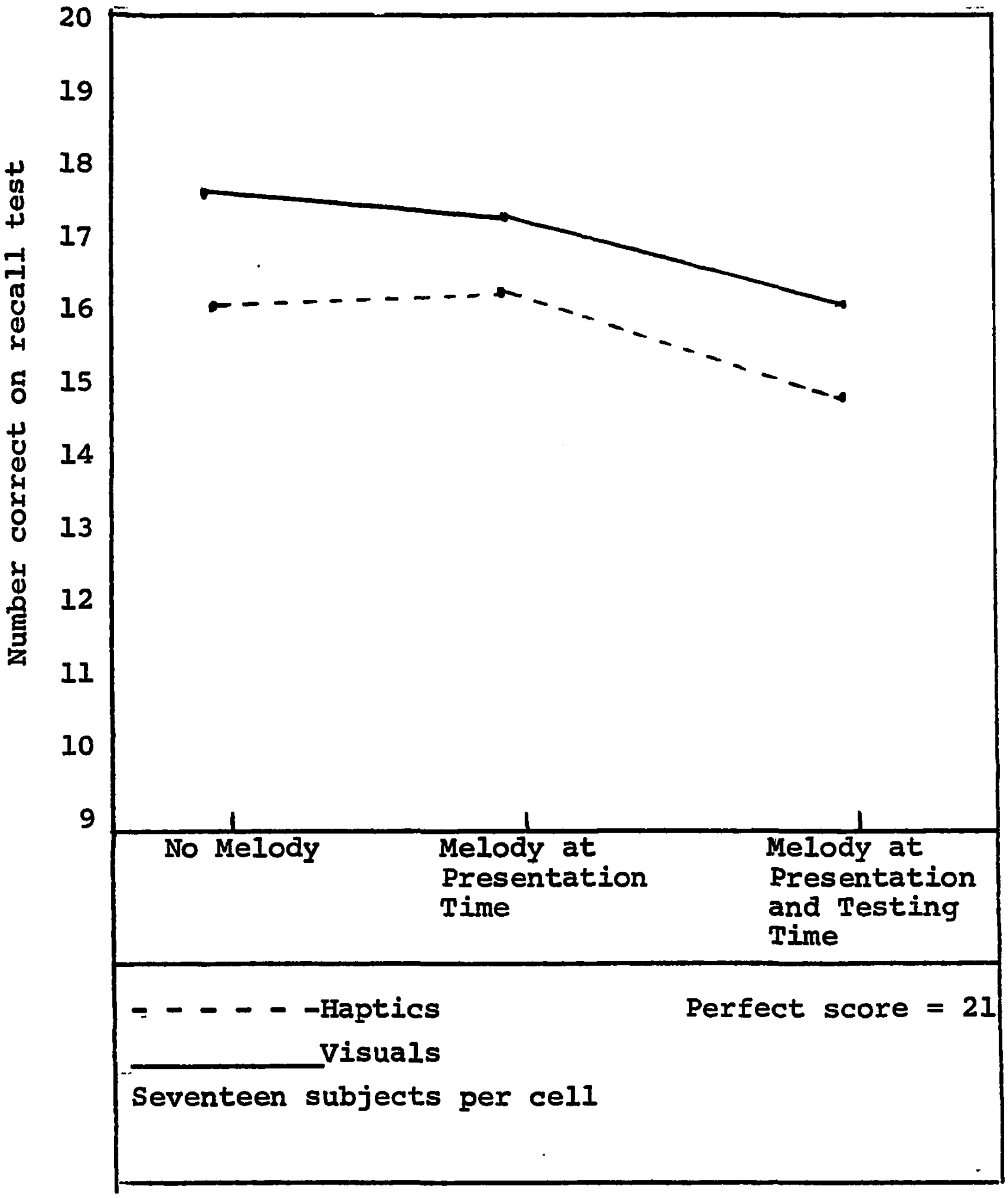

Number correct on recall test
20
19
18
17
16
15
14
13
12
11
10
9
No Melody
Melody at Presentation Time
Melody at Presentation and Testing Time
------Haptics
Visuals
Perfect score = 21
Seventeen subjects per cell

Figure 2

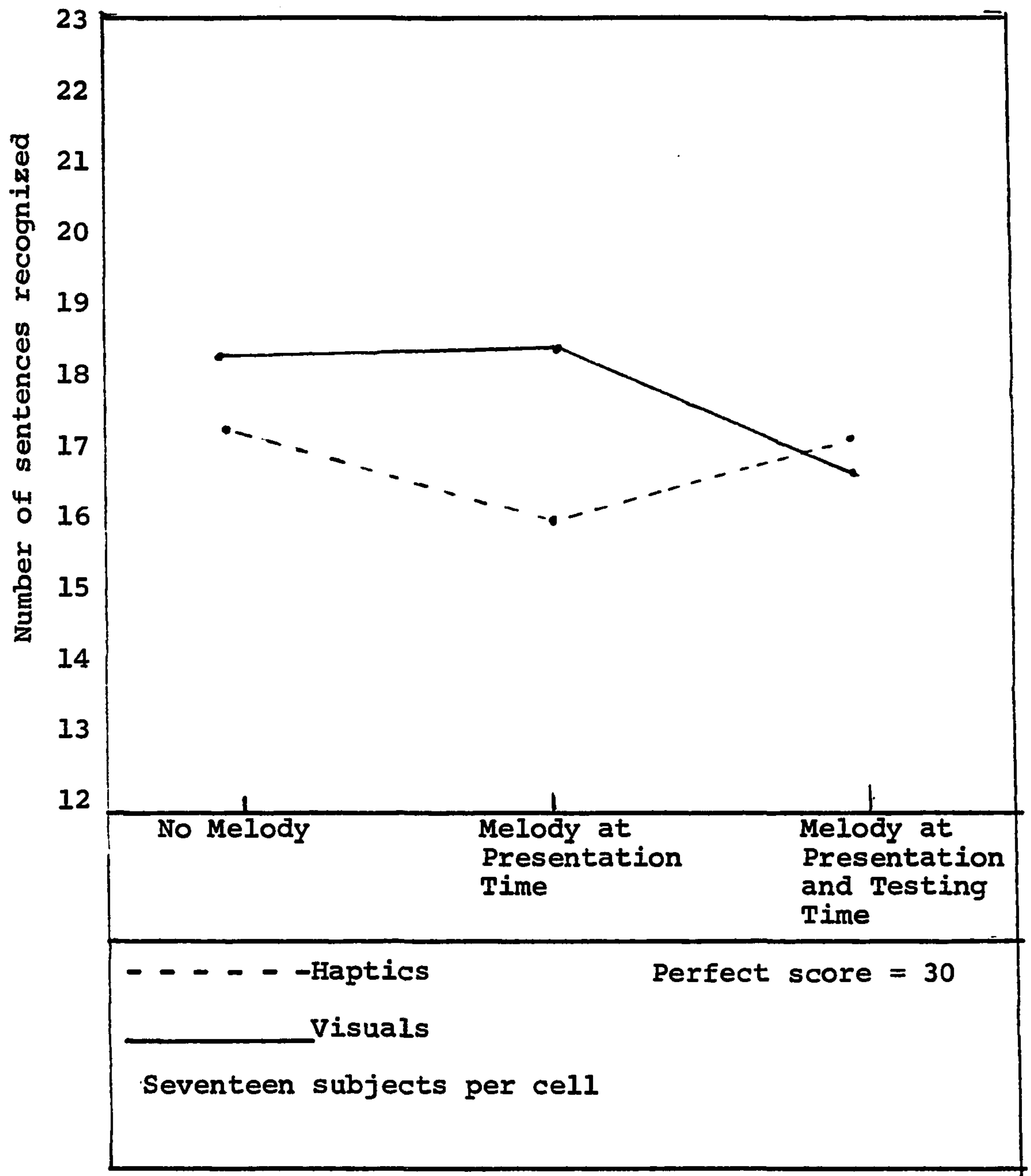
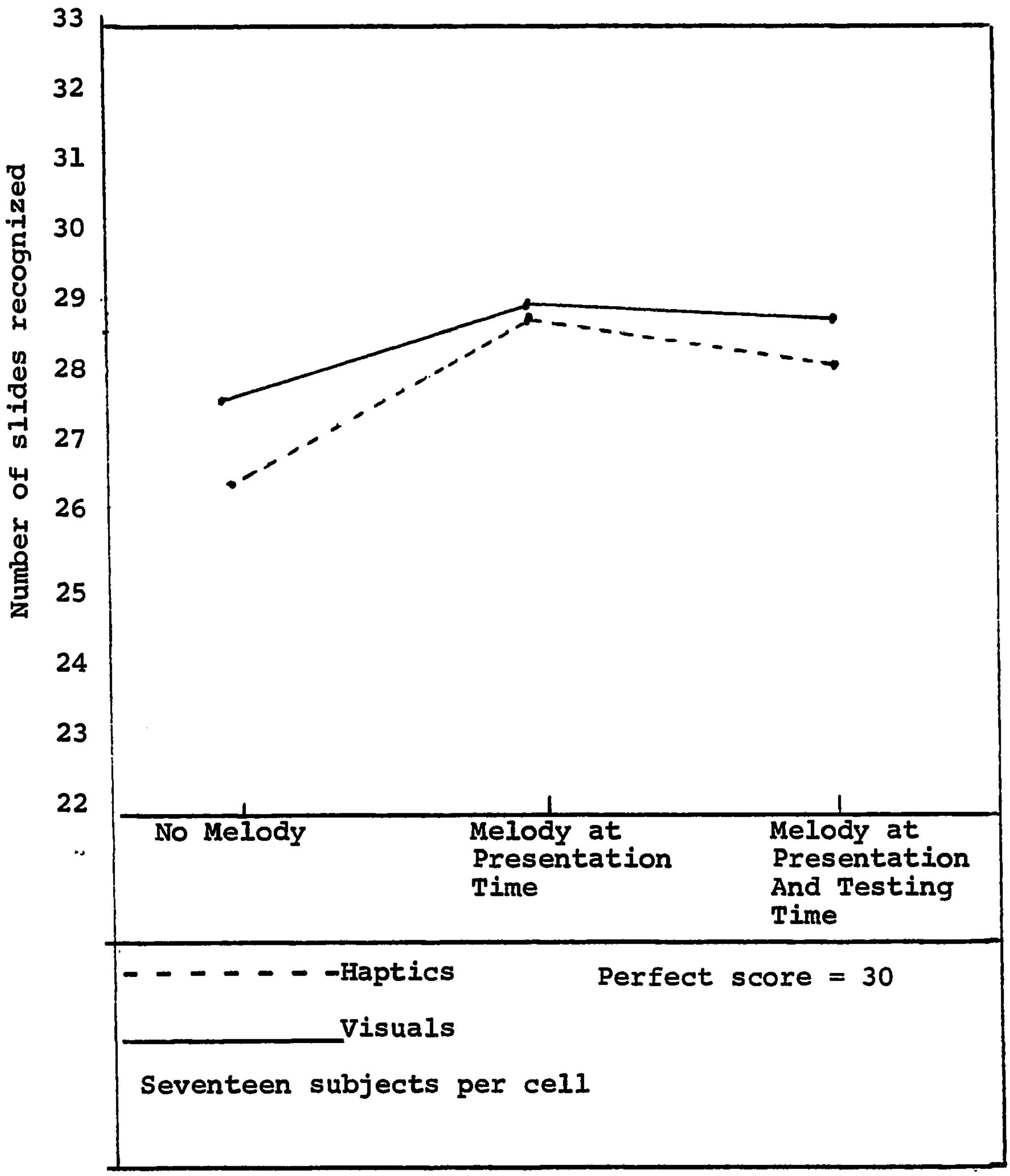

23
22
21
20
19
18
17
16
15
14
13
12
Number of sentences recognized
No Melody
Melody at Presentation Time
Melody at Presentation and Testing Time
- - - - - -Haptics
Perfect score = 30
Visuals
Seventeen subjects per cell

Figure 3



Number of slides recognized
33
32
31
30
29
28
27
26
25
24
23
22
No Melody
Melody at Presentation Time
Melody at Presentation And Testing Time
Haptics
Visuals
Perfect score = 30
Seventeen subjects per cell

Figure 4

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APPENDIX A

Prospectus

RELATIONSHIP OF MELODY AND PERCEPTUAL TYPE IN RECOGNITION AND RECALL TASKS

Introduction

Ask almost any man or woman on the street if music increases learning ability or helps memory, and he or she will say, "Yes, of course it does." That person will be likely to elaborate in one of the following ways:

1. "Songs help my memory of specific facts. I couch the facts into a rhyme, put a tune with it, and sing this little jingle to make memory easier." (In this case it could be that the rhyme is a mnemonic device and that the melody behind it is really contributing very little.)

2. "If I play music when studying, it soothes my emotions and enables me to learn faster and more efficiently." (This might work only with certain persons. Others might be affected negatively, and would learn less well.)

3. "Music is a synthesis of the sensuous and the intellectual functions of human beings. Since it is, it represents the true tempo of life. It puts one in tune with the universe, and, as a result, a person is able to function better in everything that he does." (This would seem to mean that each person would learn better if he really synthesized or utilized the music available to him, but would be unaffected by it if

he chose to ignore it.)

The subject properly belongs to psychology because it deals with human behavior, but American psychologists have not, until recently, been concerned to a great degree with music. Musicians of the past did not request that psychologists deal with such matters because they were more interested in the psychology of learning music itself rather than learning other things through music. Serious questions need to be asked about the effects of music on learning and memory. If people insist that music has great powers, perhaps it does.

A major area of interest today in the field of educational technology is that of aptitude treatment interactions. Individual differences are known to have an effect on learning and are thought to suggest differences needed in instruction. One area of difference between learners is perceptual type, a term denoting preference for either seeing or touching as ways of knowing the world.

An essential function of the brain in all learning tasks is the ability to retain what has been acquired by the learner. There can be no learning without memory (Maggio, 1971). In a classification of learning tasks and their related cognitive styles (Ausburn, Ausburn, and Ragan, 1980) it was noted that tasks requiring short-term or long-term memory or recall of details of images are related to leveling/sharpening cognitive controls (ability to accurately store and recall discrete details and images) and visual/haptic perceptual type (ability to mentally retain visual images). The visual/haptic perceptual type was discovered and named by Viktor Lowenfeld, an Austrian artist and art professor. He said that visual space, perceived through the eyes, was the widest possible space permitted to an individual. The senses all limit space perception in some way, and haptic space, perceived through the organs of touch and bodily sensations, is the most restricted of all of them (Lowenfeld, 1939). The haptic does not want to mentally retain visual images. He or she prefers an inner world of the emotions, and relates all experience to its effect on the self. The visual type, on the other hand, prefers to use his or her eyes as the main vehicle for sensory input, and will translate kinesthetic and tactile information into visual form. The distribution of visuals and haptics in the population was found to be roughly fifty percent visual, twenty-five percent haptic, and twenty-five percent indeterminate (Lowenfeld, 1945). Persons who are either visual or haptic seem to be the best choice of subject in a study that will be concerned with memory and imagery. Descriptions of the way these people operate in reaction to stimuli are often reminiscent of some of the modern theories of brain operation in memory.

The way that human memory works is not yet known for certain, but it has fascinated man for centuries. Aristotle saw memory as a series of mental pictures which were not part of the brain's intellectual capacity, since animals could also demonstrate memory. One could see and <u>hear</u> what was not present, but consciousness that these imaginings had occurred earlier, at another time, must be added by the brain.

Various theories of memory exist, but most of them agree that verbal and nonverbal retention stores are separate in the brain, at least for short-term recognition and recall. None of the theories are universally accepted. Memory can be thought to be composed of recognition which is accomplished in the presence of a patterned stimulus, and recall which is accomplished in the absence of some patterned stimulus that occurred at a time in the past. Recognition, according to Piaget, "is a double utilization of that figurative mechanism which we designate as perception." Recall requires the construction of a memory image which can be retrieved (Piaget, 1973).

Perception is not as simple as this definition of it would seem. It is not merely an imprinting on the brain of a sensual input. It requires identification, assimilation and storage according to some organization scheme. That scheme might very well be an image.

Images, such as those discussed by Aristotle, are controversial. Some psychologists believe that all cognition takes place either in the form of words or images, while others argue that both images and words are formed from smaller abstract storage units in the brain. Studies are usually done on visual images and little work has been done on other kinds of imagery such as auditory, olefactory, gustatory, or tactile.

The majority of experiments on the duration of sensory memory have been concerned with visual storage, (Deutsch, 1975) yet people seem to recognize melodies for longer periods of time than they remember visuals. This observation seems to contradict the widely held notion that visual images are stronger than auditory ones.

Ancient peoples, Greek, Hindu, and East Asian, thought that music affected the emotions, but some philosophers through the ages have spoken out against music. The Greek philosopher, Democritus, thought that there was no need for music. He said that it "arose from the existing superfluity." John Locke wrote that it was a waste of time, and Goethe said, "In comparison with the eye, the ear is a dumb sense." These beliefs seem to be in the minority in advanced civilizations. Most people value music highly as one of the fine arts, and are puzzled about its nature and its origin. It is not learned in quite the same way as other cultural skills, but seems to be a synethesis of the cognitive processes that are already present in the human body. (Blacking, 1973). Revesz has offered a theory that music and speech have a common source, and that music had its beginning as a calling signal of man. As such, it gave him pleasure and was continued. (Revesz, 1954).

Film makers of today add music for the purpose of arousing and controlling the viewer's emotion, or, in the case of educational films, to motivate the learner or to direct his attention. Music is used in psychotherapy and in advertising. The claims for some of its therapeutic success and its ability to encourage listeners to purchase either goods or services are based on the theory that music is either masculine or feminine and can cause sexual arousal. Studies by Altshuter (1946), Tilly (1947), Farnsworth, Trembley and Dutton (1951), and Beardslee and Fogelson (1958) dealt with these issues, but claims of a connection between music and sexuality have not been demonstrated scientifically. Music as therapy to motivate psychotic children, to increase speech in the mentally retarded, and many other such uses reported regularly in journals such as Music Therapy, seem to be well documented. Many people believe in the power of music to affect human behavior at least some of the time under certain conditions. Will it also affect learning?

Lozanov believes he has created a teaching method which can speed up learning fifty times, increase retention, and which requires no effort on the part of the learner. It is called "Suggestology," and is based on the Yoga technique of relaxation. Students listen to gentle, soothing music while they learn a language such as French. They are reported to learn 120 to 150 new words in a two-hour session. (Ostrander and Schroeder, 1970). The music is thought to relieve muscle tension, anxiety, and stress. Alpha rhythms are said to predominate, and a reverie-like state is said to be created which improves memory for some time after the session has ended. Claims are made that the method reaches people who are retarded and brilliant, who are young and old, and that no one can remain unaffected. It requires no special equipment. Such claims suggest a tapping of elemental forces that transcend individual differences. An American study using the Lozanov method found that synchronized music, suggestion, and proper breathing had a positive effect on the learning and retention by college students of 50 Spanish words (Benitez-Borden & Schuster, 1976). Suggestopedia (another term that is used for this phenomenon) has been used frequently in the teaching of language, but is purported by its advocates to work equally well whenever the learning of facts is a goal. The Yoga may be having more effect than the music. Udupa and Singh (1978) found that Yoga exercises and regular breathing practice decreased mental fatigue and improved memory in Indian subjects.

A recent experiment by the author (Raburn, 1980) used a film with musical background and no dialogue. It was shown to two groups of American Indian high school English students. There were eight males and eight females in each group. One group saw the film with its musical background, and the other group saw it as a silent movie. A multiple choice test on content was given immediately after viewing by both groups. There was a marked drop in the scores of the group which had not heard sound. The difference between the two groups was found to be significant (alpha = .001) when tested with a two-way ANOVA. The conclusion was that music had contributed either to comprehension (the subjects understood the film better because of the music) or to recall (music had helped the subjects remember what went on in the film and to be able to retrieve that information more efficiently.)

No firm conclusions could be drawn as to why these results occurred, and related literature is contradictory in its suggestions. Background music could have increased emotional involvement because it made the viewing more pleasant for the subject, and, as a result, more of what was seen was remembered. Another possible explanation is that emotional reactions may form conditioned responses to visual stimulation much like a tuning fork caused Pavlov's dogs to salivate. The resulting gratification increases learning and memory. On the other hand, a sensory integration of visual and auditory imagery could have taken place.

Music seems to have the power to arouse imagery of a very personal sort in the listener. (Farnsworth, 1969). These images are specific to the unique experiences of the listener. (English, 1943). This means that the same music would not cause identical images in different listeners, each of whom would bring his or her own background and experiences to the occasion. Even so, the auditory image could provide support for what was seen, much as a mental picture of an object can increase memory of that object's abstract name.

