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The Effects of Radio Programs on Recognitive Memory in High School Students

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THE EFFECTS OF RADIO PROGRAMS ON RECOGNITIVE MEMORY IN HIGH SCHOOL STUDENTS

by

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LIFE

William Edwin Tatter was born in Chicago, Illinois, October 19, 1924.

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CHAPTER I

INTRODUCTION

The purpose of this investigation was to evaluate the effects of a variety of radio programs on the memorization of nonsense syllables and simple visual forms, by high school students, as measured by recognition tests.

Many conditions are known to be capable of disturbing the efficiency of the student in his school work. It has been indicated by student advisors, and others interested in guiding the student, that certain study techniques, preparatory procedures, and environmental conditions could make home studying efficient while, on the other hand, others might hinder efficiency.[1] Important among the latter were the social conditions that confronted the individuals who attempted to do their studying. As noted in the purpose, this paper is concerned with one aspect of these environmental-social conditions, that of the relation of the radio to the efficiency of memorizing specific materials.

The more general problem, of the effects of the radio

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1 F. K. Berrien, Practical Psychology, New York, 1947, 3-28.

on studying, was suggested by a group of high school students, following a discussion of study habits. The available texts, on that occasion, did not adequately cover the subject and though the students did attempt to find a definite solution, their own conflicting ideas and experiences on the topic could not be resolved. It was then planned to search available literature in the hope that one or a number of studies already performed might have solved this problem. Unfortunately this was not the case for the literature even related to the problem was sparse and primarily made up of generalizations not based on valid experimental data. The few data that were acceptable were often contradictory.

Therefore a group experiment was conducted with the help of the high school students mentioned. This first experiment was found to be unsatisfactory for a number of reasons, but it did serve in part as a basis for the final experiment. Related literature also contributed greatly to the development of the final experiment, and was especially helpful in the evaluation of the data.

The final experiment included a list of nonsense syllables and a list of simple visual forms which were presented to each subject for memorization while he listened to a radio program of his own choice. Corresponding lists were likewise presented when the radio was turned off during a period of silence.

Thereafter the subject was tested for the learned materials by the method of recognition. The results were then statistically evaluated.

CHAPTER II

REVIEW OF RELATED LITERATURE

No study was discovered that adequately solved the stated problem. However a large number of related studies were noted. Of these the more important will be discussed in the following section.

Educational and physiological experimentalists have contributed works that have a bearing on the problem, and a large number of related studies have been completed also in the field of industry. In the interests of clarity the studies will be kept within the above categories.

The common experience that work might be completed more rapidly, and with less feeling of effort, during the presence of some additional sounds, was only partially confirmed by some studies; and contrary to such findings, it has been stated that sounds also may cause detrimental effects.

A well known study conducted over thirty years ago by Morgan attempted to find an answer to this dilemma. The method of his study was incorporated partly into the present experiment and therefore requires added attention.

Ten associates, consisting of three-letter words, each paired with a different number, were presented at two second intervals.

> After the first presentation of the series, a word was exposed alone to which the subject responded by pressing a key corresponding to the number he thought was associated with the word in the first presentation. The pressure of the key caused the correct number to appear, to which the subject again reacted by pressing the corresponding number. This reaction caused the next word to appear, and the process was thus continued until he had responded three times to each word in the series. Four such lists were used with each subject, two in quiet and two in noisy conditions.
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> While the learning was in progress graphic records were taken of the time of each reaction, the accuracy of the responses, of the subject's breathing and the amount of pressure he exerted upon the keys in reacting. Two days later the subjects were asked to recall as many of the words used in the experiment as possible; and after the recall test they were given the 40 words that had been used, mixed with 40 new words and they were asked to check those they recognized as having been used in the experiment.
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> The distractions were three in number. A gramaphone was played during each noisy period. At the same time a large fire gong and a buzzer placed behind the subject were kept sounding alternately at varying intervals of change.[1]

The important conclusions of the study were given in summary in the following points:

1) The noises did interfere with the task, and were more pronounced in the earlier than in the later working period.

2) Tension was assumed to be greater in the noise period

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1 J. J. B. Morgan, "The Effect of Sound Distraction Upon Memory," American Journal of Psychology, XXVII, 1917, 192-193.

than in the silent, and greater in the first part of the noise period than in the second.

3) The amount of material retained in the noise period after two days was less than that learned in quiet conditions.