According to Paivio's dual coding theory (Paivio, 1972), information held in both the verbal and imaginal systems is more accessible than information which is held in only one system. An explanation might be that information can be retrieved by alternative routes, either from visual for from verbal storage. However, information does not seem to be stored in both systems from simultaneous perceptions in two modes. Strong non-music-oriented evidence indicates that while individuals are performing tasks usually the speciality of one hemisphere, the other hemisphere is turned off. If not turned off, it may interfere with the hemisphere that is trying to deal with its specialty (Fincher, 1976). This might mean that verbal information and melody occuring at the same time would result in retention of one or the other, but not both. If both hemispheres were processing, neither input would be retained. On the other hand, an auditory image might work like Paivio's visual image and increase recognition of verbal information, but it might block, rather than facilitate, retrieval of visual information, since both visual and audio information would be stored and processed in the same system. Another interesting possibility is that since visual information and melody would input to the same nonverbal system, they would be stored together as a much stronger memory trace than either of them would be stored alone.

Ladik and Greguss (1969) saw information carriers as waves of energy which must undergo a two-step imaging process on their way to being stored in holographic memory. They must first be compared to patterns that are already stored, and then new patterns must be generated from both old and new information. The new patterns are put into storage in holographic form in a component of the cells called ribonucleic acid or RNA.

Later research has indicated that RNA does not store memory traces, but causes proteins which store them to be synethesized. Research with mice, using labeled precursors, shows increases in RNA formation in the hippocampus section of the brain during training, and an increase in protein formation immediately after training. Both substances increase again eight hours later, which may be the formation of long-term storage (Pohle, Loessner and Ruethrich, 1974).

It might be that people who are visual would have stored more reference patterns for visual information than would people who do not like to use their eyes as the main sensory receptor. It would then be much quicker for the visual person to recognize new visual information, or to recall old patterns already stored in the brain. If new information is able to match some model in the brain, it is easier to remember than if there is no match (John, 1967).

The haptic, conversely, does not have visual patterns stored in memory. Each picture is a new emotional experience, and older ones are not necessarily retained. Sound images are preferred by the haptic (Erickson, 1966). Music is sound, and is known to cause emotional reactions in listeners. Haptics should respond to it, and may associate it in memory with the visual information that it accompanies so that the visual information is stored rather than discarded.

Indefinites can shift their perceptual processing from visual to haptic as needed, but visuals and haptics are the extremes of the continuum and do not shift easily into the opposite style (Short, 1953). Differences between persons within the visual or haptic category should be relatively small.

Music may be ignored by the visual so that it has no effect on recognition and recall, or it may distract him or her so that visual information is not stored as efficaciously. Since music influences the electrical conductivity of the human body, (Disrens & Fine, 1939) and the activity rate of children (Rieber, 1965) it might improve everyone's ability to learn both pictorial and verbal information, but haptics should be improved the most. They get involved in situations, while visuals are spectators (Lowenfeld, 1939). John (1967) has postulated patterned electrochemical brain interactions during memory operations. Since melody has pattern, it may either activate this process, or provide a synchronization with it that augments it.

Because it is widely believed that music affects people, and since claims have been made that it improves memory, these questions should be scientifically investigated. Not only could schools benefit from an enhancement of the memory power of students if we better understood the reciprocal action between music and learning, but the discipline of music might also take a new place of major importance among other aspects of the study of learning and instruction.

Definition of Terms

Emotion--Part of the affective area of consciousness. Aroused feelings, measured here by increased retention of all stimuli presented to the senses.

Visual--A person who prefers to take in perceptions of the world through his or her eyes.

Haptic--A person who prefers to take in perceptions of the world in tactile, kinesthetic, or emotional ways.

Retention--Memory.

Memory--The function of retaining, recognizing and recalling previous impressions and experiences.

Ikonic memory--Something is sensed. The impression remains only milliseconds unless the brain orders it sent to short-term memory.

Short-term memory--STM--Sensory or verbal inputs sent here by the brain remain for only 30 seconds unless rehearsed or sent to long-term memory. Inputs may travel back and forth between long-term and short-term memory before being saved in long-term memory. Information on transfer remains in both stores (Atkinson & Shiffrin, 1968).

Long-term memory--LTM--Relatively permanent storage in the brain.

Image--Nonverbal memory representation of concrete objects or events. In this case it will often be auditory imagery.

Verbal--A speech or language mode. Although it often relates to words, it may also mean abstract or symbolic processes.

Stimulus--An instructional event.

Hemisphere-Cerebral hemisphere. The right and left sides of the brain.

Hippocampus--A curved elongated ridge extending over the floor of the descending horn of each lateral ventricle of the brain.

Melody--A succession of single pitches in an agreeable arrangement of sound. It has both pattern and rhythm.

Recognition--Identification of something seen or heard previously, measured here as number of slides seen or sentences heard correctly.

Recall--Rememberence of what has been previously learned or experienced. It will be measured here by a paper and pencil multiple choice and short answer test over the content of an orally read paragraph, and by verbal descriptions and/or sketches of slides presented a few minutes earlier.

Phoneme--The smallest unit of speech that distinguishes one sound from another.

Serial processing--A one-after-another process.

Parallel processing--Many separate comparisons going on at any one time.

Statement of the Problem

The purpose of this study is to investigate the relationship between melodies and the ability of visual and haptic learners to recognize and recall pictorial and verbal patterns in meaningful learning materials.

Specifically the following hypotheses will be tested:

1. Haptic individuals recognize more speech phonemes presented as orally given sentences than do visual individuals.
2. Haptic individuals recognize fewer pictorial slides than do visual individuals.
3. Haptic individuals recall fewer pictorial slides than do visual individuals.
4. Haptic individuals recall more content from orally presented paragraphs than do visual individuals.
5. Music accompanying pictorial information at presentation time will increase recognition of that informa-

tion for haptics, and will decrease recognition for visuals.

6. If music accompanies pictorial information at presentation time and at testing time, both visual and haptic individuals will improve in recognition tasks, but haptics will show the greatest improvement.
7. If music accompanies verbal information at presentation time, recall will be increased in both visual and haptic subjects.
8. If music accompanies verbal information at presentation time, recognition will be increased in both visual and haptic subjects.
9. Music accompanying verbal information at presentation time and at testing time will increase recognition of sentences for both visual and haptic subjects.
10. Music accompanying verbal information at presentation time and at testing time will increase recall of that verbal information for both visual and haptic subjects.

These hypotheses have been generated because they seem to be logical assumptions growing out of the literature review.

Alpha rhythms predominate in suggestology which uses music to increase memory (Ostrander & Schroeder, 1970; Herr, 1978). Since no attempt to relax the subjects will be made in the present study, the presence of alpha rhythm will have to be a natural occurrence. Haptics seem to have persistent alpha rhythms which would make them candidates for more efficient memory production. This, too, is not at all certain. Walter (1953) thought that the people whose EEG's showed persistant alpha rhythm corresponded to Viktor Lowenfeld's haptic perceptual type. They were never tested for visual-haptic tendencies.

Alpha rhythms are electrical in nature, and it is known that electrical activity starts chemical processes in the brain. Subsequent synethesis of protein in the brain is thought to be the memory storage process (Ladik & Greguss, 1969). Music may influence the electrical conductivity of the human body (Disrens & Fine, 1939), but this conjecture is highly speculative. These authors privately published a work on the psychology of music which included a statement that music influenced the electrical conductivity of the human body. Increase in electrical activity of the human brain induced by music has not been verified.

Lowenfeld's characterization of the haptic personality showed them to prefer sound to visual input, and to prefer emotions and feelings as a response to their environment. These attributes of the haptic personality have not been scientifically tested and verified, but if they are valid observations, haptics should be more responsive than visuals to music. They would also be more likely to forms auditory images to increase memory efficiency.

Visuals prefer the spectator role and do not want to be emotionally involved. Their brains produce alpha rhythms only when their eyes are closed. It is certainly questionable whether alpha rhythm is the one electrical activity of the brain which produces memory. Visuals often have good memories, so other brain rhythms must also trigger the protein synthesis process. It does seem logical that those other rhythms would affect the visual and be more efficient for visual storage, while music would increase and improve haptic processing activities if Lowenfeld's observations are accurate descriptions of differences in these perceptual types.

Design and Methodology

Adults will be chosen as subjects to eliminate various problems associated with developmental differences among children. Sex differences in brain function are thought to exist, so sex differences will be controlled for by using only females. Some evidence suggests that females perform better in left hemisphere tasks while males do better in right hemisphere tasks. (Levy, 1972). There is some evidence that female adults do not show a dominance of left brain and right brain modes of processing. (Witelson, 1976). Paivio (1971) has stated that any generalization regarding incidental memory and imagery needs to be qualified in terms of the sex of the subject and the nature of the task. He found high imagery females superior to low imagery females and to males in general. Marx, Homer, & Marx, (1980) report that females are better at retention of verbal material.

Approximately 500 people who are students at Cameron University will be given the Successive Perception Test 1 (United States Army Air Corps, 1944). This is a motion picture form of Lowenfeld's original Integration of Successive Impressions Test which was developed by him to distinguish between visual and haptic types. SPT-1 consists of three practice items and 35 test items. The subject views part of a design which is visible behind a moving slot. Later he must pick out that design when shown four other similar ones. Visuals can put these pieces together and see the whole. Haptics either cannot do so, or they do not care to do so. The test was used extensively in the U. S. Army, and has been used in educational research with people of junior high age or above. The reliability, based on a retest of subjects with the same test six weeks later, has been reported by Ausburn (1975) as .68. Subjects who got 60% of the items correct were considered by the Ausburns (1975, 1979) to be visual. Those who got 60% of the items wrong (21 through

35 incorrect or 0 to 14 right) were considered to be haptic. They seem to have been basing those figures on a percentage basis used by Lowenfeld on a 20-item test of his reported in the American Journal of Psychology (Lowenfeld, 1945). Erickson (1966) used a frequency distribution to assign persons to visual or haptic groups. The argument he used was that the test was not a standardized test and had no norms. He used obvious breaks in the distribution as indicators of change in perceptual processing preferences. In this study, persons who make scores that represent the upper 20% of the 500 people tested will be considered visual. Persons who make scores that represent the lower 20% of the 500 people tested will be considered haptic. The rest will be classified indefinite. Fifty-one visual and fifty-one haptic females will be selected to participate in the three experimental groups.

At the time of administration of the Successive Perception Test 1 some other questions will be asked of the participants. These may be seen in Appendix E. Writing posture and handedness can be indicative of brain organization, so each person will be asked if she is right or left handed, and if she writes in straight or inverted hand position. Inverted hand position is very common among left handers, but is unusual among right handers. Ninety-nine percent of right-handed people use their right hemisphere for spatial-temporal tasks and their left for language. The situation in left handers is reversed about forty-four percent of the time. Their spatial skills are in the left hemisphere and the right is used for language. The inverted hand position may be a biological marker indicating that the hemisphere for language specialization is on the same side as the writing hand (Levy, 1972). Zenhausern (1978) found that visual or non-visual thinking style is a direct consequence of cerebral dominance. Since it is possible that hemisphere specialization might be a factor in the results, groups will be matched as to handedness and inverted writing position.

Musically inexperienced listeners have been shown to recognize melodies better with the left ear (right hemisphere), while concert level musicians demonstrated a distinct right ear (left hemisphere advantage (Restak, 1979). Wagner (1975) in an experiment which electronically measured the brain activity of trained and untrained listeners found that the untrained subjects were using their left hemispheres analytically in attempting to understand the music, while musicians were using the right hemisphere in a very relaxed manner. Alpha waves predominated in the musicians's brains. These studies present two views that are diametrically opposed. The first says that the right hemisphere processes unfamiliar materials, then, as the materials become more familiar, the left hemisphere takes over and performs intellectual operations on it. (That is assuming the most common configuration of the brain in a right-handed person.) The second view would seem to indicate that familiar material, if it were music, would be processed by the right or holistic brain. Since there is reason to believe, then, that musical training inputs on how musical information is processed, subjects will be asked how much musical training they have had. Groups will be matched by years of training in music possessed by the subjects within them.

A question will also be asked about tone deafness, and whether or not the subject likes music. All tone-deaf people, and those who dislike music will be eliminated from the study. Critchley (1977) observed that some people are non-responsive to music. If those people do not respond to it, their recognition and recall of verbal and visual material might not be affected by it. It seems likely that such people would not react in a normal way to musical sounds.

Students will also be asked if they suffer from impaired vision. Those who have impaired vision that is uncorrected by glasses or contact lenses will be omitted from the study since they could not see the visual presentations well enough to process them into memory.

Subjects will be randomly assigned to three groups by using a random number table, after they have been matched for handedness and musical training. Each group will have 17 visual people and 17 haptic people in it.

The design is a completely randomized factorial design with one treatment of two levels, one treatment of three levels, and one categorization of two levels. It is a 2 x 3 (CRF pq) design (Kirk, 1968). The independent variables are perceptual style with two levels: visual and haptic; pictorial stimuli with three levels: melody at presentation time, melody at both presentation and testing time, and no melody; and verbal stimuli with three levels: melody at presentation time, melody at both presentation and testing time, and no melody. (See Figure 1) The dependent variables are the number of slides and sentences recognized by the subjects, the number of slides recalled, and the scores on the paragraph content test.

Slides of landscapes, animals, common objects, and flowers will be made to insure realism and similiarity to actual materials that might be used in a classroom. The slides will be of high quality, and will be similar in color, brightness, and content so that distinguishing characteristics are not blatantly obvious. To insure that this is true, two similar slides will be made of each category of subject matter. There will be two slides each showing a different style of china cup, two slides each showing a different mountain, etc. One person will view them, and will rate them on a Likert-type scale using five points of similarity: (1) extremely similar, (2) slightly similar, (3) undecided, (4) slightly dissimilar, (5) extremely dissimilar. All combinations should fall into the range (2), (3), or (4), or they will be discarded. After one person has evaluated them, four persons will be asked to rate them according to the same process. Lastly, twenty or more people will rate them, and, if their results fall into the middle range, the slides will be judged to be valid for their purpose. Using similar or associated distractors will yield poorer recognition performance (Klatzky, 1975). If the items are not similar, subjects can recognize pictures with a 97% accuracy (Shepard, 1967).

Slides will be shown to subjects by using a Kodak Carousel projector. This machine will project onto a wall surface twenty feet away. The method will be to show 15 slides for 10 seconds each. Subjects will be asked immediately to recall as many of the 15 as they can remember. They may describe them verbally, sketch them, or do a combination of the two. They will have been told before being shown the slides what is expected of them, and two or three practice runs will be done. After they have finished recalling what they can of the 15 slides, their papers will be taken up and they will be asked to recognize those slides in a series of 30 slides, each one shown for 10 seconds each. The recognition process of picking out old and new examples from a pair of items has been used widely by Shepard (1967), Standing, Conezio and Haber (1970), and others.

The next treatment will present a paragraph being read on tape orally. Subjects will immediately take a content test after hearing the paragraph. This content test will have a Kuder-Richardson score of .70. After these papers have been taken up, subjects will pick out 15 sentences from the paragraph when hearing them mixed with 30 similar sentences. The same voice will be used on both tapes since recognition is assisted by accoustical identity between presentation and test items (Madden & Bastian, 1977). As before, they will have had a practice run ahead of time to show them what is expected of them. Both practice runs will use materials that were not used in the test.

The paragraph used will be taken from a French fairy tale that is unfamiliar to Americans. Recall of narrative prose is twice as good as recall of expository prose, and unfamiliar material is remembered better than familiar material (Cohen & Graesser, 1980).

The first group will have no music, a second group will see 15 of the same slides, each one accompanied by a folk melody without harmony as background. These will also be shown for 10 seconds each, and subjects will try to recall them as before, and then will try to identify the 15 when seeing the same 30 slides that the first group saw. There will be no musical accompaniment with either the recall or the recognition test for the second group. A third group will be shown the same slides with a folk melody as background. The folk melodies will accompany the same slides when they are presented in a group of thirty slides, and will also be used as background for the other 15 slides. Subjects will see two slides which have the same melody, so they will have to remember visual elements of the correct slide instead of simply recognizing the melody which accompanies it. The 15 melodies will play as subjects in the third group try to recall the slides, and then again as they try to recognize the slides.

The second treatment for both of these groups will present a paragraph being read on tape orally. Subjects in the second group will have a folk melody as background as the paragraph is read. Immediately after the reading is finished, subjects will take the content test, and then they will attempt to pick out 15 sentences from the paragraph when hearing them mixed with 30 similar sentences. Both the first group and this second group will have no music at testing time. The third group will have the same folk melody played as background while the paragraph is read. This same melody will be played during the content test, and during the recognition test when the 15 sentences are presented with other similar sentences. The similarity of the sentences will be validated at the same time and in the same way as the slides, except that the sentences will be accepted for use in the study when they are rated as extremely similar or slightly similiar. It is easier to recognize visual material than it is to recognize verbal material, so this will be a factor affecting the validators as well as the subjects. People think that sentences are similar if they are very different in form, but close to each other in meaning (Dooling & Christiaansen, 1977).

The method of sentence recognition chosen for this study has been used by Sachs (1962), Sulin & Dooling (1974), and Dooling & Christiaansen (1977). Recognition memory is good for sentences when foil sentences come close to the original (Sachs, 1962), so in this study sentences will not be placed close to the true sentence that they resemble on the theory that a more difficult task will be more likely to show any effects of music that might be present.

Recall seems to be dependent on subjects forming associations between items or seeing relationships between them. Recognition depends on attention to detail and the ability to discriminate between items (Tversky, 1973). The recall test will be given first, followed by recognition. This will increase the precision of the experiment (Brown, 1976).

Materials, both slides and sentences, will be the same in the three groups. A flute will be used as the instrument, since it is common enough not to be a novelty, nor should it be disliked by great numbers of people. It is a very ancient instrument, and is commonly heard as a solo. It is often thought to resemble the human voice. Melody shows different psychological characteristics when it is played on instruments of dissimilar timbre (Farnsworth, 1969).

Folk music written in major keys will be used. An attempt will be made to choose music that is not familar to Americans, but it will be in the Western tonal system. Short-term recognition of melodic patterns is greater when they are in the subject's tonal system. The difference between attempting to recall a musical sequence in a familiar tonal system, as compared with a set of notes chosen at random, is equivalent to the difference in trying to recall a sentence as compared with a set of nonsense syllables. Although subjects will not be trying to remember the melody, this problem was thought to be a possible nuisance variable which should be controlled. It is more difficult to remember modern music than it is to remember folk music, because modern music discards the traditional probability relationships. Each piece of modern music establishes its own set of transitional probabilities (Meyer, 1956; Critchley, 1977).

For the recognition tasks, subjects will mark a paper numbered from 1 to 30 for each slide, and another one marked from 1 to 30 for each sentence. They will check old or new as each one is presented. The number correct will be tabulated, and this will form the score for each subject.

A 2 x 3 analysis of variance will be performed on slide recognition scores and on sentence recognition scores. A third and fourth analysis of variance will be performed on slide recall scores and on verbal recall scores. A graphic representation of the design is shown in Figure 5.

Completely Randomized Factorial Design

		Treatment Levels		
Perceptual Type		Group 1	Group 2	Group 3
	Visual	17	17	17
	Haptic	17	17	17

Group 1 = No melody
Group 2 = Melody at Presentation time only
Group 3 = Melody at Presentation time and at Testing Time

Figure 5

If significant differences occur in any ANOVA for recall or recognition, pairwise comparisons will be done on the means of that group. If interactions are present, regression analysis will be conducted, and the results will be graphed to show aptitude-treatment-interactions. Cronbach and Snow (1977) suggested 100 or more subjects, fifty in each aptitude category, as necessary to test for interactions between aptitudes and treatments. Such a large number is not considered necessary in this case, since power for the test, figured on the interaction, is over .99 with 17 persons per cell. This is adequate to detect differences of 1.5 standard deviations between means.

Although it is not thought to be necessary to the accuracy of the study, a correction for guessing will be made in the scores for visual recognition of slides and aural recognition of sentences. The procedure is actually a theory of recognition as developed by Green and Swets (1966) and described by Klatzky (1975). It is called the signal detection approach, and instead of only two choices, familiar or unfamiliar, the subject demonstrates four reactions. She says familiar (or old in this case) when she is right, and familiar (or old) when she is wrong. A "familiar" when she is wrong is called a miss. The subject also says unfamiliar (or new) when she is wrong. An "unfamiliar" when she is wrong is called a false alarm. These responses can be represented as percentages. (See figure 6.)

SIGNAL DETECTION THEORY PERCENTAGES				
	Subject has seen an old item.		Subject has seen a new item.	
Subject says?	Old	Hit (__%)	A False Alarm	(__%)
	New	Miss (__%)	Correct Rejection	(__%)
	TOTALS:	Old items = 100%	New items = 100%	
Types of trials that can occur in an old/new recognition test.				