4) The scores for both recall and recognition were lower for the lists used in the noisy periods.

5) The conclusions taken together indicated that irrelevant noises had a permanent effect upon an individual.

One experimenter studied the effects of general distraction on higher mental processes by giving a mental test to a group of college students under standard conditions, and a retest under severe distraction. The author suggested that the following inferences seemed justified from the data:

> (1) Higher mental processes are compatively unimpeded by distraction. (2) Intelligence is not related to susceptibility to distraction. (3) There are no individual differences in susceptibility to distraction. (4) True mental ability is more nearly approximated under distraction than under standard conditions.[2]

A similar investigation involving distraction was conducted as follows. The subjects were asked to read a psychology textbook and worked an arithmetic test in alternate half hours. It was found that very loud noises, if fairly uniform, had comparatively little effect, especially when the arithmetic test was

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2 H. B. Hovey, "Effects of Genral Distraction on the Higher Thought Processes," American Journal of Psychology, XL, 1928, 591.

being worked; but intermittent noises caused a good deal of disturbance, especially to the reading of the textbook.[3]

The latter investigator also noted that though in some cases noise did not cause noticeable overt effects, there was an increase in oxygen absorption that was significant. He considered it quite obvious that physiological effects of distraction were very important, perhaps equally as important as the overt behavioral effects. A number of other experiments have been conducted to answer some of the many similar problems involved.

One physician summarized the statements of some psychiatrists who attempted to show the beneficial effects of music on the brain. His reference to one author was especially interesting.

> Dr. Altschuler enumerates the following attributes to music for mental patients.
> 1. Capacity to produce changes in metabolism, respiration, blood pressure, pulse and endocrine and muscle energy.
> 2. Ability to command attention and increase its span.
> 3. Power of diversion and substitution (as distracting from morbid states and replacing wholesome feelings and ideas.)
> 4. Capacity to modify the mood.
> 5. Capacity to stimulate pictorially and intellectually.[4]

It has been suggested, however, that music might also have detrimental effects on the organism in certain circumstances

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3 H. M. Vernon, and C. G. Warner, "Objective and Subjective tests for Noise," The Personnel Journal, XI, 1932, 148-149.

4 E. Podolsky, "Music Rhythms Affect Brain Rhythms," Etude, LXIV, 1946, 604.

Hyde[5] measured physiological reactions that had been excited by different sorts of music through the use of the Einthoven string galvanometer, and sensitive sphygmomanometers. She concluded from the investigation that tragic mournful tones affected most people unfavorably, and gay rich-toned harmonic melodies favorably. Individual differences in native endowment and training were suggested to be accompanied by individual differences in physiological reactions to certain musical compositions. It was further suggested that those selections of music that exerted a favorable reflex action on the cardio-vascular system, also exerted favorable influences upon the muscular tone, working power, digestion, secretions and other functions of the body.

A like experiment gave basis for the following conclusions on the effects of noise upon some physiological and psychological processes.

1. Experiments with two subjects have shown that mental work together with its physical concomitants is accompanied by small but consistent increases in metabolic rate, heart rate; and breathing rate and volume. When complex noises, ranging in intensity from 55 to 65 decibels, are added to the situation further increases in these values are observed at first.
2. The increases in the working values caused by the noises may run as high as 60 percent or more during the first days of an experiment; and they are most marked during the first periods in which the noises are present.

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5 Ida H. Hyde, "Effects of Music Upon Electrocardiograms and Blood Pressure," Journal of Experimental Psychology, VII, 1924, 223.

3. When the subject is presented with the same situation day after day, over a period of several weeks, the noise effects gradually disappear, and the working values tend to return to normal.
4. Adjustment to the noises tends to appear first in those work periods which showed the greatest initial effect of the noise, and last in the subsequent work periods.
5. When the subject becomes adjusted to a particular kind of noise or to a special manner of presentation of this noise, a change of either will result in a repetition of the adjustment process, though on an abbreviated scale.
6. The effects of the noises tend to carry over to a small extent into the recovery periods following cessation of the work; and here, as elsewhere, the process of adjustment may be traced.[6]

As conclusions to the above observations the author stated:

> At their first introduction, the noises represented a new factor in the subject's environment, and one to which they must needs adapt themselves. The accomplishment of this resulted in a temporary impairment of efficiency and a correspondingly greater tax upon the organism. The progress of this adjustment is controlled by the same factors which govern an individual's adaptability in other situations and is related in part to his variability from day to day. The extent to which noise effects and adjustment are dependent upon the quality and quantity of the noises themselves must be determined by future investigators.[7]

Other studies involving psycho-physiological functions have shown that though nervous fatigue was less obvious than other more measurable phenomena, it was a serious factor.[8] That

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6 F. L. Harmon, "The Effects of Noise Upon Certain Psychological and Physiological Processes," Archives of Psychology, No. 147, 1933, 79.