Figure 6

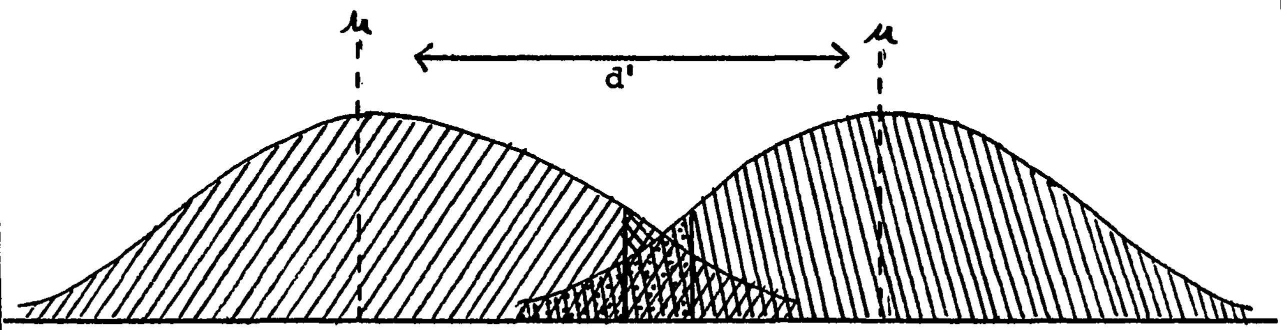
The "old"-"new" answers can be thought of as two distributions. One contains the signal plus noise, and the other one contains noise alone. The difference between means of the two distributions is d' or true recognition memory. The d' statistic is a comparison of obtained performance with ideal performance. See Figure 7 for a diagram of the way these two distributions relate to each other in this particular experiment. To prevent a possibility of minus scores, one point will be added to every d' score. An ANOVA (2 x 3) will be done on the d' scores to see if the groups differ significantly from each other in true score.

Hypothesis #1 will be tested by an analysis of variance on verbal recognition. If perceptual type differences are noted, pairwise comparisons of the means of visuals and haptics in the no melody treatment condition will be done. If the hypothesis is true, the mean of haptic scores on the sentence recognition test will be significantly higher than the mean of visual scores.

Hypothesis #2 will be tested by an analysis of variance on pictorial recognition.

Hypothesis #3 will be tested by an analysis of variance on pictorial recall. If perceptual type differences are noted in either hypothesis #2 or hypothesis #3, pairwise comparisons of visuals and haptics in the no melody treatment condition will be done. If either hypothesis is

DIAGRAM OF A SUBJECT'S
CORRECTED SCORE



μ = mean

d = difference or true recognition memory score

= Subject said old (familiar) when correct. (Or signal + noise)

= Subject said old (familiar) when incorrect. (A miss.)

= Subject said new (unfamiliar) when correct. (Or noise)

= Subject said new (unfamiliar) when incorrect. (A false alarm.)

Figure 7

true, that haptics recognize fewer or recall fewer pictorial slides than do visuals, the mean of visual individual scores on the slide recognition test or the slide recall test will be significantly higher than the mean of haptic scores.

Hypothesis #4 will be tested by an analysis of variance on verbal recall. If perceptual type differences are noted, pair-wise comparisons of the means of visual and haptic scores will be done in the no melody treatment condition. If the hypothesis is true, the mean of haptic scores should be significantly higher than the mean of visual scores.

Hypothesis #5 will be tested by an analysis of variance on pictorial recognition. If a significant interaction occurs, the means will be graphed to determine its direction. If mean scores for visuals drop below their no melody levels when melody at presentation time is the condition, and the scores for haptics improve over their no melody condition when music is present at presentation time, then the hypothesis will be accepted.

Hypothesis #6 will be tested by the analysis of variance on pictorial recognition.

Mean scores should go up for both haptics and visuals when melody is present both at presentation time and at testing time. Pairwise comparisons will be done between the means of scores of visuals and haptics when music is present at presentation time, and when music is present at both presentation time and at testing time. If these scores are not significantly improved in the latter condition, and over the no melody condition, the hypothesis will be rejected. The difference in haptic mean scores should be higher than visual mean scores.

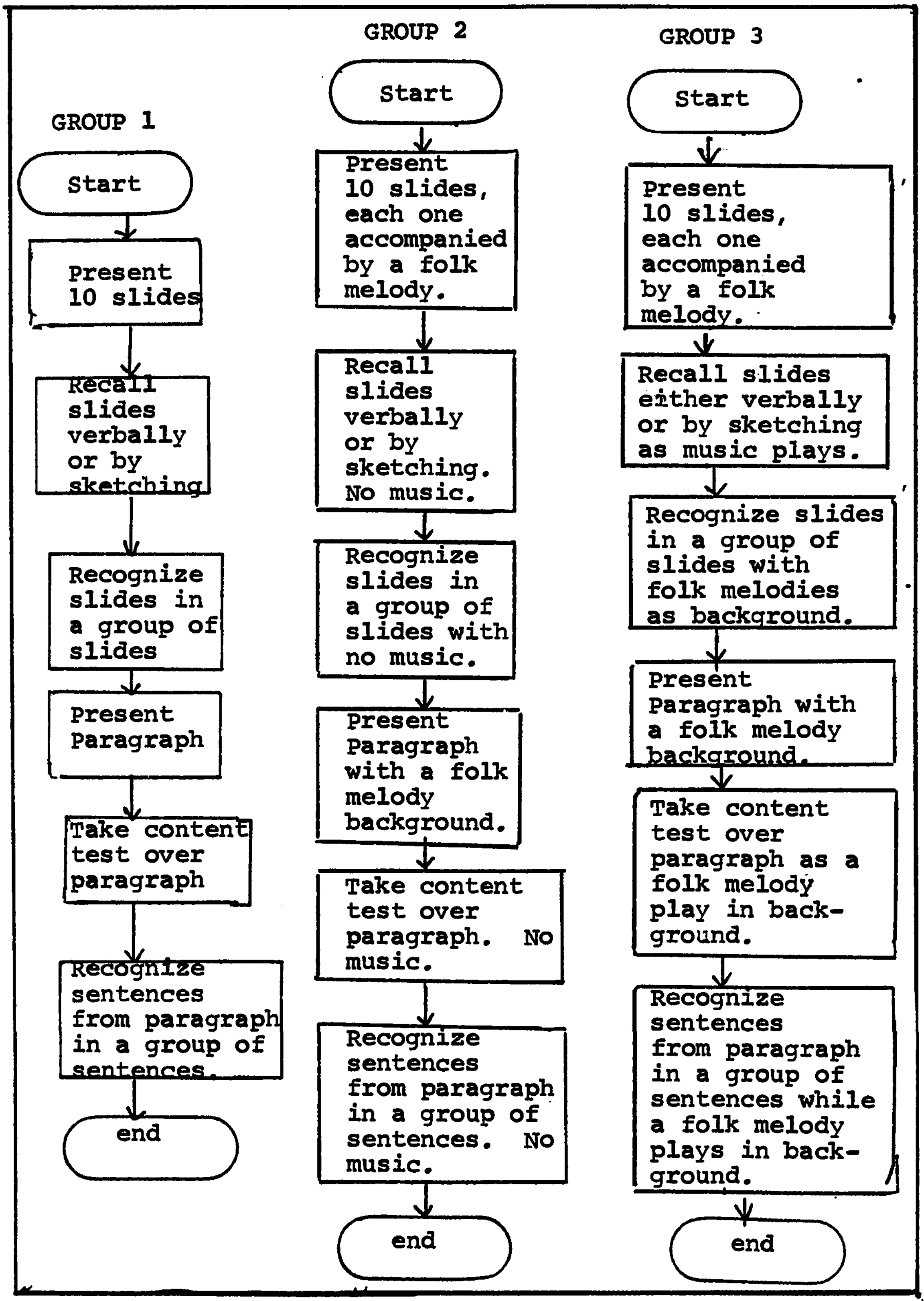
Hypothesis #7 will be tested by an analysis of variance for verbal recall, and hypothesis #8 will be tested by an analysis of variance for verbal recognition. If treatment condition differences are significant in either test, pair-wise comparisons will be done on the means of the scores in the various treatment conditions. These means should be significantly higher in the melody at presentation time and at testing time condition in both tests for the hypotheses to be true.

Hypothesis #9 will be tested by an analysis of variance for verbal recognition. The means for both visual and haptic subjects should be significantly larger in the third treatment condition (melody at presentation time and at testing time) than in the no melody condition for this hypothesis to be true.

Hypothesis #10 will be tested by an analysis of variance for verbal recall. Means in the music at presentation time and at testing time should be significantly larger for both visuals and haptics for the hypothesis to be true.

The four analyses of variance will be done in two multi-variate tests to control error rate, but they will also be done separately to be sure what is going on with the data.

FLOWCHART OF EXPERIMENT



APPENDIX B

Review of the Literature

REVIEW OF THE LITERATURE

Studies relating to the problem have to do with what is known about the brain and its function in memory; theories about the storage and processing of information in the brain; qualities of melody; the effects of music on recognition, recall, and emotion; the effects of emotion on learning; and the relationship of the visual, haptic perceptual type to processing of visual and verbal information. They will be presented in that order, and summarized in a final paragraph at the completion of the review.

The Human Brain and its Function in Memory

Memory has its roots in genetic information or heredity and is species specific to a degree. The way that human beings process perceptions is a human mechanism. Even if perceptual abilities interact with intelligence so that certain individuals are more skillful than others in their perceptions, the process is the same for both bright and dull.

All stimuli are composed of a number of small elements arranged in some kind of configuration or pattern, and pattern recognition is an important part of memory. A sensory receptor (eyes, ears, nose, taste buds, or nerve endings on the skin) sifts through thousands of pieces of incoming information and concentrates on one pattern to let through to the brain. For this pattern to be recognized, it must be matched to another, previously acquired pattern of a similar sort, which was stored in long-term memory. If the pattern is not recognized, it may be encoded and added to the store. Even if it is recognized, it may be encoded along with that previous information, and added in a new form to the memory store. How incoming stimuli are first registered in the brain is not a matter of general agreement among researchers. Perhaps a register exists for each sense. Psychologists have called these stores, whatever their form, by several different names. The storage functions are variously referred to as sensory information stores, iconic stores, and precategorical stores. Visual storage was often called iconic, and auditory storage was termed the echo. Both terms mean a very brief holding of the information in exactly the same form that it had when picked up by the sensory receptor. Results of experiments (Sperling, 1960; Averbach and Sperling, 1961) indicate that much more is available immediately after a visual presentation than remains even one second later.

A phenomenon known as backward masking or erasure (Averbach & Coriell, 1961) suggests that the brain prevents scrambling of visual information by clearing away preceding iconic storage when new information is registered.

The echo is a hearing in the mind of auditory stimuli which are no longer present. Most sounds occur over a period of time, and their patterns could not be understood if each component were not stored until the entire pattern was finished. The estimation of this storage time varies from 1 second to 15 minutes. According to Klatzky (1975) the 15 minute interval may be highly questionable. In studies obtaining this long interval (Guttman and Julesz, 1963) the subjects may be using verbal mediation to assist memory. It does seem to be true that registery storage time for auditory stimuli exceeds that of visual stimuli. It is sufficient to say that these very short-term stores preserve the raw sensory information just long enough for the brain to pick it up for processing. If new information comes in too thick or too fast, much of it is lost through erasure.

Recognition is composed of this incoming stimulus registration process, another process in which the incoming pattern is compared with an existing pattern already stored in memory, and a coding process that stores the new information.

Memory may be susceptible to comparison with what happens in a computer. There seem to be coding procedures, rehearsal operations and search strategies. There is a sensory register, a short-term store, and a long-term store. Incoming sensory information first enters the sensory register where it resides for a very brief period of time, then decays and is lost. Short-term storage is the person's working memory. This store receives inputs from the sensory register, and also from the long-term store. Information in the short-term store decays completely and is lost within a period of about thirty seconds, but a control process called rehearsal can maintain a limited amount of information in this store for as long as the subject desires. The long-term store is a permanent repository for information which has been transferred from the short-term store. It may be that information in short-term storage is transferred in some degree to long-term memory, even if it is not to be kept there. Atkinson and Shiffrin (1968) have proposed such a system, and they speculate that transfer from short-term to long-term storage may be a reversible process from the beginning. Information could remain in both stores, but it would have to be verbally encoded for it to go into long-term memory. Long-term memory holds material from perceptions and enables people to recall events, recognize patterns, or to think. Some researchers think that short-term memory and long-term memory are separate stores; but others do not agree. Pellegrino, Rosinski, Chiesi, and Siegel (1977) analyzed the size of human semantic and perceptual decision times to see whether the unitary or dual models were supported. They found support for the unitary memory model. Lewis (1979) says that "the distinction between a temporary and fragile memory (short-term) and one that can become permanent (long-term) is no longer adequate to explain the data that has been gathered from both animals and humans." (p. 1054) An alternative that he proposes is to consider all memories long-term or permanent--with some being active, and others being inactive.

Freud (1925) saw memory as a wax pad covered with a transparent layer of celluloid. A waxed paper was between the wax pad and the celluloid. Any writing on the celluloid would appear on the surface of the pad, but could be erased just by lifting the waxed paper. To Freud, the celluloid was short-term memory, the wax beneath it long-term or permanent memory. Impressions that go into the wax cannot be erased. He was saying that short-term memory is a part of consciousness, but that long-term memory is not. The organism is not aware of the items held in long-term storage.

Recognition processes are possible only because of stored data in long-term memory. The process by which that information was encoded is probably a function of short-term memory where the items were chunked, mediated, or rehearsed. The concept of chunking is based on the supposition that grouping new information permits a learner to assign codes to the subgroups of a sequence, so that he need only remember the smaller set of codes (Johnson, 1970). Recognition processes may be serial (one after another) or parallel (occuring at the same time).

Recall is a complex process which brings back previously acquired, stored information in the same form and in relationship with the same cues with which it was learned. Recall may occur at different levels of abstraction. It can also be partial or total, but total recall is exceptional. Partial recall means that in the reconstruction from stored memory traces, information is lost by being forgotten or by being blocked by some sort of interference. A cue causes the retrieval of information in the process of recall. It may be a request such as, "List the words you learned," or it may be a smell or a sound that triggers the recall. Theories of recall usually have to do with associations and searches, so we think of recognition and recall as being two different procedures.

There are several theories about how recognition differs from recall. It has been obvious for many years that subjects do better on recognition tasks than they do on recall tasks. One of the first theories to explain this difference was called the threshold hypothesis. Kintsch (1970) reviewed this hypothesis and found evidence both for and against it. In this theory, both recognition and recall depend on the strength of items in memory. There is a threshold for recognition and a threshold for recall, and the latter is the highest.

Another theory (Adams, 1967) is called the dual-trace hypothesis. It says that recognition and recall depend on different sets of information in memory. Data may be stored in verbal form or in pictorial form. Recognition relies on the perceptual trace, while recall uses only the verbal trace.

The Dual-Process hypothesis (Anderson and Bower, 1972; Kintsch, 1970) tries to unify theories of recognition and recall by saying that recall uses recognition as a sub-process. This hypothesis combines the threshold theory with ideas of search and association. When a subject is given a retrieval cue, long-term memory is entered at an appropriate point. A search process moves out and scans stored items. When a matching one is found, recognition occurs and eventually the proper items are recalled. In a study which attempted to separate auditory and visual components in short-term memory, subjects seemed to be relying on different modality codes in recognition and recall (Vingilis, Blake, & Theodor, 1977). It may be possible that short-term memory is primarily visual in nature, and that the initial encoding is into a visual store. Verbalizing enters the memory process only during recall when verbal decoding from a visual store occurs. These researchers found an auditory component to be an integral part of recall, but it did not play a significant role in recognition. In recognition tasks performed by their subjects, visual similarity hindered accuracy while acoustical similarity facilitated accuracy in recall. Other researchers think that recognition and recall differ only with respect to the actual nature of the retrieval information available to the rememberer (Tulving & Watkins, 1975).

Storage and Processing of Information in the Brain

There are various theories about the coding process by which information is stored in the brain. The template theory agrees with memory as seen by the philosophers. They thought that memory consisted of an image, picture, or copy of past events. Recognition would then be a matching process (Kosslyn & Pomerantz, 1977). This theory is usually discounted because too many templates would be needed, and the storage capacity of the brain is not that large. Sutherland (1968) proposes a mechanism in the brain for shapes that are "memorized." This storage system is hierarchically arranged with lower level rules and higher level rules. In this theory a stimulus is encoded as a prototype plus some variations. Each new stimulus event is compared to its prototype or pattern, and it can be recognized as being a member of that class of objects even though it has unique properties.

Prototypes exist for every class of information possible. When a new pattern is presented, it is compared with each existing one to see which one it most nearly matches. This theory is more complex than the template theory since it involves the idea of processing information.

Anderson and Bower (1972) see memory being stored as concepts connected by symbol structures which can form relationships between concepts. Kintsch goes even further and proposes networks of propositions for nouns, and separate networks of propositions for verbs (Kintsch, 1972). Propositions are verbal statements that are stored in memory. They are made up of concepts and are very abstract (Anderson, 1978; Pylyshym, 1973). Propositions theory has been widely used in theories of sentence comprehension, but propositions can deal with visual information as well as it can deal with verbal data. Proponents of propositions as the components of memory in the brain see visual information being stored in an abstract way using color intensity and shadow information to reconstruct images of those perceptions (Kieras, 1978). Gagne and White (1978) incorporate the propositions idea into their memory structure model, but they also include another form of memory structure for images of all kinds.

Sheehan (1966) believes that humans construct images in the brain from information that the senses have picked up about the layout of the environment. It may be possible that humans have specialized cells in the brain whose function it is to recognize features. Animals have been shown (Hubel & Weisel, 1962) to have nerve cells which respond only to certain visual patterns. The difficulty experienced by children in distinguishing certain letters such as "b" and "d" seems to support this theory. Individual features may be compared to features stored in memory, and when enough of these appear to form a certain pattern, then propositions come into play.

It is not known for certain what does occur in the brain, but evidence has accumulated that there are two systems for coding and processing material. The dual model is composed of a verbal system specialized for sequential processing, and an image system for parallel processing in the spatial sense (Paivio, 1971). Propositions cannot explain the enormous amount of knowledge that can be retained and used by human beings (Paivio, 1977). Propositions theory also limited the interpretations that can be made of imagery as well as other cognitive functions. Experimental evidence that image mneumonics are extremely effective memory aids has been provided by Paivio and others. The earliest reported study on this subject was done by E. A. Kirkpatrick in 1894. The hypothesis that imagery could function both as an alternative memory code and as a supplemental memory code which could enhance the recall of concrete words was supported (Kirkpatrick, 1894).

Imagery mediation has been studied most often in paired-associate learning situations. Bower (1972) found that subjects who used imagery to learn a pair of nouns did extremely well, but that imagery works to enhance recall only when the peg-word and response item are combined in a composite image. Imagery studies have also been done to examine the human memory for natural language. Sachs (1962) found that subjects did not notice whether a sentence had been changed from active to passive voice as much as they noticed a change in meaning.

Both concrete and abstract sentences were used, and subjects remembered concrete sentences much better than the abstract ones. This was taken as evidence that they were using imagery to help them when the example was concrete enough for imagery. Begg and Paivio (1969) did a similar experiment. They presented subjects with a series of sentences, and then presented one of them again, either in the same form as before or changed in some slight way. The meaning might be changed by reversing subject and object. They predicted that wording changes would be noticed better than meaning changes in abstract sentences. This proved to be true, and seems to support the dual coding theory, since there is independent forgetting of wording and meaning. People remember the implications of sentences better than they remember the sentences themselves (Brewer, 1977). It seems that listeners get more information from sentences than the words themselves supply. Inferences are kept by the listener so that similar sentences are thought to have been heard when they were not. Although comprehension aids retention and recall (Bobrow & Bower, 1969), word-for-word memory of sentences is inaccurate (Bransford, Barclay & Franks, 1972). Recall of sentences is better if they are presented as a story (deVilliers, 1974; Cohen & Graesser, 1980).

Richardson (1978) found correlations between imagery and memory across stimuli and across subjects. If a stimulus had imageability the recall of it was improved. It seems that sentences dealing with abstract matters are coded in verbal terms, while concrete sentences are internalized as imagery (Begg & Paivio, 1969; Davies & Proctor, 1978). Imagery seems to store redundant information that provides alternate retrieval routes (Kieras, 1978). There are also conflicting theories on how the verbal elements of sentences are stored. Anderson & Bower (1971) see components of a sentence being stored as fragments which are put together again through a series of independent associations. Foss and Harwood (1975) do not agree. They see sentences as configurations or patterns that are stored together. Johnson (1970) thinks that people use the phrase elements of sentences as chunks. None of these explanations are fully able to explain the fact that meaning is stored when actual words are not. Information seems to be packaged before it is stored. It may be divided into meaning in the form of paraphrase, and referrents in the form of images (Miller, 1972).

The thought-to-words progression when information is recalled must be reversed when meaningful speech is perceived.

Experiments have also been done with visual stimuli. Standing, Conezio, and Haber (1970) showed pictures to subjects for 10 seconds each, and their performance in a forced choice task exceeded 95%. They discovered that presentation time could be reduced to one second per picture without affecting performance. Shepard (1967) found that subjects discriminated best when pictures were meaningful and colored. Picture recognition was better than sentence recognition, but only four subjects were used to get the high picture recognition rate of 99.7%. Seventeen subjects had an 89% mean recognition rate for sentences.