7 Ibid., 80.

8 P. E. Sabine, "The Problems of Industrial Noise," American Journal of Public Health, XXIV, 1944, 366.

the ill effects of distraction were not consciously recognized cannot alter the fact that they might have existed as a constant drain on nervous and physical energy. It has been further postulated that the higher the center of the neural hierarchy actively involved, the quicker it tires.[9] Therefore activities which involved abstract thinking, or ever thinking on a lower level, fatigued the organism with greater rapidity than physical activity which involved less of the thought processes.

As noted previously, in the field of industrial psychology empirical studies have been made to discover answers to allied problems dealing with the effects of music and distractions on efficiency in the various aspects of production.

An early experiment in the industrial setting showed some interesting conclusions:

1) Phonograph music was felt to be a decided advantage to workers in an architectural drafting room.

2) Few workers suggested that the music distracted them or hindered them in their work.

3) Instrumental music was preferred.

4) Unfamiliar music was not considered desirable.

5) It was found that music aided the workers in two ways. First, many felt that it actually speeded movements. Sec-

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9 F. Kenny, "Fatigue and Noise in Industry," New York State Journal of Medicine, XXXVI, 1936, 1927.

ond, practically all the workers found it beneficially affected their moods and spirits, which in turn was thought to be reflected in their work.

6) Music was most effective when played frequently and for short periods. It was less effective when used rarely as sort of a diversion or intermission.[10]

Jazz and dirge music were used in one experiment because they were considered extremes. The subjects were typists, and as expected the music appeared to them as a serious distraction. The author suggested that it would be a safe procedure, where speed and accuracy were demanded, to avoid distractions of this type unless it could be demonstrated that accommodation had taken place to such an extent that performance would not be affected materially. Accommocation over a protracted period was not measure in the latter experiment.[11]

Often other factors besides music, distraction or silence could enter the experimental situation to affect the resultant data. Studies were made in an industrial plant in which the playing of music had been an established practice for five years previously. The statistical computations indicated that

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10 Esther L. Gatewood, "An Experiment in the Use of Music in an Architectual Drafting Room," Journal of Applied Psychology, V, 1921, 357-358.

11 M. B. Jensen, "The Influence of Jazz and Dirge Music Upon Speed and Accuracy of Typing," Journal of Educational Psychology, XXII, 1931, 461-462.

scrappage results were in general higher in the absence of occupational music than during its presence, but inconsistencies in the statistical results indicated that factors other than music were present. None of these factors were observed but it was suggested that they operated to produce some and possibly all of the differentiating effects noted.[12]

Kirkpatrick, after viewing the field of music in industry, made the following evaluation:

> It seems fair to conclude after a survey of experimental literature that no highly significant or conclusive research has been published concerning the effect of music on the output or health of workers in industry. This is a field of research that may be attractive and rewarding for the psychologist who is interested in industry and in social processes. It is possible to note some generalizations to come from experimental work and from intelligent observations made by management and labor. There is good reason to believe that the use of music in industry does relieve boredome and that it facilitates socializing. It is a general agreement that, properly controlled, music may increase happiness and contentment in work, improve output and lessen fatigue, and make the work setting attractive to applicants. Experience and experimental evidence also seem to indicate: (1) Music is most often appreciated by workers who perform repetitive manual tasks which require little mental concentration; (2) the music should be "turned on" only for comparatively short periods and that this should be determined by the study of fatigue curves; (3) workers say that music is desirable and helpful in their "feelings" during work hours; (4) music is a hindrance to those types of work that demand mental concentration; and (5) as a general rule, two or perhaps three periods of music of less

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12 J. F. Humes, "The Effects of Occupational Music in the Manufacture of Radio Tubes," Journal of Applied Psychology, XXV, 1941, 585.

than half hour's duration produce the most satisfactory results.[13]