Slides do not have the high recognition rate that pictures have because of differences in the perception of slides and pictures. Yonas and Hagen (1973) found that slides have less surface information than do pictures. Adult perception errors reached 25% with certain types of slide stimuli, and 10% with others. Adults vacillate between the flatness information and the depth information provided by slides, and their performance is thereby conflicted (Hagan, 1974).

Luria, a Russian, first described the process of visual perception as an active mental process. When perceiving something visually, a person does "palpation" of the object with the eyes. Familiar objects are perceived quickly. With unfamiliar, complex objects, the process of perception is extended in character and is converted into a successive series of palpations of the object with the eyes (Luria, 1966). Adults pick out details in pictures even on casual inspection. Redundant contours are easily fixated, and texture helps, too (Mackworth, 1967). If texture differences are absent, and pictures lack redundance or familiar items, discrimination becomes more difficult. Rundquist (1971) found that similarity, either acoustic or orthographic, among stimulus items interferred with learning. Nelson, Reed, & Walling (1976) showed how configural similarity among pictorial stimuli interferes with recall of those pictures even when objects presented conceptually distinct units. Analog properties were having an effect over detail. People were perceiving the pictures holistically and missing important differences between them.

The ability to see what is in pictures is a learned trait. Perceptual learning improves the ability to discern distinctive features in the stimulus array (Gibson, 1963).

Pictures are remembered better than verbal stimuli in recognition tasks (Paivio, Rogers, & Smythe, 1968; Sampson, 1970; Standing, 1973; Snodgrass, Volvovitz, & Walfish, 1972;

Gehring, Toglia, & Kimble, 1976). Females are better at verbal retention than males (Marx, Homer, & Marx, 1980), and extroverts have better short-term recall than introverts (Gillespie & Eysenck, 1980).

Both dual coding theory and propositions theory can often be shown to account for the results found in recognition and recall experiments. King and Bevan (1979) used slides in a recall experiment. Cues were parts of drawings on the slides, or words, or both drawings from the slides and words in combination. When words were present, subjects did not do as well as they did when only drawings were being recalled. This was interpreted by the researchers as evidence supporting propositions theory. It could also be taken as support for Paivio's dual trace theory.

Paivio sees independent, but interconnected systems for the storage, organization, and retrieval of information. Right and left brain theories agree with this view, and the corpus callosum connects the two hemispheres of the brain so that information can pass back and forth between the hemispheres (Pines, 1973; Cassel, 1978; Goodman, 1978; Restak, 1979).

Images go in and out of fashion with psychologists. The argument persists that they are private affairs which cannot be investigated scientifically. Joseph Wolpe (1958) accepted this limitation when he proposed that images were "specific neural events which formed part of the pattern or neural sequence which had previously been evoked by a perception of external stimuli." The image could stand in for the real situation, and the emotional response to both would be the same. In a study of systematic desensitization of fear, Lang, Melamed, and Hart (1970) found a relationship between the physiology of imagery evoked by instruction, and emotional behavior change. Lang (1977) says that that we are unable as yet to manipulate this neurophysiology implied by Wolpe's analysis, so the use of the concept is limited. If a means could be found to activate images, it would have a wide use in therapy and in learning. He argues (Lang, 1977) that images are propositional structures rather than raw, sensory representations, and he refers to a theoretical paper by Pylyshyn (1973). Pylyshyn does not deny the existance of images, and says that they are too prevalent to be discounted. He does discount the beliefs of those who seem to think that knowledge exists only as words or pictures, and he defines an image as an internally constructed perceptual description.

Pylyshyn examines the three major approaches which have been used in theoretical studies of the representation of data in the brain. Propositions have the advantage of being logical and open to mathematical testing. What people know can be represented by a finite list of axioms. These are not thought to be stored as actual sentences. This belief allows a generative approach. Many questions can be asked of the person, and the amount of knowledge stored in his memory can be deduced. The theory has some limitations, the most startling being that, when carefully examined, it seems to allow a person to hold contradictory beliefs and to make contradictory statements without being aware of it.

Paivio (1977) says that propositions and computer simulation models as they are presently formulated are as doomed to extinction as the wax tablet idea was.

The second approach discussed by Pylyshyn is the data-structure approach. This approach is similar to the propositions approach because the contents of data structures could be viewed as propositional. It is different in that the data structure concept is the same thing as what is done with the computer. Information is presented in the best manner available, the most suitable manner, for the operations that are going to be performed on it. Symbols are used for units of data.

The third form of representation is one that represents concepts and facts as rules and procedures. This allows one to know facts and to take certain actions relevant to the facts.

Baylor (1972) uses information theory to speak to the question of imagery. He distinguishes between factual and pictorial knowledge, and the difference between the two is only a difference in access. The two systems are separate, but closely related and "visual mental imagery is just another representational system." The image has been broken up into data structures.

Pylyshyn believes in holographic storage of information in the brain. To think of raw sensory experience being held in its original form to be scanned at a later date is unacceptable to him. It would place an incredible burden on the capacity of the brain (Pylyshyn, 1973). Holograms provide a powerful mechanism for storing the image constructing properties of optical information. They allow a fantastic memory storage capacity. One hundred million bits of retrievable information have been stored in a cubic centimeter of holographic memory. The holonomic model also applies to auditory brain functions (Bekesy, 1960). This model sees the brain as a computer, but with more parallel processing capability.

Pribram (1960) says that the mind constructs visual, auditory, motor, somatsensory, and olefactory patterns from sensory input. The brain, doing parallel processing in a holonomic way, handles this incoming data and gives the organism information about what it has perceived. To Pribram the structure of the brain is in the form of program, and the mind is active in the organization of its perceptions. Evidence shows that the memory trace is stored by means of an encoding process. It must be adequately coded to be remembered (Pribram, 1974). If perception is validated by other senses it is accepted as real. Otherwise, it is considered to be an illusion. Distribution in the brain is in the form of holograms (Pribram, 1977).

Blundell (1975) has noted that the psychological study of learning and memory developed independently of the physiological and biological aspects of human and animal activity. Until just recently psychologists, with the exception of Pavlov and Lashley, made little reference to physiological mechanisms.

Information must gain access to the nervous system, be encoded in some way in neural tissue, and be capable of being extracted when needed. A physiological process must occur. It is generally accepted that the initial pattern of electrical activity, generating from a stimulus and being picked up by a sensory receptor, starts a chemical reaction which modifies or rearranges neural tissue. It is not known whether the chemical changes occur between neurons or within neurons.

Nucleic acids such as deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) and proteins are implicated in the memory process. Hyden (1962) states that the structure of the RNA molecule is sufficiently complex to provide for the coding of information, and his experiments with animals (Hyden, 1968) show increases in RNA after learning. He says that RNA acts as a primer for protein synthesis (Hyden, 1962).

Ladik and Greguss (1969) see information carriers as waves of energy which were imaged and then stored in holographic memory. The stored memory traces are information patterns, and are used as reference points to compare incoming stimuli. A simplified version of their model may be seen in Figure 9.

All impressions that reach a sensory receptor cannot be processed or an overload would result. Therefore, a gate (A on the diagram) serves as a screening place for incoming sensations. The information patterns, in the form of waves of energy, that are permitted past the gate are then compared to stored patterns already in the brain. Comparisons that match are reconstructed from the reference model elements into holographic forms. At the same time, a Fourier transform of the original information pattern is formed in a group of neurons, and this can convolute with the information elements induced by the reference pattern. As a result of this coiling, a series of stimuli of the same frequency and phase, but of different amplitudes arises, which by further interference gives birth to a code stimulus (K) which represents the original information pattern. The amplitudes of the different waves just add together, and all of the phase elements of the original waves have been transformed into amplitude. This is necessary because phase cannot be stored holographically, but amplitude can be. This code stimulus then generates a new reference pattern that is stored in holographic form from the original information given.

MEMORY STORAGE

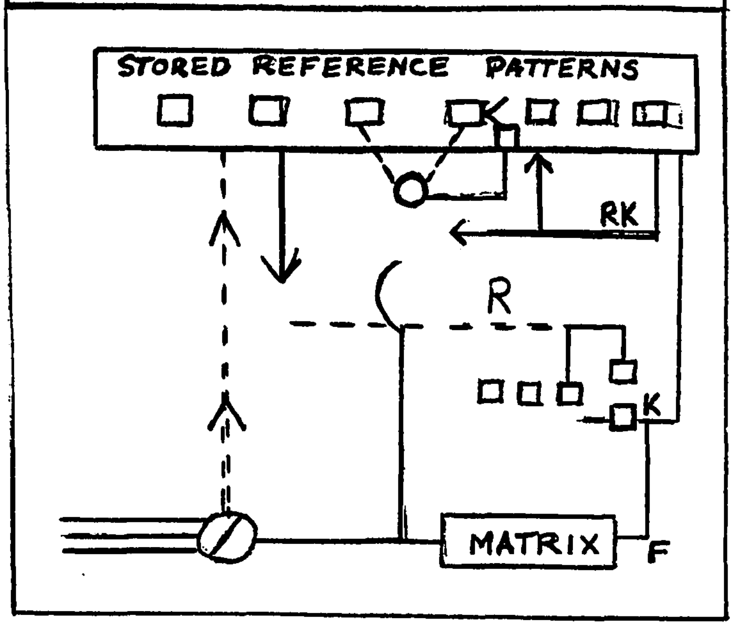


Figure 9

Paivio (1977) recognizes the neural substrate of imagery. He does not see the chemical and electrical processes as being in any way antagonistic to his dual process theory.

In the early part of the 20th century experimenters thought it important to classify imagers as visualizers, audiles, kinesthetics, and so on (Mandler, 1964). Now it seems likely that good visualizers are also good at other forms of imaging.

A person who relied mainly on auditory imagery was thought to be more distracted by sound during a visual memorization task (Angell, 1910). Many subjects were noticed translating from one mode of imagery to another.

Betts in 1909 found that most people who form visual images also tend to form vivid auditory images, and Sheehan (1964) confirmed these findings. In a group of 500 nonstudent adults, Sheehan found that 93% of them reported auditory imagery (Sheehan, 1972). Some persons always translate perceptions in one sense into images of another sense. Blends of images from more than one mode is called synethesia, and an example of it is "color hearing." People who have this ability see musical tones as colors. Others see words or numbers as colors, and they report that this helped them to remember (Horowitz, 1970). Studies in Russia as reported by London (1954) showed that a strong auditory stimulus was an accessory which improved vision. After auditory stimulation the improved effect persisted for a while. Afterimages were brightened, and the eye was still more sensitive than normal. In an American experiment when eight men were instructed to form a mental image at the same time that they either heard a sound, saw a light, or experienced nothing, it was found that detection of a signal was poor when image and signal were in the same mode (Segal & Fusella, 1970). It would seem that two visual events are confounding, two auditory events are confounding, but if a visual event and an auditory event occur together, they complement each other.

Effect of Music on Recognition, Recall, and Emotion

Experiments involving memory for many types of material have demonstrated that retention is substantially improved if the material is hierarchically structured. Music does have this structure, and should, therefore, be easily remembered. (Restle and Brown, 1970). Rather than having one hierarchy, music has multiple interacting hierarchies. There are single sounds in succession which form melody, sounds in combination which make harmony, and sounds in a temporal arrangement which make rhythm. These are further arranged into phrases, many of which go together to form movements. Several movements may join together to form compositions.

The elements of music are related to each other, and they all belong to a whole, but the impression picked up by the brain is not simultaneous. The succession of sounds in melody progresses continuously, and suggests physical movement. This motion effect has powers of physical stimulation. The rhythm of a melody suggests movement, but does not suggest advance as pitch does. Rhythm is felt by all of the senses, but pitch is picked up mainly by the ear (Gurney, 1880/1966). Gurney thought that the continuous expectancy of what was to come next was a plausible explanation of the excitement of music. He also offered the possibility of an association of music with speech because of their common feature of successively changing sounds.

This association with speech gives an impression to the listener that music has something significant to say, and that attention should be directed to it (Gurney, 1880/1966). Even though music is sequential and similar to language, the response while listening to it is not verbal (Regelski, 1977).

Seashore (1938) sees music in the mind of the listener as image, idea, thought, and emotion. The physical vibration of musical sound makes energy which results in brain activity out of which is formed tone. Human beings tend toward rhythmic grouping in their activities and are always responsive to measured intervals of time or tone. Rhythm helps them remember more, and adjusts the strain of attention. Since attention pulsates, when what is heard fits the hearer's attention wave, it gives a restful feeling of satisfaction and ease. Rhythm affects the circulation, respiration, and secretions of the body, gives a feeling of power and freedom, and arouses sustained and enriching associations (Seashore, 1938). An experiment in a Los Angeles penal institution supported the idea that music eases tension (Freedlane, 1973).

The feeling for rhythm is thought to be connected with bodily rhythms and to be instinctive. Music itself has been called an instinct. Charles Darwin identified music as inherited memory. Darwin's theory was that early human courtship voice tones aroused such strong emotions that the inherited memory of those emotions is able to excite emotion in people who listen to music today (Darwin, 1874). Davies (1978) holds that the notion of music being instinct came from an era at the turn of the century during which every behavior that could not be satisfactorily explained was lumped under the heading of instinct. A more likely explanation for the effect that music has on people is the direct result of sound and rhythm on the brain and central nervous system. Music is a mental ability, and the brain makes a melody by organizing sounds picked up by the ear in an active constructing process (Davies, 1978).

Music is often credited with producing a spiritual effect on people. Hamel (1979) shows how music stood at the service of ritual in all earlier world cultures. Far Eastern, African, Asian, and South American peoples still believe in a primal force that may be summoned by music. Hamel believes that music has a capacity to heighten concentration and sensitivity, and to make a person aware of his inner self (Hamel, 1979). It may, like religious symbol, stand on the boundary between the empirical and the intuitive or transcendental (Monelle, 1979).

The Soviet scientist U. Berdiyev of the Samarkand Medical High School is reported by Hamel to have established that notes of various pitches, volumes, and tones have a discernible effect on the cardiovascular system. Music can influence both the blood pressure and the heart rhythm. Berdiyev (cited in Hamel, 1979).

Mursell (1937) wrote that human beings are stirred by sound physically in a way that they are not stirred by sight. Tonal stimulation tends to flow over into other sense channels and to produce physiological changes similar to the changes that take place during emotion (Mursell, 1937). Late in the nineteenth century William James proposed a theory of emotion which stated that a perception occurs first, a behavior occurs next, and an emotion is aroused because of the bodily state which exists. "Bodily changes follow directly the perception of the exciting fact, and that our feeling of the same changes as they occur IS the emotion" (James, 1890, p. 449).

This theory, according to Davies (1978) is no longer acceptable, because the physical manifestations of emotion are limited in number. There are numerous felt emotions, and they all may come from some basic emotions combined in different ways. Jorgensen (1962) thought that the basic ones were fear, happiness, sorrow, want, anger, and shyness. Wedin, as reported by Davies, proposes a three factor model of emotion in musical experience. It is composed of gloom versus gaiety, solemnity versus triviality, and tension/energy versus relaxation (Wedin, 1972 cited in Davies, 1978).

Hillman (1962) separates emotion from other processes and sees it as a separate entity. This makes two contrasted approaches to emotion. The first one sees it as the result of another occurrence, while the second one sees it as the cause of another occurrence.

Different people have different emotional responses to the same music. Some people will not react emotionally to the same music that moves other people. Emotion is not an automatic response to music, and one cannot predict reactions to specific pieces of music. Cognition seems to be the reason for feelings in response to music, but perception of bodily states may be a component of that emotional feeling (Davies, 1978).

Music usually extends emotional states until they have become moods (Gundlach, 1935). A tune evokes emotional feelings through association with past events, and has little to do with the music itself. This emotion becomes attached to the music through a learning process. Music affects people, but it does so in relation to each individual's past experience. Also, people do not perceive what is really occurring, but what they expect to perceive. If their expectancies are confirmed or not confirmed, emotional states result from those facts. The music has given rise to those emotional states. Unfamiliar music is meaningless to people (Davies, 1978). The response that people have to music is what gives music its power

(Monelle, 1979), and the emotional images formed by music are memories of feelings (Fincher, 1977; Davies, 1978). These feelings are not connected to the world of objects (Moog, 1980). The tendency is for people to remember more experiences that are rated as pleasant than those which are unpleasant (Dutta, 1975; Mowrer, 1960), so music which aroused pleasant feelings or pleasant memories of former feelings might tend to have a positive effect on memory. People tend to project their feelings on to perceptions of objects, and to organize perceptions in a certain way. Once the organization exists, a perception can evoke all sorts of meanings and other influences of past experiences (Henle, 1977).

Some people are better at organizing their perceptions than others (Ozier, 1980), so music might affect some people more than others.

Contradictory results have been found in studies which examined the effects of music on some of the observable aspects of learning. Fendrick (1937) found music a distraction for people reading difficult material, and it distracted people with high`intelligence more than it distracted those with lower intelligence. He did not test for significance, but merely looked at the means and standard deviations to determine this. It is very possible that the drop in scores was due to chance, or was so small as to be unimportant.

Henderson, Crews & Barlow (1945) found that music was not a serious distraction; and Freeburne and Fleischer (1952) found that jazz had a facilitating effect on the reading speed of college students. Other types of music did not change reading speed in one way or another. Background music helped 8th and 9th graders make higher scores on a silent reading test as reported by Hall (1952).

Whitely divided 128 students into three groups and had them memorize words and poetry with music present and without music. He found no facilitating effects for music. In fact it seemed to bother memorization. The statistical analysis that he used on these experiments was very elementary, and, like the Fendrick study, results cannot be relied upon. They were so slight that differences might not have appeared at all under changed conditions.

A study which tested the effects of four types of music on the learning of nonsense syllables found no difference between oriental music, jazz, classical music, and no music, but rock and roll music did improve learning (Baugh & Baugh, 1965). Another study using classical music and rock music in the learning of nonsense syllables showed no apparent difference between the two (Carlson & Hergenhahn, 1967). Music was found to neither distract nor help. Dannenbaum (1945) found that the visual acuity of each of his subjects was significantly impaired, not improved, by the presence of music. A number of experiments have attempted to look at the effects of music on arithmetic or mathematics. Engel & Engel (1962) measured arithmetic learning by giving 20 number problems in addition, subtraction, multiplication, and division each week for 8 weeks. The musical background used every other week was alternated, and the week following performance with a musical background, students worked the problems in silence. Music did not decrease or increase the efficiency of these average 5th graders when they were doing number problems. An analysis of variance showed no significance. Madsen and Forsythe (1973) found that music improved the incidence of correct response to mathematics problems, and Madsen (1979) found that contingent music and music lessons used as a reward for correct responses in mathematics improved mathematics scores of children.

Mann (1979) found that fourth grade students remembered stories better when they were accompanied by music and sound effects. Both short and long-term retention were improved. Carlson & Hergenhahn (1967) found no effects of music on reading or study habits. The forced hearing of music during study hours caused some people to show negative results while others showed measurable benefits. Variables, in their opinion, are the difficulty of the material, preference for the music heard, and the reading and study habits of the individual. Some people study regularly with music in the background.

Smith & Morris (1976 & 1977) found that stimulative music causes anxiety during test taking. Calm music had an opposite effect. Their conclusions were that the effects of music are due to cognitive processes rather than physioological/affective responses. Lundin (1967) found that the use of music in industry increases production and tends to relieve monotony, but too much music is undesirable. Farnsworth (1937) found no difference in the learning of two groups, one with noise, the other with quiet. Jerison (1959) found that for short, spurt-like efforts no performance decrements were caused by noise, but noise was bad for sustained performance. Noise is psychological stress and differs from the sounds which make up music. When creativity tests were given to fifteen fifth grade boys under conditions of industrial noise, music, and quiet, music was not shown to be a strong detriment to performance. Quiet seemed to be the best condition for productivity, music was next, and noise was the worst (Kaltsounis, 1973).

In the early sixties a yogi from Bulgaria named Georgi Lozanov developed a pedagogical technique called suggestopedia as the basis for his doctoral dissertation. It used music as part of a program designed to tap unconscious parts of the brain which store memory. Lozanov's theory, as reported by Hammerman (1979), is that all perceptions remain forever in brain storage, but are often not available to the conscious mind because of interferrence from emotion, attitudes, and anxieties.

Suggestopedia depends on the authority of a teacher, respect for the source of information, and a feeling of rapport or harmony between learner and teacher (Hammerman, 1979). The student is reduced to a child-like state through suggestion and the information is presented to him or her while in that state through the use of rhythm. This is called the concert stage and the rhythm may be supplied by intonations of the voice or by music.

Ostrander and Shroeder (1970) first introduced suggestopedia to America, and several schools began to use it. Research on its effectiveness is faulty and conflicting. Benitez-Borden and Schuster (1976) found that it helped foreign language learning, but their tests were merely pilot studies which used no control group. Biggers & Stricherz

(1976), using college students, presented a word list on slides and on tape and tested memory of the list. They used a control group and a group which was taught by the Lozanov method of relaxation. They found that their control group was superior to the relaxation group. No music was used in this experiment.

Schuster & Pausegrau (1977) did not find that Lozanov's whispering technique worked. The whispering technique recommends lowering the human voice to a whisper while presenting information in a background of louder music. This study found that males learned more when the volume of the speaking voice was increased, and female learning was unaffected by voice volume. The subjects were attempting to learn rare English words (Schuster & Pausegrau, 1977).