Following the entry of the United States into the Second World War, the management of the R.C.A. Victor Division of the Radio Corporation of America became greatly interested in either verifying or repudiating the claims, some admittedly extravagant, made by various individuals regarding favorable effects of music on factory output. Previous "careful" experiments were noted by the authors, and four further experiments were conducted in different factories. In the light of the results the following facts were enumerated:

1. In 12 out of 12 comparisons, average output was greater on music than on no-music or less-music days.
2. In 7 out of 10 comparisons, average quality was higher on no-music or less-music days than on music days, while in the other comparisons the opposite was true.
3. In 5 out of 5 comparisons, over net good yield was higher with music than without music.
4. Present evidence indicates that best production is achieved with music that is subjectively of moderate or peppy tempo.
5. Music in these experiments was associated with greater percentage of production increases in those departments not having incentive-wage systems.
6. Additional research is needed on the effects of specific musical factors on efficiency.[14]

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13 F. H. Kirkpatrick, "Music in Industry," Journal of Applied Psychology, XXVII, 1943, 270.

14 W. A. Kerr, "Effects of Music on Factory Production," Applied Psychology Monograph, 1945, No. 5.

Summary and Conclusions:

As has been noted, the problem of the effects of noise and music on individuals in different situations is a complex one. Inconsistencies in the different studies and within the same studies indicate that factors other than the noise or music were often present. However a number of generalizations are warranted.

Irrelevant or disturbing noises or music, especially those interpreted as intermittent noises, tend to have a permanent effect upon the subjects. These effects are presumably most detrimental to activity that demands concentrated or precise work, generally work including the activity of the higher thought processes. These effects have been measured by checking noticeable overt effects, subjective effects, and measuraable physiological effects.

Adjustment to such distraction, in many cases, develops over a period of time, tending to appear first in those periods which show the greatest initial effect of the disturbance, and to continue in the subsequent work periods.

Extreme types of music are generally harmful to any activity that demands some concentration. The gay, rich toned, harmonic melodies are thought to be beneficial to work that does not demand the use of concentrated mental activity. But it is suggested that differences in native endowment and training are

accompanied by individual differences in the reactions to certain types of music.

Essentially then, the problems center around the question of whether music injected into a situation is a distraction from the task performed, or whether the music is subjectively or physiologically disturbing. It would seem likely that, though generalized rules have been attempted, the actual solution to the question depends on the testing of a sufficient number of hypotheses within the specific situations under observation.

CHAPTER III

PROCEDURE AND MATERIALS

The subjects for this study were high school students. It was thought that they would possibly be more naive than college students, and therefore the study might be less influenced by the effects of suggestion.

These subjects were volunteers solicited from Boy Scout troops, girls' clubs, and also consisted of neighbors or friends of the writer. They resided in the southwest districts of Chicago and in Blue Island, Illinois.

The tests were conducted in the homes of the subjects during the preliminary experimental periods. The subjects were asked to time themselves and in other ways conduct all the duties involved in the testing procedure. However it was suggested by a number of parties that at least two serious difficulties could interfere.

1) The subjects might be distracted by their duties as time keepers etc., would not maintain uniform effort on the tests, and consequently would invalidate the results.

2) Unfortunately some students might try to show themselves at their best advantage, and a few papers where cheating occurred

would invalidate the data.

As a result of the latter suggestions, a number of changes were incorporated into the test procedures. The present experiments were conducted either in the home of the subject, or in the home of a friend of the subject. The test materials were handled by the friend of the subject who was termed the "experimental assistant." Later that friend, the experimental assistant, acted as the subject, with the original subject conducting the tests.

The experiments were presented to the subject in sealed envelopes, which were broken only according to the directions, and following completion of the experiments were sealed and given back to the experimental assistant. This procedure eliminated the assistant's opportunity to note any of the contents of the experiments, this being necessary since he was later to act as the subject. This method, furthermore, discouraged cheating by the subject.

A number of days prior to the time of the experiment both the subject and the assistant were given the opportunity to read the specific directions in the presence of the writer and questions were answered at that time. To further insure an understanding of the crucial directions, a list of reminders was discussed with these individuals. This list is printed on the directions to the experimental assistant as may be noted by re-

ferring to the sample test.

The test materials consisted of paired nonsense syllables and simple visual forms. It was thought that such materials could be most easily paired for equal difficulty and would also be amenable to statistical treatment. The materials used were previously tested, altered, and retested under like conditions with groups of high school students.

The nonsense syllables were, for the most part, unpronounceable, though through the process of alteration a number of pronounceable syllables were added. The lists were made long enough to have an adequate number of components so that they might receive valid statistical treatment, and it was likewise important that they be learned or memorized within a short time. The tasks had to be short since they were presented to volunteer high school students and it was apparent in preliminary experiments that boredom is an important factor with these individuals. The tasks were further structured so that they would be difficult enough for the more mature or intelligent students, and yet not too difficult for the less intelligent.

Additional paragraph material was tried but eliminated after the preliminary experiments because of the difficulty of adequate matching. Research in related literature further gave the impression that paragraph materials were very seldom competently used, presumably because of their unreliability. On the

other hand nonsense syllables and visual forms did not seem to differ in difficulty to any great extent and thus were considered adequate for the present study, as may be noted in the following table.

TABLE I

THE DIFFERENCES IN DIFFICULTY BETWEEN PAIRED LISTS OF TEST MATERIALS DURING SIMILAR PERIODS OF SILENCE

Nonsense Syllables				
N	Mean Score First Period	Mean Score Second Period	"t" of Difference	Significance Level
34	.44	.47	.94	40 - 30%
Paragraphs				
N	Mean Score First Period	Mean Score Second Period	"t" of Difference	Significance Level
27	.30	.35	1.64	20 - 10%
Visual Forms				
N	Mean Score First Period	Mean Score Second Period	"t" of Difference	Significance Level
15	.38	.42	.95	40 - 30%

The paired tests were interchanged in sequence to avoid significant errors in the results due to differences in difficulty. The music was alternately presented so that its effects, as to position, would not also significantly invalidate the results, as noted in Table II.

TABLE II

INTERCHANGE OF MATERIALS AND MUSIC

Group Category I

Test IA " IIA	Presented with the radio
Test IB " IIB	Presented during a silent interval

Group Category II

Test IB " IIB	Presented with the radio
Test IA " IIA	Presented during a silent interval

Group Category III

Test IA " IIA	Presented during a silent interval
Test IB " IIB	Presented with the radio

Group Category IV

Test IB " IIB	Presented during a silent interval
Test IA " IIA	Presented with the radio

Here Test IA signifies one list of nonsense syllables, and Test IIA a paired list of nonsense syllables. Test IB signifies one list of visual forms, and Test IIB a paired list of visual forms.

The radio programs were not restricted to a musical or to any specific program but were chosen entirely by the subject,

as may be noted on the directions for the subject on the sample test. It was thought that a suggested or restricted radio program would deviate from the normal study habits of the subjects.

The statistical analysis and method used can be divided into two sections: the scoring of the tests, and the evaluation statistically of the data obtained.

The Scoring of the Tests: As noted previously, in the tests the original stimuli were dispersed among a large number of similar stimuli. The recognition of the number of original stimuli would give the "raw score." But it is obvious that the falsely recognized stimuli must also affect the score. Therefore the following familiar formula was used.[1]

$$\text{Score equals } \frac{\text{Right} - \text{Wrong}}{N}$$

Here "N" is the whole number of test stimuli; "Right" equals the number of correctly recognized stimuli; and "Wrong" equals the number of incorrectly recognized stimuli.

The Statistical Evaluation of the Data: The data were evaluated as to the significance of differences between the means scores of the paired lists of stimuli or test materials. The small sample theory was used which required the use of the

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[1] R. S. Woodworth, Experimental Psychology, New York, 1938, 11.

formula:

$$t \text{ equals } \frac{M_o - M_h}{\sqrt{\frac{\text{Sum } d^2}{n(n-1)}}}$$

Here "M_o" is the observed mean; "M_h" is the hypothetical mean, which in our present experiment is equal to zero since we are testing the hypothesis that the true difference between the means is zero; "d" equals the deviation from the mean of the differences; and "n" equals the number of subjects.