Beer (1978) used suggestopaedia in a Vienna, Austria elementary school to teach several subjects, including arithmetic. Operas and stories were used for the latter with good results.

Bancroft (Canada) reported that alpha waves increased during the concert stage and explained the effect by saying that music creates a positive emotional response toward the learning. She is supported in this belief by Racle. (Bancroft, 1976; Racle, 1976).

Two major criticisms of suggestopedia are that the claims for it have not been successfully documented empirically, and that its greatest successes are in the area of foreign language learning which may not reflect recognition and recall functions (Scovel, 1979 cited in Hammerman, 1979).

There seem to be sex differences related to music. Females are more verbal than males and musical training seems to increase the achievement of spatially oriented persons more than it increases the achievement of verbal types (Karma, 1979). Females are more highly attentive to auditory input than are males, and respond to both its emotional and its meaningful properties (Shuter-Dyson, 1979).

One study had college students rate music as either masculine or feminine. There was agreement on whether or not a peice of music was masculine or feminine in character, and both males and females preferred masculine music. The study also designated musical instruments as either masculine or feminine. The flute was considered a feminine instrument (Farnsworth, Trembley, & Dutton, 1951). Results were probably reflections of stereotypes present in the culture rather than being due to qualities inherent in the music.

Fisher and Greenberg (1972) checked the effects upon women of exciting or calm music. They found that the amount of disturbance caused by the music was inverse to the woman's degree of femininity. Calm music was safe, and, therefore, less disturbing. The study indicated that there was a difference in the way that males and females respond to music, and that men should be more discomforted by it than women.

The Effects of Emotion on Learning

Each emotion seems to be composed of a specific pattern of neural activity in the brain, physiological changes in the rest of the body, overt behavioral or expressive characteristics, and a subjective aspect of private experience (Blundell, 1975). Since it does represent an interaction between cognitive and physiological variables, it should certainly have some effect on learning and memory. Lang (1977) tells us that the effect of a media presentation depends on the response propositions which are processed with it. Lazarus (Lazarus, Speisman, Mordkoff, & Davison, 1962) studied reactivity to fear films, and showed that the emotion could be reduced by certain instructions to the subjects. Mackworth (1969) found that an increase in arousal facilitates attentiveness. Schacter (1964) found that an instructional set that was not consonant with an emotional response can undermine arousal manipulations. Pictures and films are not objective stimuli. Each type of media is a kind of image or thesis, and the vividness of the image and its potential to cause behavior change (learning) depends on the viewer or listener's ability to supply an emotional response to it. Lang (1975) suggests that the ability to initiate visceral change on instruction is a normally distributed skill, so learners should be able to respond favorably to stimuli when requested to do so. Henle (1977) says that only the image in the human brain of an object, not the real object can elicit a response from a person. Each individual lives in his own world with his own perceptions, and is cut off from the perceptions of others. People project feelings onto perceptions of objects. This theory of perception is that all perceptions are organized in a certain way by a person. Once this organization exists, a new perception can evoke all sorts of meanings because of past experience. Memory traces cannot be contacted without a particular organized percept. These memory traces are themselves the aftereffects of previous perceptions. All learning would seem, in this theory (Henle, 1977) to be tied to emotion.

Meissner (1968) says that the hippocampus in the brain plays an important role in learning, remembering, and in the feeling of emotions.

Studies of the relationship of affect to learning have not successfully connected the two in a reliable way.

<u>Visual and Haptic Perceptual Type</u>

Perception was thought by Lowenfeld to be an inate quality which varied between individuals. He saw a continum, the ends of which were extremes. At one end were people who were visual, and at the other end were haptics. Lowenfeld took the word, haptic, from the Greek word, haptos meaning "laying hold of." Visuals and haptics do not perceive or process stimuli in the same way. Visuals learn through visual imagery, and haptics learn by means of touch, feelings, and kinesthetic functions (Lowenfeld & Brittain, 1970). The visual person observes things and judges them by their appearance. He or she processes the world through the eyes, and translates kinesthetic and tactile experience into visual experience (Lowenfeld, 1957).

The haptic person has normal vision, but relies on muscular sensations, tactile or kinesthetic perceptions, and emotions to experience the world. He or she does not translate these perceptions into visual ones. The haptic does not desire to break up something into its components and then put the details back into a whole again. He or she will put himself or herself into a situation vicariously, and will feel the emotion of that imagined scene. Partial experiences are not visualized and integrated with tactile experiences. They are discarded as incomplete, and the haptic does not desire to hold visual information in memory. Lowenfeld noticed that the haptic wanted his or her art work to express emotion, while the visual person dealt with the realistic perspective and proportion of the observed world (Lowenfeld, 1975).

In research that he did in art education, both in the United States and in Austria, Lowenfeld identified such people through tests that he devised for that purpose. His Integration of Successive Impressions test had the subject combine partial views of pictures to make whole pictures. Another test, Subject Impressions had the subject make drawings of items, or asked him to estimate the number of floors in a building visualized in the imagination. His Visual-Haptic Word Association Test asked subjects to make associations with words; The Visualization of Kinesthetic Experiences Test allowed them to make mental pictures of kinesthetically experienced objects, and The Test of Tactile Impressions had them recognize felt objects (Lowenfeld, 1945).

Lowenfeld did not believe that visual imagery is necessary for learning to occur. Gottesman (1971) agrees with him. His study with both blind and sighted children shows no differences between them in the ability to identify shapes by touch. Perceptual type seems to be an innate characteristic that is not subject to change. A recent study of the relationship between Lowenfeld's visual-haptic theory and Piaget's developmental theory found that males are more visually oriented than females, and that the more visually oriented a person is, the higher that person's intellectual goal is likely to be. Visual people were also formal, and haptic people were more concrete. Some very formal people were found to be haptic, abstract thinkers, but usually abstract thinking went with visual ability (Butzow & Schlenker, 1978). An earlier study (Schlenker, 1977) also showed a correlation between Lowenfeld's visual-haptic continuum and Piaget's concrete-formal continuum. Schlenker also compared the various Lowenfeld tests and found that two of them should not be used. The most trustworthy of the tests was found to be the Successive Impressions Test (Schlenker, 1977).

Marcia Ozier (1980) studied free recall and recognition, and she found that certain people were good at both while others were not good at either task. Her conclusion was that some people form better memory traces than others and she labeled those people high organizers. The ones who did poorly may have formed "foggy traces" (p. 362), and she called them low organizers. If a definite connection could be made between visual, abstract, high organizing ability; and haptic, concrete, low organizing ability, Lowenfeld's description of these types may prove to be not totally accurate. He has characterized haptics as being concerned with the inner self, and as getting most of their perceptions from personal feelings rather than finding them to be at a lower level of development.

Walter (1953), in a study of alpha rhythms in the brain, found that people who have the ability to produce constant alpha rhythms tend to auditory, kinesthetic, or tactile perception. Visual perception or visual imagery actually supresses or stops alpha activity in the brain. Walter's types parallel Lowenfeld's visual, haptic, and indefinite types. Persons with persistent alpha activity correspond to haptics. Persons that Walter would say had responsive alpha rhythms match Lowenfeld's indefinites, and the third type with no measurable alpha rhythm conducts thinking through visual images as do visuals. Walter believed that adult alpha rhythms in the brain would be an indication of aptitudes and tendencies that could supplement I. Q. and personality tests. He stated that the absence of alpha rhythms usually meant that the adult possessed a vivid visual imagination. In most people alpha rhythms are prominent when the eyes are shut and the mind is at rest. They disappear when the eyes are open, or when the subject makes a mental effort such as solving a problem.

The group which had persistent alpha rhythms were called "P" for persistent. People with responsive alpha rhythms were called "R" for responsive, and people whose electroencephalograms (EEG's) showed no significant alpha rhythms at all were labeled "M" for minus. The latter group conducted their thinking processes almost entirely in terms of visual imagery. Several surveys were made to find out how these types were distributed in the population. It was found to vary by occupation, but, in general, two-thirds of a normal group of people selected at random were of the "R" type and could process in both visual and kinesthetic ways. The remaining one-third were evenly divided between visual and kinesthetic. Walter saw these characteristics as hereditary and inborn. True visuals, and true kinesthetics are extremes and would correspond to very high scores and very low scores on Lowenfeld's <u>Successive Impressions Test</u>. Although Walter and Lowenfeld do not agree on the proportion of these perceptual types in the population, they do agree that such types exist.

Through Walter's theory there is a direct connection made between the electrical activity of the brain, most certainly a factor in memory, and the way a person perceives and processes information. Other research (Barratt, 1956) finds that alpha waves may not be reliable in predicting the ability to visualize or to form images. Production of alpha rhythm was essential to the improvement of learning in suggestology. In fact, music was used as a device for encouraging such rhythms. These studies indicate that a haptic condition, if haptics do possess more alpha waves in their brains, is most ameniable to learning. They do not agree with the Schlenker (1977) study or the Butzow and Schlenker study (1978) which favored a visual condition. Other research has pointed to the superiority of visual persons in performing various tasks. Erickson (1964, 1966) found that visual persons were better at mechanical drawing, and a study in 1967 showed that reading levels for haptics tended to be lower than the reading level of visuals (Erickson, 1967).

Ausburn (1975) found that multiple imagery helped haptics perform visual tasks, and Ausburn (1979) connected haptics with field dependence, impulsiveness, and leveling. Visuals were more field independent, and would display analytical characteristics, reflectivity, and sharpening.

Summary

Studies selected for this review came from scholarly journals, ERIC documents and books. The books were compilations of articles on a subject under the direction of an editor, reviews or discussions of studies in a particular area, collections of papers from conferences, or reports of a particular author's research. The review covers the major studies of sentence recognition, sentence recall, picture recognition and picture recall after which this study was designed, and goes into related areas when needed for clarification or for better understanding of the material.

The history of brain theory, and the effects of music go from the last quarter of the 19th century up to and including 1979 and 1980 material. Since emotion might be a factor in the results, brief coverage of what is known about the relationship of emotion to music and to learning is included.

The visual-haptic perceptual type, and related research which might be connected to those individual differences has been covered in some detail. Research which tries to connect the Lowenfeld and Piaget definitions of this continuum is also included.

This study will use signal detection theory in a forced choice test for sentence recognition and for slide recognition. Music will be an added factor, and so will visual-haptic subjects.

Recall of slides is similar to other recall studies, but the recall test for verbal information has been newly designed. In the verbal recognition test subjects will try to discriminate between very similar sentences. This is a task which is almost never called for in a real learning situation, since meaning is expected to be retained from verbal information. However, since retention of detail from sentences is very low, close to chance (Sachs, 1962), if music improves that ability, it should be very obvious.

The present study should shed some light on which of the theories of brain function might be true, and should support or fail to support one of the theories of imagery. New information should be added to what is known about the visual and haptic perceptual type, and the effects of music, if any, on the recognition and recall of pictorial and verbal materials should become apparent. Since the effects are considered to be functions of the brain, it will be possible to generalize them to include all adult females who are high school graduates.

APPENDIX C

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APPENDIX D

The Pilot Study

EFFECTS OF MELODY ON RECOGNITION AND RECALL PROCESSES OF VISUAL AND HAPTIC LEARNERS A PILOT STUDY

Research has been done using pictures, words, and sentences to study imagery, but the use of slides and sentences within a paragraph combined with music is unique. Because of this fact, it was seen as desirable to do a pilot study. There were three major purposes for the pilot:

1. To find the best way to accompany each slide with music, and to get feedback on the reactions of subjects to this and to other mechanics of the study.
2. To become proficient at conducting the experiment.
3. To see if results warrant performing the study, and if the hypotheses are reasonable.

Method

Three children's literature classes at Cameron University were used for the pilot study. There were approximately 30 students in each class. One class was used for the "no melody" treatment condition, one for the "music at presentation time" treatment condition, and one for the "music at both presentation time and at testing time" treatment condition. Since the classes were composed of both men and women, scores made by male students were dropped. Of the women, the proportion of visuals and haptics was not sufficient in any class to have more than 6 subjects in a cell. One class had no haptics at all. To obtain equal cells it was necessary to divide subjects into visuals and haptics by using some indefinites as haptics. If 16 to 27 items were incorrect on the Successive Perception Test 1, the person was considered haptic. If 0 to 14 were missed, the person was considered to be visual. No one missed less than 5 or more than 27. Using this criteria, it was possible to obtain 14 people from each class--seven visual females and seven haptic females. Those who qualified for participation, but were not needed, were randomly eliminated.

Each recognition and recall test was analyzed by a 2 x 3 analysis of variance, the design of which is shown in Figure 5.

EFFECTS OF MELODY

	No Melody	Melody at Presentation Time	Melody at Presentation Time & Testing Time
Visuals	7	7	7
Haptics	7	7	7

Figure 10

There were four of these tests and alpha was set at .05 for each of them. Two-tailed *t* tests were also used to test differences between two sets of scores, even though the analysis of variance did not find significant differences between them. Alpha was also set at .05 for the *t* tests.

Hypotheses to be tested by the pilot study were:

1. Haptic individuals recognize more speech phonemes presented as orally given sentences than do visual individuals.
2. Haptic individuals recognize fewer pictorial slides than do visual individuals.
3. Haptic individuals recall fewer pictorial slides than do visual individuals.
4. Haptic individuals recall more content from orally presented paragraphs than do visual individuals.
5. Music accompanying pictorial information at presentation time will increase recognition of that information for haptics, and will decrease recognition for visuals.
6. If music accompanies pictorial information at presentation time and at testing time, both visual and haptic individuals will improve in recognition tasks, but haptics will show the greatest improvement.

7. If music accompanies verbal information at presentation time, recall will be increased in both visual and haptic subjects.
8. If music accompanies verbal information at presentation time, recognition will be increased in both visual and haptic subjects.
9. Music accompanying verbal information at presentation time and at testing time will increase recognition of sentences for both visual and haptic subjects.
10. Music accompanying verbal information at presentation time and at testing time will increase recall of that verbal information for both visual and haptic subjects.

In addition to testing the hypotheses, a small test was planned to discover the best way to combine the slides with their accompanying folk melodies. Rather than having each folk tune last only 10 seconds, it was thought to be important to achieve closure on each musical excerpt. A melody which is not resolved is irritating to the listener, and might cause negative feelings in subjects which would bias the study. To provide closure the flutist played longer than the 10 seconds needed to show each slide if that was necessary. Duration of each folk melody varied from 10 seconds to 20 seconds. To see if the way a slide accompanied the music made a difference in subject scores, half of the slides were shown with music preceeding the slide, during the showing of the slide, and following the showing of the slide. The slide was timed to be precisely in the middle of the musical presentation. The other half of the slides were shown with music preceeding the slide and during its showing, but not following it. Slide and music ended together. These differences in presentation were alternated for both the 15 slides at presentation time, and for the 30 slides at testing time in Group three, the "music at presentation time and at testing time" treatment condition. Subjects were asked about their preferences, and the two groups of scores were also analyzed by tallying incorrect odd numbered scores and incorrect even numbered scores and comparing the two.

Results

Subjects recommended lowering the music to a soft background sound. They reported that they saw no difference in the placement of slides in relation to the music, but more than twice the number of even numbered slides were missed as were odd numbered slides. Even numbered slides had a long period of music at the beginning when nothing was being shown, then the slide appeared and remained on the wall for 10 seconds. Both music and slide ended together. It was considered to be more efficient to show the slide in the middle of the music as had been done with the odd numbered slides.

Subjects seemed to understand the instructions well, and to know what was expected of them. Lighting was a problem, and had to be adjusted so that the slide was bright enough to see in full color and detail at the same time that the room was bright enough for the student to be able to check the proper answer on the pictorial recognition test.

Two methods of distributing the tests were tried. In one instance the tests were coded and all four of them plus the two practice tests were handed to an individual after she had removed her name from the stack. She was not supposed to look at any of the tests until told to do so. Some of the students did go through the tests ahead of time. Although the only test that could be improved upon by reading it ahead of time was Test Number 3 for verbal recall, it was considered best to have names on each of the tests, and to pass them out as needed.

Analyses of variance were done on the results of the four tests. Means were calculated and graphed, and standard deviations figured.

There was a difference between visuals and haptics on pictorial recall. Visuals were much better at it than haptics, and results were significantly different. See Table A and Figure 11.

Visuals were significantly different from haptics on a verbal recall test based on aurally presented narrative prose. They outscored haptics at every treatment level.

ANOVA Summary Table
For Pictorial Recall

Source	SS	df	MS	F
Perceptual types	20.02	1	20.02	5.11*
Melody conditions	7.48	2	3.74	.95
Interaction	1.76	2	.88	.22
Error	141.14	36	3.92	
Totals	170.40	41		

Table A

There was a melody effect which was not significant, but when the means were graphed (Figure 12) it became obvious that the scores of both visuals and haptics dropped when melody was present.

ANOVA Summary Table
For Verbal Recall Test

Source	SS	df	MS	F
Perceptual types	40.02	1	40.04	4.35*
Melody conditions	44.33	2	22.1785	2.41
Interaction	1.47	2	.80	.08
Error	331.14	36	9.19	
Totals	417	41		

Table B

Visuals did not outperform haptics when the task was pictorial recognition. Both of the perceptual types improved their pictorial recognition scores when melody was present, and results were significant. Table C shows the results of the 2 x 3 analysis of variance, and Figure 13 gives a graphic representation of the means.

ANOVA Summary Table
For Pictorial Recognition

Source	SS	df	MS	F
Perceptual types	.214	1	.214	.12
Melody conditions	19.047	2	9.52	5.31*
Interaction	.5714	2	.286	.16
Error	64.571	36	1.7936	
Totals	84.405	41		

Table C

Although the results of the verbal recognition test do not approach significance, a look at Figure 14 shows that melody seems to be distracting visuals so that they do poorly at sentence recognition. It distracts haptics, too. They drop in score when music is present during aurally read narrative on tape. However, their scores improve when melody is present at both presentation time and at testing time, but the scores still do not approach the "no melody" condition.

ANOVA Summary Table
For Verbal Recognition

Source	SS	df	MS	F
Perceptual types	1.5237	1	1.5237	.264
Melody conditions	22.904	2	11.452	1.988
Interaction	17.76	2	.88	1.54
Error	207.43	36	5.76	
Totals	249.619	41		

Table D

Discussion

Hypothesis #1 was not supported by the pilot study. Visual individuals were better than haptic individuals at verbal recognition. Hypothesis #2 was not supported. Although haptic individuals recognized fewer pictorial slides than visual individuals, the differences did not reach statistical significance, $F\ (1, 36) = .12$, $p < .73$.

Hypothesis #3 was supported. Haptics did recall fewer slides than did visuals, $F\ (1, 36) = 5.11$, $p < .03$.

Hypothesis #4 was not supported. Haptics did not recall more content from orally presented paragraphs than did visuals. They recalled significantly less than visuals in every treatment condition, $F\ (1, 36) = 4.35$, $p < .04$.

Hypothesis #5 was not supported. Music slightly increased scores for both haptics and visuals when it accompanied slides at presentation time, but Figure 13 shows that it increased more for visuals than for haptics. Since haptics started out slightly better than visuals at recognition, an interaction occurred between the "no melody" condition and the "melody at presentation time" condition. Hypothesis #6 was supported. Music which accompanied pictorial information at presentation time and at testing time increased recognition scores for both visuals and haptics over the no melody condition. However, visuals dropped somewhat from their presentation time high discussed under hypothesis #5, forming another interaction. The ANOVA did not find either interaction significant. Treatment condition $F\ (2, 36) = 5.31$, $\underline{p} < .009$. Interaction $F\ (2, 36) = .16$, $\underline{p} < .85$.

Hypothesis #7 was not supported. Scores for both visuals and haptics dropped as if the music were distracting them somewhat as they tried to recall verbal information after having heard a paragraph accompanied by music. The drop was not significant, $F\ (2, 36) = 2.41$, $\underline{p} < .10$.

Hypothesis #8 was also not supported, since recognition was affected in much the same way as recall. Scores reflecting the ability to recognize sentences from the paragraph dropped lower than scores of subjects in the "no melody" treatment condition. Hypothesis #9 was not supported. Music accompanying verbal information at presentation time and at testing time decreased recognition of sentences for visual subjects.

Haptics were slightly lower than, but almost equal to their "no melody" treatment condition. They did better when music was present at both presentation time and at testing time than they did when it accompanied a paragraph only at presentation time. The treatment condition F for verbal recognition was $F\ (2, 36) = 1.99$, $p < .15$. A t test between the means of the "no melody" condition and the means of the "music at both presentation time and at testing time" condition for visuals showed a significant drop in their scores, $t\ (12) = 3.03$, $p < .01$. Music distracted visuals significantly.

Hypothesis #10 was not supported. Music at presentation time and at testing time caused a drop in the scores of both visuals and haptics, but the decrease was not significant, $F\ (2, 36) = 2.41$, $p < .10$ A t test, $t\ (12) = 1.29$, $p < .30$ between "no melody" and "melody at presentation time and at testing time" was not significant for visuals. The t for haptics between the same melody conditions was $t\ (12) = 1.37$, $p < .20$. It, too, was not statistically significant.