The use of the statistical evaluation "t" was essential in this study. The formula for the standard error of the mean is based on an unknown parameter, that of the standard error of the population. But we are able to secure an estimate of the true standard error of the mean by substituting for the parameter in the formula the standard error of the sample. When the sample is large, the statistic is reasonably close to the true parameter but with a small sample the error may be large and involve a serious error. Therefore the need for a small sample theory. The theory used is that supplied by the statistician Fisher.[2]

The present method had in part evolved from previous studies in which the subjects were asked to memorize nonsense syllables under the influence of recorded radio programs, as

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2 E. F. Lindquist, Statistical Analysis in Educational Research, New York, 1940, 51.

contrasted with silent conditions. The studies did not solve our present problem because the socio-environmental conditions were considered too divergent from normal study situations. Decided advantages of the present study, in terms of methodology, are presented as follows:

1) The radio programs were chosen by the subjects individually.
2) The study situation was more natural. The surroundings were those in which the study would have been most often performed.
3) The time of day agreed with usual study habits.
4) The effects of strangers or groups not usually in the study situation could be avoided.
5) The effects of suggestion were less liable to invalidate the results. Instructions were carefully written to overcome the perhaps serious effects of suggestion.[3]
6) Disturbing physiological and psychological states could be more easily eliminated from the test situation. This

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3 One researcher showed in his study that if the subjects were led to believe that music would facilitate work, they gained a little, but if led to believe that music disturbed their work, they lost a little. K. H. Baker, "Pre-Experimental Set in Distraction Experiments," Journal of General Psychology, XVI, 1937, 471.

was more possible since the subjects could pick their own times for the experiment, and likewise were not subjected to the general laboratory conditions.

7) The procedure was more adequately controlled with the applications of precise instructions, and the use of an "experimental assistant" who directed the subject's use of the materials.

CHAPTER IV

RESULTS AND INTERPRETATION

A total of sixty nine per cent of the tests given out were returned. Of these a number were discarded as the result of the mishandling of test materials. The following table summarizes the data on the collection of the material and subsequent use of it.

TABLE III

NUMBER OF TESTS DISTRIBUTED AND USED

Test Given Out	162
Test Returned	113
Tests Discarded	9
Tests Used	104

Each of the group categories (noted in Table II, p. 17) was made up of approximately twenty-five per cent of the total subjects, as shown in Table IV. Therefore it may be suggested that the interchange of materials and the alternated sequence of the radio programs ruled out significant statistical errors in case the tests themselves were not adequately matched, or in case

a set sequence of music would have affected the results.

TABLE IV

NUMBER OF SUBJECTS IN THE GROUP CATEGORIES

Group	N
I	27
II	25
III	24
IV	28
Total	104

The data were divided for analysis on the basis of supplementary information obtained on the question sheet, which was included in the test materials.

For all such groupings of data the music score for the nonsense syllables was lower than the silence score, but the music score for the visual forms was higher than the silence score. Though significant values for "t" were not found, it may be suggested, on the basis of trends noted in these data, that nonsense syllables were less easily learned than visual forms when the learning took place under the extraneous influence of the radio. This may have been because the nonsense syllables demanded more concentrated mental activity.

TABLE V

THE EFFECTS OF RADIO PROGRAMS ON THE MATERIALS USED

Nonsense Syllables				
N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
104	.24	.27	1.17	30 - 20%

Visual Forms				
N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
104	.49	.45	1.45	20 - 10%

TABLE VI

THE EFFECTS OF THE RADIO ON MALES AND FEMALES

Nonsense Syllables				
Subjects	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Males N =63	.21	.28	1.33	20 - 10%
Females N =41	.25	.25	0.00	100 - 90%

Visual Forms				
Subjects	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Males N =63	.55	.49	1.36	20 - 10%
Females N =41	.39	.36	.61	60 - 50%

Table VI indicates that the boys tended to react more to the radio programs while learning the materials than the girls. In the tests with the nonsense syllables the boys seemed to do more poorly while under the influence of the radio, but the girls did not seem to be disturbed. The boys tended to do better on the visual forms with the radio. The girls also tended to do better though to a lesser degree.

Though the ages and school grades of the sexes were approximately equivalent, it would seem likely, as suspected by some writers, that the girls were more mature physically[1] and mentally,[2] and consequently then perhaps more stable. If this be the case it would also seem likely that the girls, as a group, would be less affected by interfering influences, were the influences detrimental or beneficial. On the basis of such an hypothesis the data would not seem unusual.