Visuals were better than haptics at all verbal tests, and were significantly better than them at verbal recognition in the "no melody" condition.

Although the pilot study did not show that music makes a significant difference in recognition and recall of verbal information for haptics, it distracts visuals when the task is discrimination between sentences that are similar. Music significantly increased recognition of pictorial information for both visuals and haptics, but did not help either of them in pictorial recall. There was a significant difference between the two perceptual types in their ability to recall pictorial information with visuals outperforming haptics at this task.

Results of the pilot study indicate that further study of the effects of music on verbal and pictorial recognition and recall is warranted. Because of the exploratory nature of the pilot study, the hypotheses will be revised as follows: Number 1 will be changed to read that haptics will recognize fewer speech phonemes than do visuals. Number 4 will be omitted. Number 5 will be changed to read, "Music accompanying pictorial information at presentation time will increase recognition of that information for both haptics and visuals. Hypothesis #7 will read, "If music accompanies verbal information at presentation time, there will be no effect on the recall of visual and haptic subjects." Number 9 will read, "Music accompanying verbal information at presentation time and at testing time will have no effect on the recognition of sentences by either visual or haptic subjects. Number 10 will read, "Music accompanying verbal information at presentation time and at testing time will have no effect on the recall of that verbal information for either visual or haptic subjects.

No evidence for music-generated electrical activity which could trigger chemical reactions favoring the formation of memory traces was found. Such activity, if it had existed, would have increased verbal and pictorial scores, both recognition and recall, for all subjects. Such was not the case.

Attempts to graph verbal recognition scores matched up with each subject's perceptual type score in the hopes of doing regression analysis failed. Many more subjects need to be tested before this interaction can be studied.

PILOT

PLOT OF THE MEANS FOR PICTORIAL RECALL

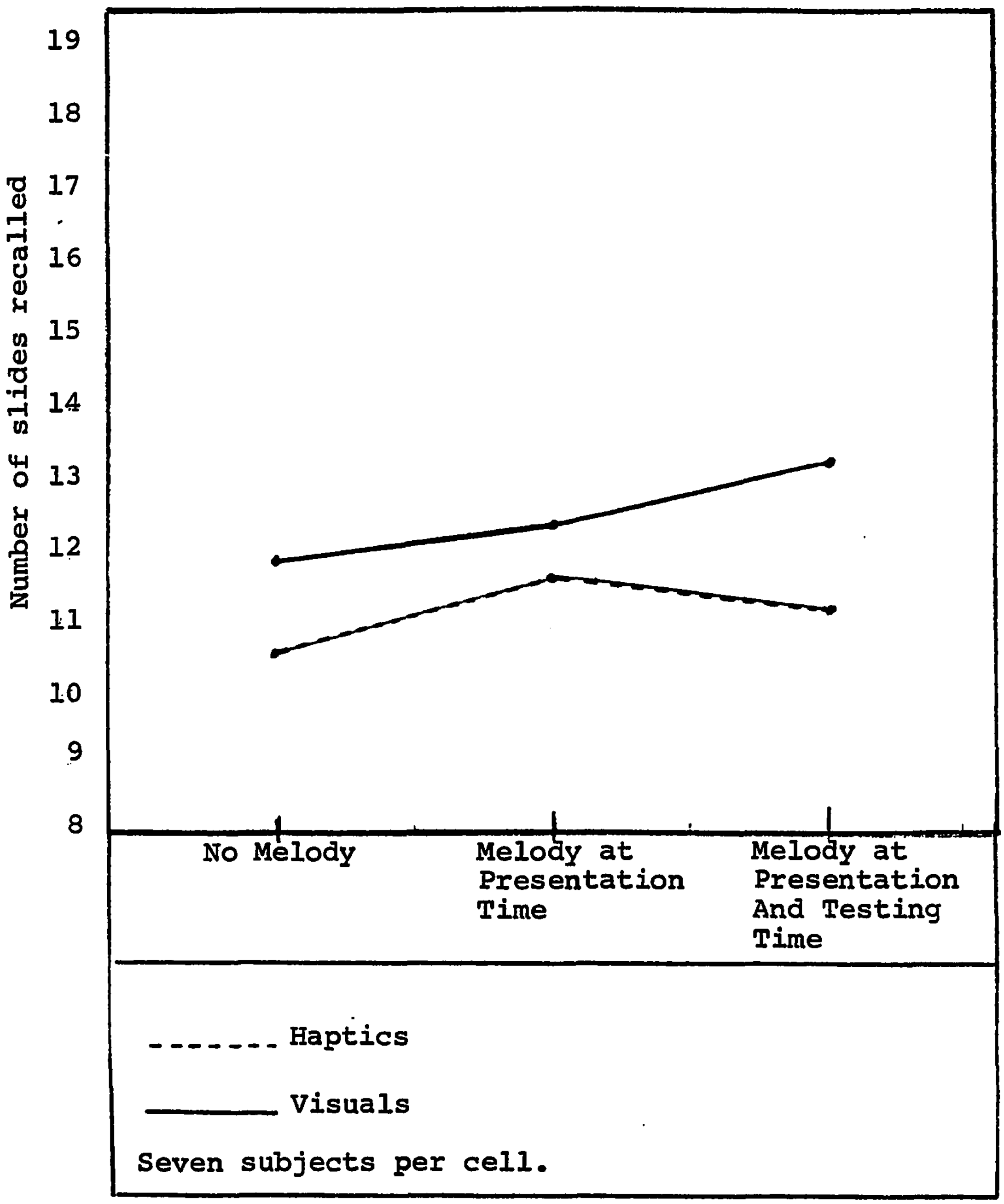


Figure 11

PILOT

PLOT OF THE MEANS FOR VERBAL RECALL

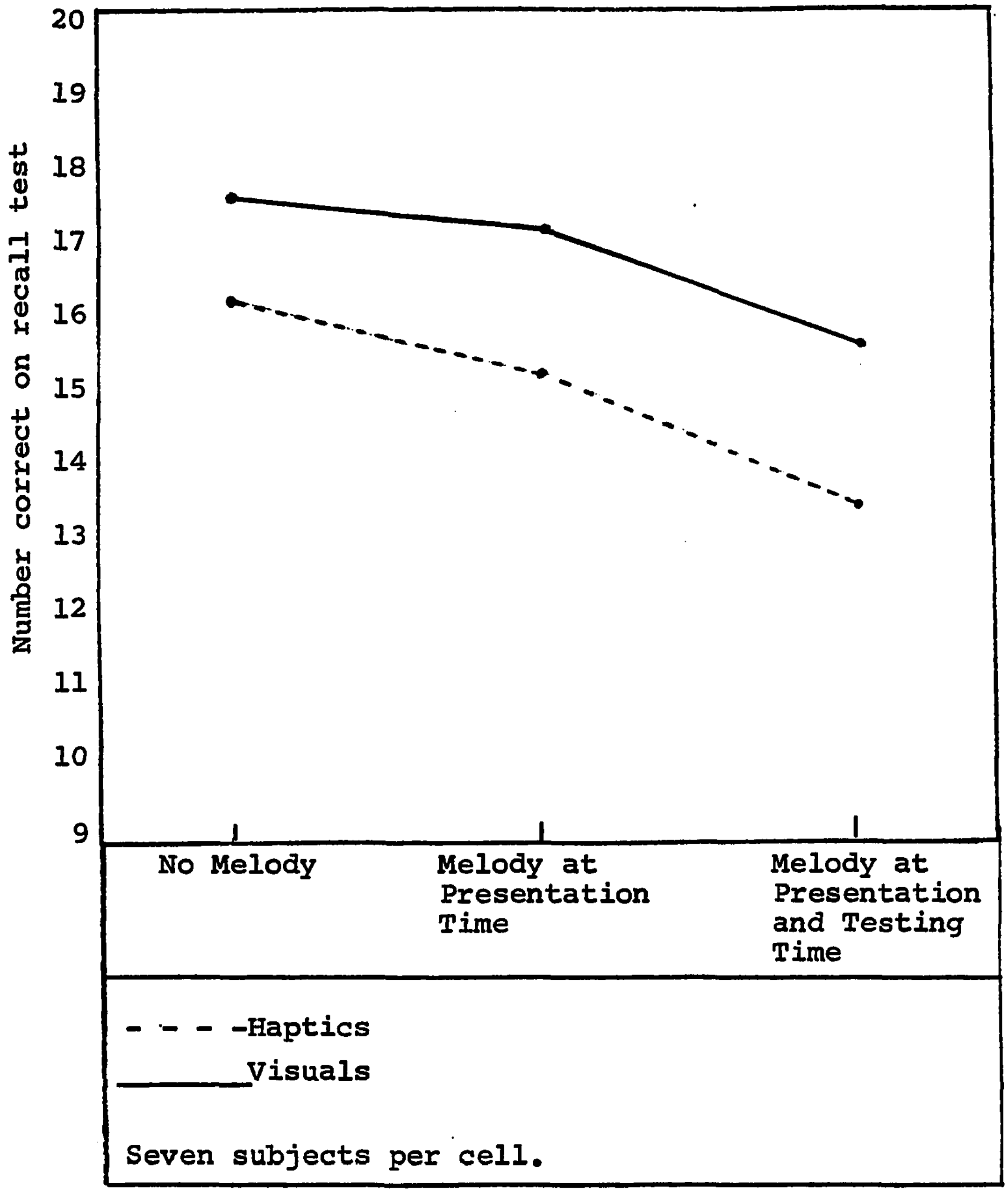


Figure 12

PILOT

PLOT OF THE MEANS FOR VERBAL RECOGNITION

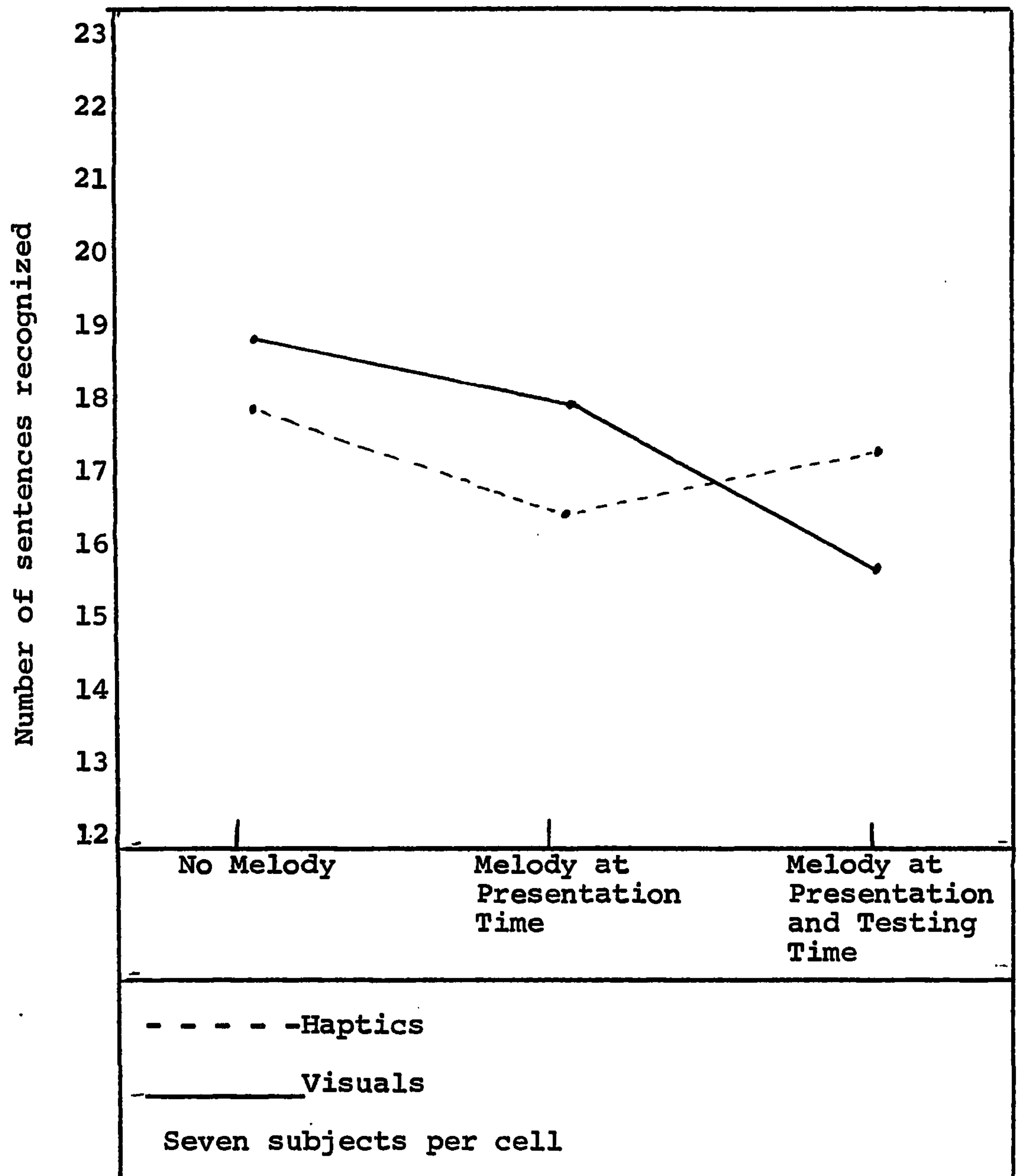


Figure 14

PILOT

PLOT OF THE MEANS FOR PICTORIAL RECOGNITION

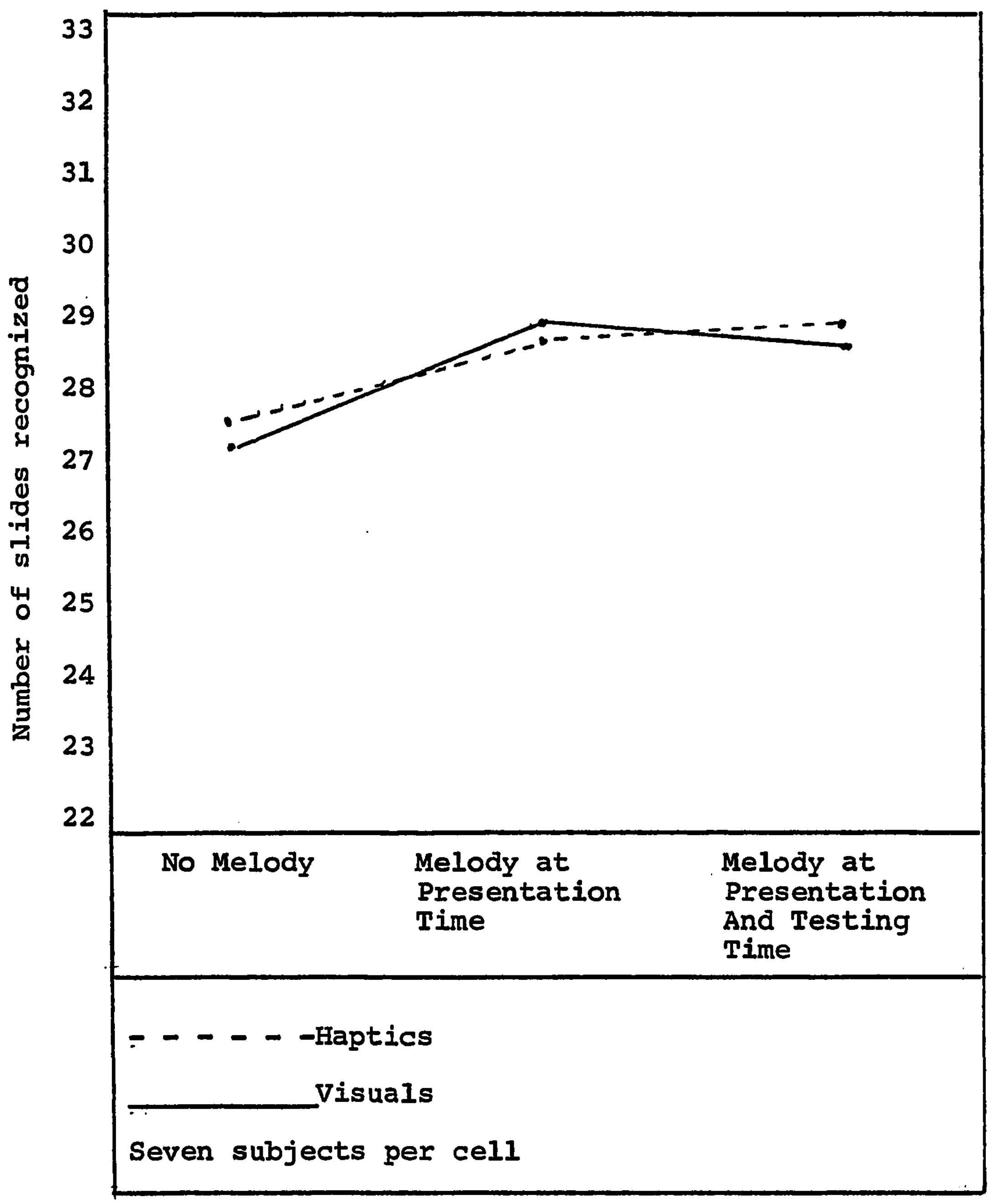


Figure 13

APPENDIX E

Personal Questions for Selecting Subjects

Name________________________________Address__________________

____

Telephone Number___________Sex: Male___Female___

Would you be willing to participate in an experiment to test the effects of music on memory?

Yes____ No ____

Are you right handed? Yes____ No ____

Are you left handed? Yes____ No ____

Do you write in inverted hand position? Yes____ No ____

Are you tone deaf? Yes ____ No ____

Do you enjoy listening to music? Yes ____ No ____

Have you even taken music lessons of any kind? (Voice, instrument or choir?)

Yes ____ No ____

If the above question is yes, how many years did you take?

0-1 ____ 1 to 5 ____ 5 to 10 ____ Over 10 ____

Age: 18 or below ____ 19-25 ____ 25-30 ____ Over 30 ____

Vision 20/20 with or without correction? Yes ____ No ____

APPENDIX F

Paragraph
And
Practice Paragraph

PARAGRAPH

There was a boy who was as tall and as straight as a young tree. He was as strong as a bull and very generous. His one big fault was that he loved to sit with his friends and talk. He would chatter on and on. The difference between truth and imagination was quite forgotten. His name was Jack, and his friends soon named him Jack Braggert. They would smile and wink at each other. Jack is bragging again, they would say. "I will join the army and in just one month they will make me a corporal," Jack said one day.

"Oh yes, and after two months they will make you a general," his friends answered.

"Not only that," said Jack, "but I will soon marry the princess and be king of all the land."

One day his father got tired of Jack's boasting and put a hundred gold soverigns on the table in front of his son.

"Now go", he said, "and I don't want to set eyes on you until you are at least a corporal."

So Jack went to town, found the army barracks, and became a soldier. The first thing he did was to take the colonel and his whole regiment out for a treat. He spent all but one of his hundred gold soverigns on them, and gave the last of his coins to a poor beggar outside the barracks. All that Jack had left in the world now was his heart of gold.

PRACTICE PARAGRAPH

Once upon a time there was a poor collier who already had twenty-five children when his twenty-sixth was born. He was a boy, a lively and good-looking baby, but the poor collier did not know whom to ask to be the child's godfather. When someone has twenty-six children there is always something to worry about!

"What can I do but go out into the world and seek a godfather," said the collier.

APPENDIX G
TESTS

PRACTICE TEST FOR PARAGRAPH

RECALL

Circle the correct answer if you are given a choice of several answers. If there is a blank space, fill it in with the correct word from the paragraph you just heard.

1. The collier was
   - a. rich.
   - b. poor.
   - c. unhappy.
   - d. harrassed.
2. The twenty-sixth child was a ______________ and good-looking baby.
3. The collier went out into the world to seek a ____________.

RECOGNITION When you hear a sentence that you have heard before, check "old." If you have not heard it before, check "new."

1. ____old ____new
2. ____old ____new
3. ____old ____new

RECALL TEST

1. The boy was

   a. short
   b. tall
   c. stocky
   d. pale

2. He was straight as a(n) ________________.

3. He was strong as a(n) ________________.

4. Jack loved to sit with his friends and ______________.

5. When he began to brag, his friends would smile and ___________ at each other.

6. Jack forgot the difference between _______________ and imagination.

7. What did his friends name him? Jack _________________.

8. Jack said he would get a promotion in the army in one __________.

9. To what rank would he be promoted the first time? ______________.

10. What did his friends say about his planned promotion?

    a. That he would never make it.
    b. That he would probably be demoted instead.
    c. That he talked too much.
    d. That he would be a general in two months.

11. What was Jack's final occupation to be? ___________________.

12. Jack's manner of speaking was characterized by which of the following words?

    a. banter
    b. prattle
    c. chatter
    d. repartee

13. Which of the following sentences describes Jack?

    a. He had a lot of imagination.
    b. He was stingy.
    c. He was ignorant and cunning.
    d. He was untrustworthy.

RECALL TEST

14. Who did Jack take out for a treat when he got in the army?

    a. His company.
    b. The colonel and his regiment.
    c. A beggar.
    d. His father.

15. At the end of the story, what did Jack have left in the world?

    a. gold soverigns
    b. a heart of gold
    c. some coins
    d. his corporal stripes

16. Jack's father

    a. wanted him to come home on the weekends.
    b. never wanted to see him again.
    c. wanted him to become a general.
    d. did not want to see him until he was at least a corporal.

17. Whom did Jack say he would marry?____________________

18. Jack's father gave Jack______________gold soverigns.
    (how many?)

19. Where did Jack's father put the soverigns?

    On the _________________.

20. Jack went to town and found the army ______________.

21. Jack gave coins to a poor _________________.

SENTENCE RECOGNITION TEST FORM

When you hear a sentence that you have heard before, check "old." If you have not heard it before, check "new."

SENTENCE

1. ____old ____new
2. ____old ____new
3. ____old ____new
4. ____old ____new
5. ____old ____new
6. ____old ____new
7. ____old ____new
8. ____old ____new
9. ____old ____new
10. ____old ____new
11. ____old ____new
12. ____old ____new
13. ____old ____new
14. ____old ____new
15. ____old ____new
16. ____old ____new
17. ____old ____new
18. ____old ____new
19. ____old ____new
20. ____old ____new
21. ____old ____new
22. ____old ____new
23. ____old ____new
24. ____old ____new
25. ____old ____new
26. ____old ____new
27. ____old ____new
28. ____old ____new
29. ____old ____new
30. ____old ____new

PRACTICE SHEET FOR SLIDES

<u>Recall</u>. Verbally describe or draw all of the slides that you can remember.

1.

2.

3.

<u>Recognition</u>. When a slide is shown, check whether or not you have seen it before. If you have seen it, check old. If you have <u>not</u> seen it, check new.

1. ____old ____new

2. ____old ____new

3. ____old ____new

RECALL TEST FOR SLIDES

1.

2.

3.

4.

5.

6.

7.

8.

RECALL TEST FOR SLIDES

9.

10.

11.

12.

13.

14.

15.

SLIDE RECOGNITION TEST FORM

When a slide is shown, check whether or not you have seen it before. If you have seen it, check "old." If you have not seen it, check "new."

SLIDE

1. ____old ____new
2. ____old ____new
3. ____old ____new
4. ____old ____new
5. ____old ____new
6. ____old ____new
7. ____old ____new
8. ____old ____new
9. ____old ____new
10. ____old ____new
11. ____old ____new
12. ____old ____new
13. ____old ____new
14. ____old ____new
15. ____old ____new
16. ____old ____new
17. ____old ____new
18. ____old ____new
19. ____old ____new
20. ____old ____new
21. ____old ____new
22. ____old ____new
23. ____old ____new
24. ____old ____new
25. ____old ____new
26. ____old ____new
27. ____old ____new
28. ____old ____new
29. ____old ____new
30. ____old ____new

APPENDIX H

VALIDATION INSTRUMENTS FOR SLIDES AND SENTENCES

SLIDES

Please rate these slides as follows:

1=Extremely dissimilar
2=Slightly dissimilar
3=Undecided
4=Slightly similar
5=Extremely similar

You will be shown two slides. Then you will be given time to rate them. They will be shown twice. Please rate them as they are shown the second time.

1. ___1 ___2 ___3 ___4 ___5

2. ___1 ___2 ___3 ___4 ___5

3. ___1 ___2 ___3 ___4 ___5

4. ___1 ___2 ___3 ___4 ___5

5. ___1 ___2 ___3 ___4 ___5

6. ___1 ___2 ___3 ___4 ___5

7. ___1 ___2 ___3 ___4 ___5

8. ___1 ___2 ___3 ___4 ___5

9. ___1 ___2 ___3 ___4 ___5

10. ___1 ___2 ___3 ___4 ___5

11. ___1 ___2 ___3 ___4 ___5

12. ___1 ___2 ___3 ___4 ___5

13. ___1 ___2 ___3 ___4 ___5

14. ___1 ___2 ___3 ___4 ___5

15. ___1 ___2 ___3 ___4 ___5

16. ___1 ___2 ___3 ___4 ___5

17. ___1 ___2 ___3 ___4 ___5

18. ___1 ___2 ___3 ___4 ___5

19. ___1 ___2 ___3 ___4 ___5

20. ___1 ___2 ___3 ___4 ___5

21. ___1 ___2 ___3 ___4 ___5

22. ___1 ___2 ___3 ___4 ___5

23. ___1 ___2 ___3 ___4 ___5

24. ___1 ___2 ___3 ___4 ___5

25. ___1 ___2 ___3 ___4 ___5

26. ___1 ___2 ___3 ___4 ___5

27. ___1 ___2 ___3 ___4 ___5

SENTENCES

Please listen to the two sentences given on the tape. These sentences should be slightly similar or slightly dissimilar.

Rate them as follows: 1=Extremely dissimilar
2=Slightly dissimilar
3=Undecided
4=Slightly similar
5=Extremely similar

1. ___1 ___2 ___3 ___4 ___5

2. ___1 ___2 ___3 ___4 ___5

3. ___1 ___2 ___3 ___4 ___5

4. ___1 ___2 ___3 ___4 ___5

5. ___1 ___2 ___3 ___4 ___5

6. ___1 ___2 ___3 ___4 ___5

7. ___1 ___2 ___3 ___4 ___5

8. ___1 ___2 ___3 ___4 ___5

9. ___1 ___2 ___3 ___4 ___5

10. ___1 ___2 ___3 ___4 ___5

11. ___1 ___2 ___3 ___4 ___5

12. ___1 ___2 ___3 ___4 ___5

13. ___1 ___2 ___3 ___4 ___5

14. ___1 ___2 ___3 ___4 ___5

15. ___1 ___2 ___3 ___4 ___5

APPENDIX I

ANSWER SHEET FOR
SPT-1

ANSWER SHEET FOR SPT-1

NAME____

Circle or mark out the letter of the correct answer. Answer all items, even if you have to guess.

1. A B C D E
2. A B C D E
3. A B C D E
4. A B C D E
5. A B C D E
6. A B C D E
7. A B C D E
8. A B C D E
9. A B C D E
10. A B C D E
11. A B C D E
12. A B C D E
13. A B C D E
14. A B C D E
15. A B C D E
16. A B C D E
17. A B C D E
18. A B C D E
19. A B C D E
20. A B C D E
21. A B C D E
22. A B C D E
23. A B C D E
24. A B C D E
25. A B C D E
26. A B C D E
27. A B C D E
28. A B C D E
29. A B C D E
30. A B C D E
31. A B C D E
32. A B C D E
33. A B C D E
34. A B C D E
35. A B C D E
36. A B C D E
37. A B C D E
38. A B C D E

APPENDIX

J

SENTENCES

SENTENCES

1. Once upon a time there was a boy as straight and as tall as a young tree.

2. He chattered on and chattered on.

3. He was as strong as a bull and very generous.

4. Jack's father was so tired of his son's boasting that he put 100 gold soverigns on the table for him.

5. "Go from me," he yelled, "I don't want to see you again until you are at least a corporal."

6. Jack had nothing left in the world but a heart of gold.

7. He spent all but one of his hundred gold soverigns on them, and gave the last of his coins to a poor beggar outside the barracks.

8. Jack went to town, found the army, and became a soldier.

9. All that Jack had left in the world now was his heart of gold.

10. I will soon marry the princess and be king of the land, Jack said.

11. Jack said, "When I join the army they will make me a corporal in just one month.

12. They would smile and wink at each other.

13. His friends soon named him Jack Braggert since he bragged so much.

14. He would chatter on and on.

15. His one big fault was that he loved to talk to his friends.

16. He forgot the difference between truth and imagination.

17. He was strong like a bear and extremely generous.

18. There was a boy who was as tall and as straight as a young tree.

19. I will join the army and in just one month they will make me a corporal, Jack said one day.

20. Jack is bragging again, they would say.

21. They would wink and laugh at each other.

22. I will soon marry the princess and I will be king of the whole land, bragged Jack.

23. His name was Jack, and his friends soon named him Jack Braggert.

24. "Now go," he said, "and I don't want to set eyes on you until you are at least a corporal.

25. One day his father got tired of Jack's boasting and put a hundred gold soverigns on the table in front of his son.

26. I will soon marry the princess and be king of the land, Jack said.

27. They would say to each other that Jack was bragging again.

28. The difference between truth and imagination was quite forgotten.

29. So Jack went to town, found the army barracks, and became a soldier.

30. His one big fault was that he loved to sit with his friends and talk.

PRACTICE SENTENCES

1. Once upon a time there was a poor collier who already had twenty-five children when his twenty-sixth was born.

2. Twenty-six children is something to worry about!

3. The baby was a good-looking boy.

APPENDIX K

Tables of Means
And
Standard Deviations

PILOT STUDY

TABLE OF MEANS AND STANDARD DEVIATIONS WITH MEAN PERCENT CORRECT			
	No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
Slides			
Recognition			
Haptic			
Mean	27.28 (90.9)	29 (96.6)	28.85 (96)
SD	1.8	1.15	1.22
Visual			
Mean	27.71 (92.3)	28.85 (96)	29.0 (96.6)
SD	1.60	1.21	.81
Recall			
Haptic			
Mean	10.57 (70.5)	11.7 (78)	11.28 (75)
SD	1.72	1.25	3.45
Visual			
Mean	12.0 (80)	12.57 (83.8)	13.14 (87.6)
SD	1.91	1.13	1.46
Paragraph			
Recognition			
Haptic			
Mean	17.57 (58.5)	16.14 (53.8)	17.0 (56.6)
SD	2.57	3.07	3.31
Visual			
Mean	18.57 (61.9)	17.7 (59)	15.57 (51.9)
SD	1.51	1.25	1.9
Recall			
Haptic			
Mean	16.29 (77.5)	15.28 (72.7)	13.4 (63.8)
SD	2.87	3.35	4.27
Visual			
Mean	17.7 (84.3)	17.42 (82.9)	15.7 (74.7)
SD	2.21	1.71	3.09

* Numbers in parenthesis are the mean percentage of correct responses.

Table E

TABLE OF MEANS AND STANDARD DEVIATIONS WITH MEAN PERCENT CORRECT			
	No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
Slides			
Recognition			
Haptic			
Mean	26.29 (86.7)	28.7 (95.6)	28.17 (93.9)
SD	2.8	1.1	1.28
Visual			
Mean	27.5 (91.6)	28.94 (96.4)	28.7 (95.5)
SD	1.77	1.19	1.15
Recall			
Haptic			
Mean	9.29 (61.9)	12.35 (82.3)	11.5 (76.6)
SD	2.14	1.87	2.50
Visual			
Mean	10.58 (70.5)	12.94 (86.2)	12.76 (85)
SD	2.21	1.297	1.75
Paragraph			
Recognition			
Haptic			
Mean	17.23 (57.4)	16.0 (53.3)	17.11 (.57)
SD	2.795	2.8	3.55
Visual			
Mean	18.11 (60.3)	18.35 (61)	16.70 (55.6)
SD	2.735	1.729	2.61
Recall			
Haptic			
Mean	16.05 (76.4)	16.23 (77.2)	14.76 (70.2)
SD	3.21	2.68	3.54
Visual			
Mean	17.82 (84.8)	17.23 (82)	16.117 (76.7)
SD	1.845	2.25	3.55
Numbers in parenthesis are the mean percentage of correct responses.			

Table F

APPENDIX L

TABLES OF

Statistical Tests

ANOVA Summary Table
For Pictorial Recognition

Source	SS	df	MS	F
Perceptual types	11.33	1	11.33	4.09*
Melody conditions	69.588	2	34.794	12.55*
Interaction	4.49	2	2.24	.81
Error	266.23	96	2.77	
Totals	351.647	101		

Melody made a significant difference in the scores.

Table G

ANOVA Summary Table
For Verbal Recognition

Source	SS	df	MS	F
Perceptual types	22.588	1	22.588	2.97
Melody conditions	10.25	2	5.125	.67
Interaction	32.529	2	16.26	2.14
Error	730	96	7.50	
Totals	795.37	101		

Table H

The differences between perceptual types, melody conditions, and interaction between the two did not reach statistical significance.

ANOVA Summary Table
For Pictorial Recall

Source	SS	df	MS	F
Perceptual types	27.5392	1	27.53	6.89*
Melody conditions	140.9607	2	70.45	17.63*
Interaction	2.6078	2	1.3	.33
Error	383.7647	96	3.997	
Totals	554.8725	101		

Table I

There was a significant difference between perceptual types, and melody made a significant difference in the scores.

ANOVA Summary Table
For Verbal Recall

Source	SS	df	MS	F
Perceptual types	48.03	1	48.03	5.64*
Melody conditions	44.96	2	22.48	2.64
Interaction	2.49	2	1.25	.15
Error	818.35	96	8.52	
Totals	913.84	101		

Table J

There was a significant difference between perceptual types.

ANOVA SUMMARY TABLE FOR
CORRECTED SCORES
FOR
PICTORIAL RECOGNITION

Source	SS	df	MS	F
Perceptual types	3.1588	1	3.1588	4.12*
Melody conditions	13.57	2	6.78	8.85*
Interaction	.089	2	.0445	.06
Error	73.578	96	.766	
Totals	90.397	101		

Table K

ANOVA SUMMARY TABLE FOR
CORRECTED SCORES
FOR
VERBAL RECOGNITION

Source	SS	df	MS	F
Perceptual types	.437	1	.437	3.91*
Melody conditions	.246	2	.123	1.10
Interaction	.3325	2	.166	1.49
Error	10.74	96	.111	
Totals	11.758	101		

Table L

APPENDIX M

Error Percentage Tables

For

Recognition Tests

VISUALS

SLIDES								
No Melody			Melody at Presentation Time			Melody at Presentation and at Testing time		
	P(c)	d'		P(c)	d'		P(c)	d'
S1	.966	2.57	S1	.933	2.12	S1	1.00	3.99
S2	.90	1.81	S2	1.00	3.99	S2	.966	2.57
S3	1.00	3.99	S3	1.00	3.99	S3	.933	2.12
S4	.90	1.81	S4	.966	2.57	S4	1.00	3.99
S5	.933	2.12	S5	.933	2.12	S5	.933	2.12
S6	.833	1.36	S6	1.00	3.99	S6	1.00	3.99
S7	.833	1.36	S7	1.00	3.99	S7	1.00	3.99
S8	.933	2.12	S8	.90	1.81	S8	.933	2.12
S9	.90	1.81	S9	.90	1.81	S9	.966	2.57
S10	.866	1.54	S10	.966	2.57	S10	.933	2.12
S11	.90	1.81	S11	1.00	3.99	S11	.966	2.57
S12	.80	1.19	S12	.90	1.81	S12	1.00	3.99
S13	1.00	3.99	S13	.933	2.12	S13	1.00	3.99
S14	.90	1.81	S14	1.00	3.99	S14	.90	1.81
S15	.933	2.12	S15	.966	2.57	S15	.866	1.54
S16	.966	2.57	S16	1.00	3.99	S16	.966	2.57
S17	.966	2.57	S17	1.00	3.99	S17	.933	2.12

Table M

P(c) = Percentage correct

d' = Ideal performance compared to obtained performance

VISUALS

SENTENCES								
No Melody			Melody at Presentation Time			Melody at Presentation and at Testing Time		
	P(c)	d'		P(c)	d'		P(c)	d'
S1	.60	.36	S1	.733	.87	S1	.60	.36
S2	.60	.36	S2	.633	.48	S2	.466	-.13
S3	.30	-.74	S3	.66	.61	S3	.566	.23
S4	.63	.48	S4	.60	.36	S4	.433	-.24
S5	.666	.61	S5	.566	.23	S5	.533	.12
S6	.566	.23	S6	.60	.36	S6	.633	.48
S7	.60	.36	S7	.60	.36	S7	.50	0
S8	.70	.74	S8	.66	.61	S8	.50	0
S9	.666	.61	S9	.66	.61	S9	.60	.36
S10	.566	.23	S10	.566	.23	S10	.50	0
S11	.666	.61	S11	.60	.36	S11	.60	.36
S12	.633	.48	S12	.566	.23	S12	.533	.12
S13	.566	.23	S13	.60	.36	S13	.766	1.03
S14	.533	.12	S14	.566	.23	S14	.566	.23
S15	.666	.61	S15	.533	.12	S15	.466	-.13
S16	.633	.48	S16	.70	.74	S16	.50	0
S17	.666	.61	S17	.533	.12	S17	.70	.74

Table N

P(c) = Percentage correct

d' = Ideal performance compared to obtained performance

HAPTICS

SLIDES								
No Melody			Melody at Presentation Time			Melody at Presentation and At Testing Time		
	P(c)	d'		P(c)	d'		P(c)	d'
S1	.80	1.19	S1	.966	2.57	S1	.966	2.57
S2	.966	2.57	S2	1.00	3.99	S2	.933	2.12
S3	.933	2.12	S3	.966	2.57	S3	.933	2.12
S4	.90	1.81	S4	.90	1.81	S4	1.00	3.99
S5	.80	1.19	S5	1.00	3.99	S5	.90	1.81
S6	.866	1.54	S6	.966	2.57	S6	.966	2.57
S7	.70	.74	S7	.90	1.81	S7	1.00	3.99
S8	.90	1.81	S8	.933	2.12	S8	.983	2.12
S9	.666	.61	S9	1.00	3.99	S9	.933	2.12
S10	.933	2.12	S10	1.00	3.99	S10	.933	2.12
S11	.933	2.12	S11	.933	2.12	S11	.866	1.54
S12	.866	1.54	S12	.90	1.81	S12	.933	2.12
S13	.833	1.36	S13	.933	2.12	S13	.90	1.81
S14	1.00	3.99	S14	.966	2.57	S14	.866	1.54
S15	.966	2.57	S15	.966	2.57	S15	.933	2.12
S16	.966	2.57	S16	.933	2.12	S16	.933	2.12
S17	.866	1.54	S17	1.00	3.99	S17	1.00	3.99

Table O

P(c) = Percentage correct

d' = Ideal performance compared to obtained performance.

HAPTICS

SENTENCES								
No Melody			Melody at Presentation Time			Melody at Presentation and Testing Time		
	P(c)	d'		P(c)	d'		P(c)	d'
S1	.566	.23	S1	.533	.12	S1	.633	.48
S2	.60	.36	S2	.733	.87	S2	.566	.23
S3	.566	.23	S3	.433	-.24	S3	.60	.36
S4	.50	0	S4	.40	-.36	S4	.50	0
S5	.533	.12	S5	.733	.87	S5	.566	.23
S6	.60	.36	S6	.50	0	S6	.50	0
S7	.566	.23	S7	.433	-.24	S7	.766	1.03
S8	.50	0	S8	.50	0	S8	.40	-.36
S9	.633	.48	S9	.566	.23	S9	.633	.48
S10	.566	.23	S10	.633	.48	S10	.566	.23
S11	.533	.12	S11	.466	-.13	S11	.50	0
S12	.40	-.36	S12	.50	0	S12	.633	.48
S13	.466	-.13	S13	.533	.12	S13	.666	.61
S14	.633	.48	S14	.50	0	S14	.60	.36
S15	.766	1.03	S15	.533	.12	S15	.33	-.60
S16	.566	.23	S16	.50	0	S16	.40	-.36
S17	.766	1.03	S17	.566	.23	S17	.566	.23

Table P

P(c) = Percentage correct

d' = Ideal performance compared to obtained performance.

VERBAL RECOGNITION

PLOT OF THE MEANS OF d'

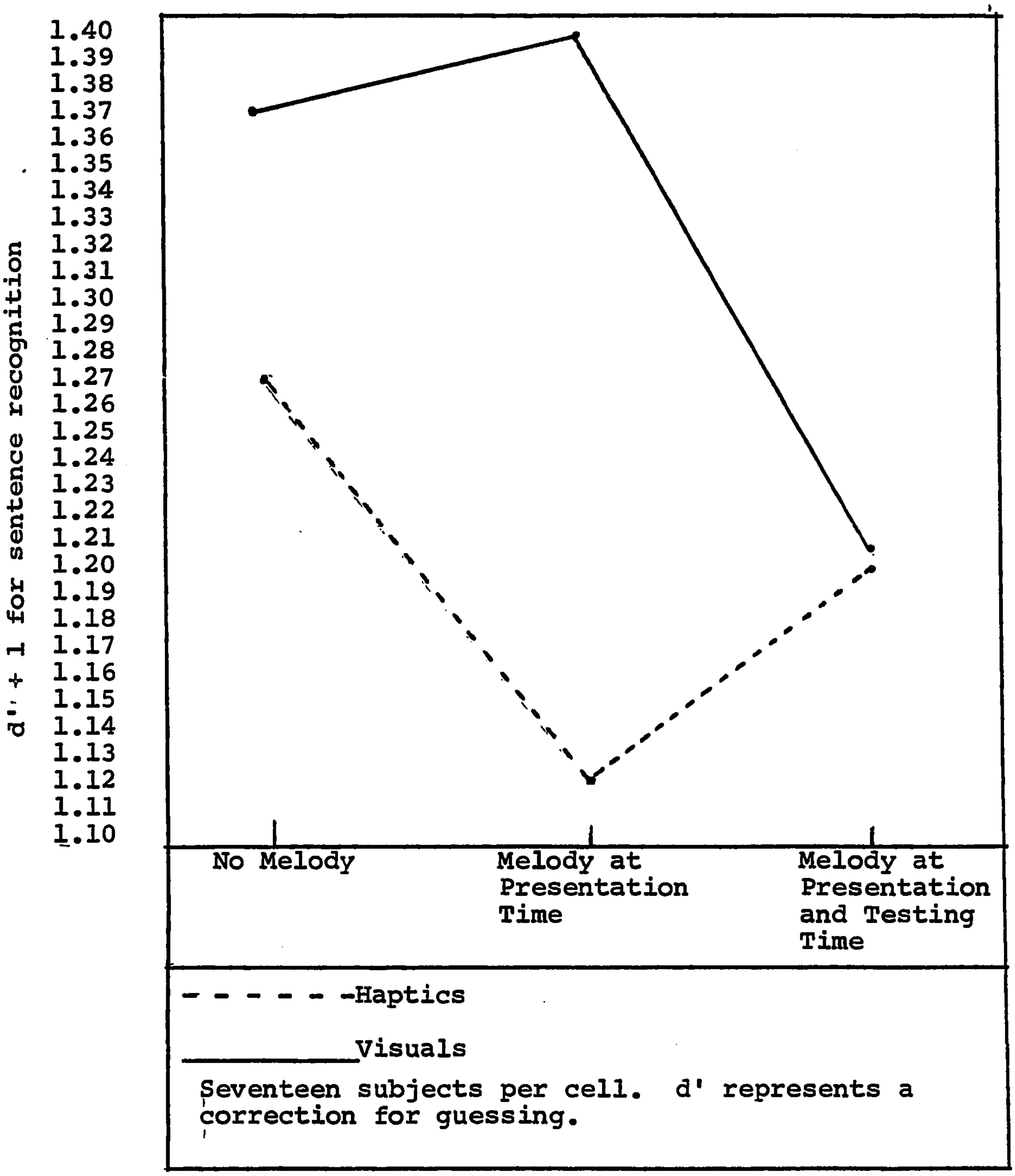
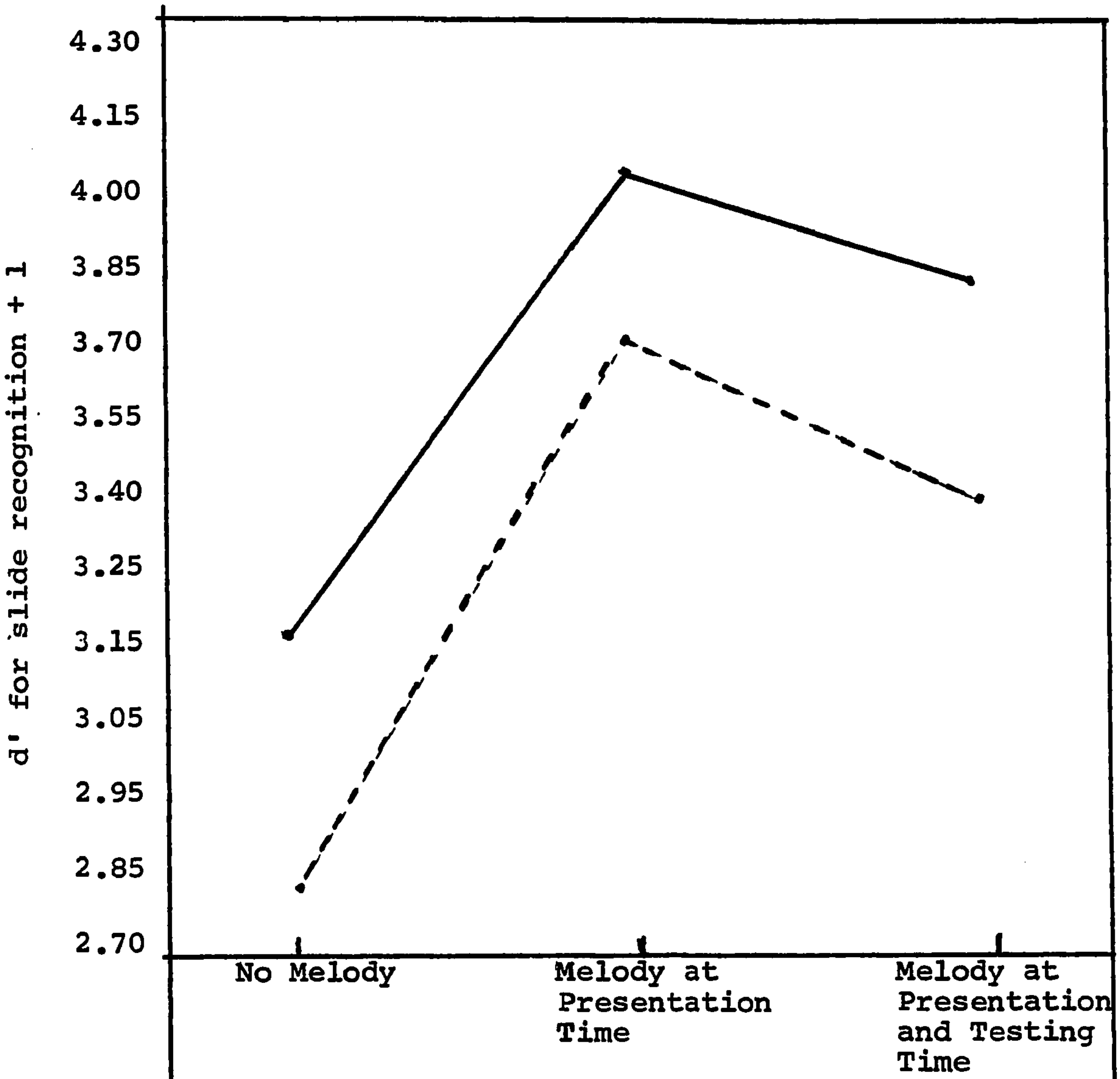


Figure 15

PICTORIAL RECOGNITION
PLOT OF THE MEANS OF d'



- - - - - Haptics

_________ Visuals

Seventeen subjects per cell. d' represents a correction for guessing.

Figure 16

APPENDIX N

Melodies and Slides

LIST OF SLIDES

1. Straight chair, Spanish style, in front of orange curtain. (silhouette)
2. Large white birds in dry, yellowish, tall grass.
3. Clear glass goblet with silver, cut-out base.
4. Puppy with floppy ears and yellow cat on green material.
5. Mt. Ranier, Washington--snow covered.
6. Needlepoint picture of rosebud between blue lines. Gold frame.
7. Large black and white birds (2 of them) rising up from blue water.
8. Two palm trees on a sandy beach with the ocean beyond.
9. Island with grey-green water. A figure is waving in foreground.
10. Yellow, red, white, and pink flowers in a garden which is in front of a brick wall.
11. White antique pitcher with pink flowers and green leaves.
12. Orange butterfly with black spots rimmed in black with white spots.
13. Bluebird on a twig in watercolor.
14. White flower with yellow center. Purple flowers at rim of slide.
15. White, 5 story apartment building with red balconies on the end closest to camera.

DISTRACTORS

1. Antique American straight back chair in silhouette against orange curtain.
2. Brown and white dog and grey tabby cat in basket.
3. Cross-stitch picture of poinsettas in a gold and green frame.
4. Island at sunset.

DISTRACTORS

5. Two palm trees on beach with ocean on right side.
6. Orange butterfly with black spots.
7. Off-white, 7-story apartment building with red and other colors in windows.
8. Two long-necked white birds touched with black eating in a meadow.
9. Purple flowers with yellow centers.
10. A blue bird with a brown and white breast in watercolor.
11. Black and white bird rising up from blue water.
12. Snow covered mountain with a green forest in the foreground.
13. Red, white and pink flowers in a garden against a green background.
14. Crystal goblet with green glass base.
15. Hand painted pitcher with purple, green, and pink grapes on it.

ORDER OF 30 SLIDES

Each old slide is numbered 1 through 15, and each new slide is numbered 1 through 15.

1. 2--old
2. 1--new
3. 14--old
4. 13--old
5. 3--old
6. 4--new
7. 6--new
8. 5--old
9. 7--old
10. 9--new
11. 8--new
12. 12--new
13. 10--old
14. 11--new
15. 15--new
16. 3--new
17. 1--old
18. 2--new
19. 15--old
20. 14--new
21. 12--old
22. 13--new
23. 4--old
24. 7--new
25. 6--old
26. 5--new
27. 8--old
28. 9--old
29. 11--old
30. 10--new

ORDER OF 30 (15 REPEATED) MELODIES (FOLK)

1. Father Put The Cat Out.
2. Boston Come All Ye.
3. He's Gone Away.
4. Close To My Darling.
5. Barbara Allen.
6. Sam Bass.
7. Hand Me Down My Walkin Cane.
8. Soldier, Soldier.
9. Dear Evelina.
10. Rio Grande.
11. Greenland Fisheries.
12. The Trail to Mexico.
13. Bury Me Beneath the Willow.
14. I Know Where I'm Goin.
15. I Know My Love.
16. Barbara Allen.
17. Boston Come All Ye.
18. Father Put the Cat Out.
19. I Know My Love.
20. He's Gone Away.
21. The Trail To Mexico.
22. Close To My Darling.
23. Sam Bass.
24. Dear Evelina.
25. Hand Me Down My Walking Cane.
26. Soldier, Soldier.
27. Greenland Fisheries.
28. Rio Grande.
29. I Know Where I'm Goin.
30. Bury Me Beneath the Willow.

BACKGROUND MELODY FOR PARAGRAPH

1. Black is the Color.

APPENDIX O

Raw Scores

PILOT STUDY
PICTORIAL (SLIDE) RECOGNITION

No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
Haptic	Haptic	Haptic
24	30	30
29	30	30
28	30	28
27	29	28
28	28	27
26	29	30
29	27	29
Visual	Visual	Visual
29	29	29
27	28	29
27	30	30
28	27	28
25	30	30
28	30	29
30	28	28
Perfect score = 30		

PILOT STUDY
VERBAL (SENTENCE) RECOGNITION

No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
	Haptic	
17	17	23
18	17	15
17	22	17
15	13	12
16	15	17
17	16	17
23	13	18
	Visual	
18	16	14
18	20	18
19	18	15
20	17	13
17	17	18
21	18	16
17	18	15
Perfect score = 30		

PILOT STUDY
PICTORIAL (SLIDE) RECALL

No Melody	Melody at Presentation Time	Melody at Presentation Time and at Testing Time
	Haptic	
12	13	15
9	11	14
9	13	15
10	11	6
9	11	10
12	13	10
13	10	9
	Visual	
9	13	15
11	13	14
12	11	11
15	13	12
11	14	14
13	13	14
13	11	12
Perfect score = 15		

PILOT STUDY
VERBAL RECALL

No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
	Haptic	
16	17	18
18	12	15
11	20	17
18	16	5
18	18	12
14	13	14
19	11	13
	Visual	
20	18	15
19	20	17
14	15	15
17	17	10
20	16	19
18	17	19
16	19	15
Perfect score = 21		

PICTORIAL (SLIDE) RECOGNITION

No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
Haptic	Haptic	Haptic
24	29	29
29	30	28
28	29	28
27	27	30
24	30	30
26	29	30
21	27	30
27	28	30
20	30	28
28	30	30
28	28	29
26	27	28
25	28	30
30	29	29
29	29	28
29	28	28
26	30	30
Visual	Visual	Visual
29	28	30
27	30	29
30	30	30
27	29	30
28	28	30
25	30	30
25	30	30
28	30	28
27	27	29
26	27	28
27	29	29
24	30	29
30	27	30
27	28	30
28	30	30
29	29	29
29	30	28
Perfect score = 30		

VERBAL (SENTENCE) RECOGNITION

No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
Haptic	Haptic	Haptic
17	16	19
18	22	17
17	13	18
15	12	15
16	22	17
18	15	23
17	13	23
15	15	12
19	17	19
17	19	17
16	14	15
12	15	19
14	16	20
19	15	18
23	16	10
17	15	12
23	17	17
Visual	Visual	Visual
18	22	18
18	19	14
9	20	17
19	18	13
20	17	16
17	18	19
18	18	15
21	20	15
20	20	18
17	17	15
20	18	18
19	17	16
17	18	23
16	17	17
20	16	14
19	21	15
20	16	21
Perfect score = 30		

PICTORIAL (SLIDE) RECALL

No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
Haptic	Haptic	Haptic
12	13	12
9	13	15
9	11	10
10	11	14
10	13	10
6	9	14
6	10	15
8	11	9
6	11	13
10	13	13
9	15	9
7	10	13
11	15	12
10	13	9
10	14	12
12	15	6
13	13	10
Visual	Visual	Visual
9	15	14
11	12	15
8	13	12
12	12	12
15	12	12
11	11	14
10	13	11
13	14	12
8	15	11
9	13	13
11	11	14
6	13	14
13	11	14
12	14	13
12	13	8
10	14	13
10	14	15
Perfect score = 15		

VERBAL RECALL

No Melody	Melody at Presentation Time	Melody at Presentation & Testing Time
Haptic	Haptic	Haptic
16	13	11
18	20	17
11	16	12
18	15	15
17	18	12
8	16	17
18	11	18
17	18	16
16	12	17
14	17	19
18	16	13
16	14	17
13	16	16
20	19	13
20	17	19
14	21	5
19	17	14
Visual	Visual	Visual
20	20	19
19	18	15
17	20	21
14	20	10
17	15	16
20	18	18
19	17	15
18	17	15
19	16	13
17	11	10
19	15	17
14	17	19
16	19	11
18	16	20
18	18	16
18	18	21
20	18	18
Perfect score = 21		

APPENDIX P

Natural Logarithms and

Plot of the Means

For Sentence Recognition Scores

NATURAL LOGARITHMS OF SENTENCE RECOGNITION SCORES

No Melody	Melody at Presentation Time	Melody at Presentation And Testing Time
Haptic	Haptic	Haptic
2.8332	2.7725	2.9444
2.8903	3.0910	2.8332
2.8332	2.5649	2.8903
2.7080	2.4849	2.7080
2.7725	3.0910	2.8332
2.8903	2.7080	3.1354
2.8332	2.5649	3.1354
2.7080	2.7080	2.4849
2.9444	2.8332	2.9444
2.8332	2.9444	2.8332
2.7725	2.6390	2.7080
2.4849	2.7080	2.9444
2.6390	2.7725	2.9957
2.9444	2.7080	2.8903
3.1354	2.7725	2.3025
2.8332	2.7080	2.4849
3.1354	2.8332	2.8332
Visual	Visual	Visual
2.8903	3.0910	2.8903
2.8903	2.9444	2.6390
2.1972	2.9957	2.8332
2.9444	2.8903	2.5649
2.9957	2.8332	2.7725
2.8332	2.8903	2.9444
2.8903	2.8903	2.7080
3.0445	2.9957	2.7080
2.9957	2.9957	2.8903
2.8332	2.8332	2.7080
2.9957	2.8903	2.8903
2.9444	2.8332	2.7725
2.8332	2.8903	3.1354
2.7725	2.8332	2.8332
2.9957	2.7725	2.6390
2.9444	3.0445	2.7080
2.9957	2.7725	3.0445

Table Q

PLOT OF THE MEANS OF THE NATURAL LOGARITHMS OF VERBAL RECOGNITION SCORES

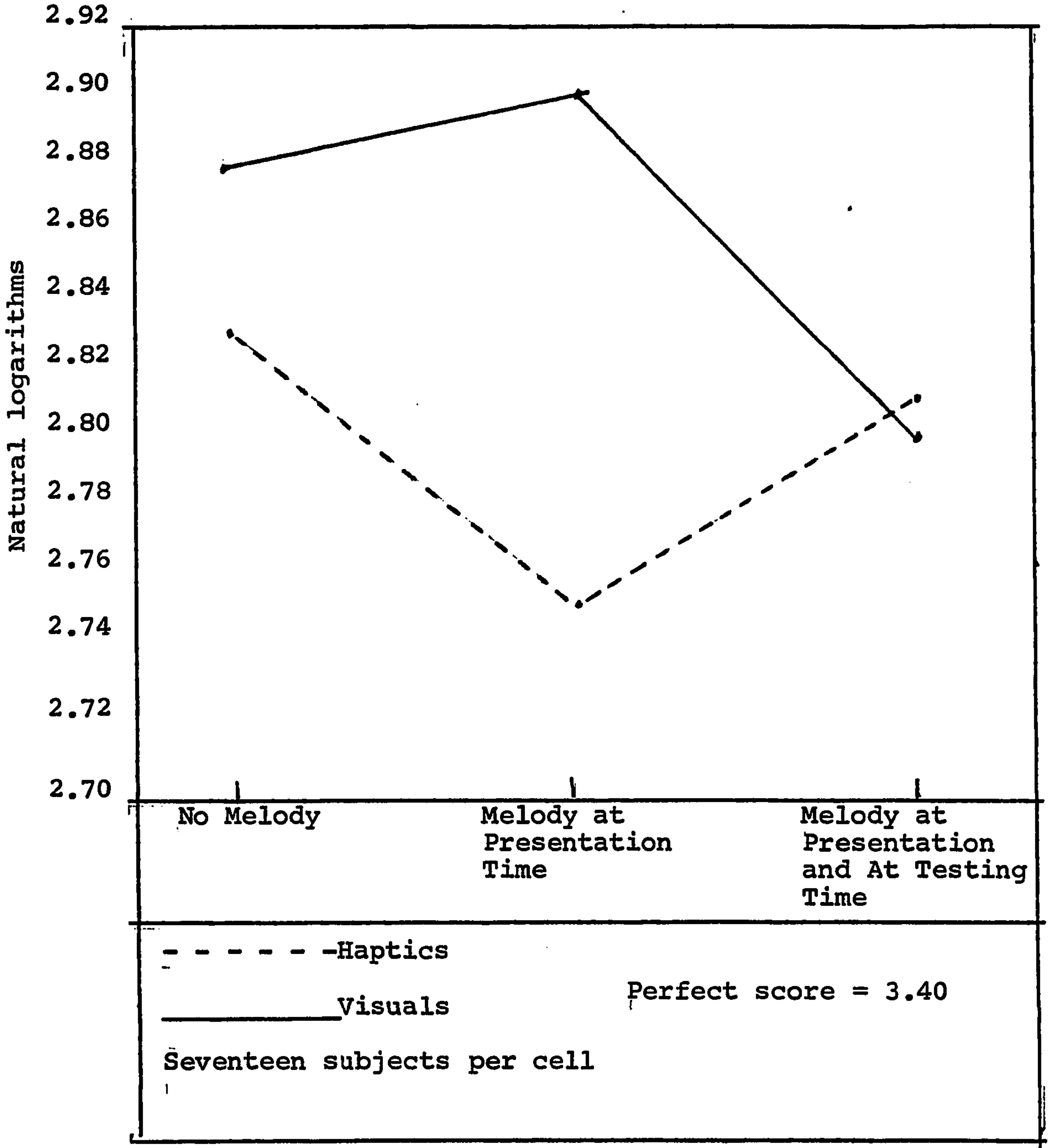


Figure 17

APPENDIX Q

Abstract

ABSTRACT

RELATIONSHIP OF MELODY AND PERCEPTUAL TYPE TO PERFORMANCE ON RECOGNITION AND RECALL TASKS

Claims made about the power of music to increase learning prompted an investigation into the effects of melody on the ability of visual and haptic learners to recognize and recall pictorial and verbal patterns in meaningful materials. It was thought that evidence might be obtained supporting Paivio's dual channel information processing theory of two systems in the brain, one for verbal or sequentially processed information, and the other for analog or holistically perceived nonverbal information.

Five hundred university students were tested with Lowenfeld's Successive Perception Test 1 to determine their perceptual type. From those students, 51 visual and 51 haptic females were chosen, were matched for handedness and musical ability, and were randomly assigned to three treatment groups. One group, "melody at presentation time," had flute folk tunes accompany slides, and a flute background melody accompany a narrative paragraph on tape. This group was tested for recognition and recall of both the pictorial and the verbal information, but it did not have music at testing time. A second group, "melody at both presentation and at testing time," used the same slides and paragraph, but it had music throughout the experiment. A third group was a control group which saw the same slides, heard the same paragraph, and took the same tests but the group was without music at any time.

Results of this experiment show that both visual and haptic individuals are helped significantly by music when the task is pictorial recognition or pictorial recall. It was also found that music played concurrently with the presentation of pictorial material, but not at testing time, is the best condition for both perceptual types. It was further noted that in the presence of music, the scores of haptic individuals are raised almost to the level of visual individuals in both recognition and recall of pictorial information. In addition, haptics are relatively unaffected by music in the performance of verbal tasks, but visuals are significantly distracted by it in both recognition and recall of verbal information. Since support was provided for Paivio's dual processing theory, educators are encouraged to be cautious about the use of music with verbal presentations.