The test information sheet required that the subject indicate whether he often studied with the radio on, or not. He was asked whether he thought that the radio helped him to study,

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1 As shown by two well known studies: B. T. Baldwin, Laura M. Bresby, and Helen V. Garside, "Anatomic Growth of Children, A Study of Some Bones of the Hand, Wrist, and Lower Forearm, By Means of Roentgenograms," University of Iowa Studies in Child Welfare, 1928, 4, No.1., and C. D. Flory, "Sex Differences in Skeletal Development," Child Development, 1935, VI, 205-212.

2 D. Wechsler, Measurement of Adult Intelligence, Baltimore, 1944, 107.

or whether he thought it did not. On the basis of these questions four groups were formed, as shown by Tables VII to X. It could be expected that "suggestion" would have some effect, but if this were the case with some individuals it was not indicated in these group results. Furthermore, specifically because of the contradictory results of the two types of materials that made up the tests, it would be erroneous to even think that one or another of these four groups were more or less affected by the radio in their tasks of memorization. However it would be expected that memorization of the nonsense syllables for these groups would be more difficult with the radio, while memorization of the visual forms may have beenfacilitated by the radio programs.

TABLE VII

THE EFFECTS OF THE RADIO ON SUBJECTS OFTEN STUDYING WITH THE RADIO ON, AND BELIEVING THAT THE RADIO HELPS THEM TO STUDY

Test Materials	N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Nonsense Syllables	33	.17	.24	1.33	20 - 10%
Visual Forms	33	.44	.39	.70	50 - 40%

TABLE VIII

THE EFFECTS OF THE RADIO ON SUBJECTS OFTEN STUDYING WITH THE RADIO ON, BUT BELIEVING THAT IT DOES NOT HELP THEM TO STUDY

Test Materials	N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Nonsense Syllables	42	.22	.26	.73	50 - 40%
Visual Forms	42	.48	.41	1.13	30 - 20%

TABLE IX

THE EFFECTS OF THE RADIO ON SUBJECTS NOT OFTEN STUDYING WITH THE RADIO ON, AND BELIEVING THAT IT DOES NOT HELP THEM TO STUDY

Test Materials	N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Nonsense Syllables	22	.32	.41	1.42	20 - 10%
Visual Forms	22	.54	.46	1.27	30 - 20%

TABLE X

THE EFFECTS OF THE RADIO ON SUBJECTS NOT OFTEN STUDYING WITH THE RADIO ON, BUT BELIEVING THAT IT HELPS THEM TO STUDY

Test Materials	N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Nonsense Syllables	7	.20	.28	.95	40 - 30%
Visual Forms	7	.54	.51	.84	50 - 40%

The choice of radio programs is similar to that which could be expected. Popular music was by far the outstanding

choice of the subjects. Of this latter group selecting popular music, approximately one half selected plays or comedies as second choices, as can be seen in Table XI. A much smaller group picked for their first choice classical or light classical music. Within this group well over half, as a second choice, picked the general category music, probably referring to music other than classical. A much smaller group, less than one tenth of the subjects, picked plays or comedies as their first choice. As their second choice this group picked predominantly musical programs.

TABLE XI

PREFERENCE OF RADIO PROGRAMS WHILE STUDYING

Group	First Choice		Second Choice	
	Type of Program	%N	Type of Program	%N[a]
A	Popular Music	73	Plays, Comedies, etc.	50
			Music[b]	40
			None[c]	10
B	Classical Music	18	Music	60
			Plays etc.	30
			None	10
C	Plays, Comedies, etc.	9	Music	60
			Plays etc.	30
			None	10

a The percentage on the second choice was only approximate for occasionally programs were of mixed categories and yet they were forced into one or another group.

TABLE XI CONTINUED

PREFERENCE OF RADIO PROGRAMS WHILE STUDYING

b In most cases, on the second choice, the term music was not differentiated into classical, popular etc..

c In approximately ten per cent of the information sheets second choices were not indicated.

Groups could be separated, as noted above, on the basis of the types of programs selected by the subjects in the actual experiment. Again, as with previous groupings of the data, it is difficult to draw any general conclusions since the two types of material gave contradictory scores.

TABLE XII

THE EFFECTS OF POPULAR MUSIC

Test Materials	N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Nonsense Syllables	76	.22	.27	1.38	20 - 10%
Visual Forms	76	.50	.46	1.08	30 - 20%

Table XII shows that popular music tended to affect the memorizing of nonsense syllables unfavorably, visual figures favorably, but neither significantly better than the ten per cent level.

The following table shows similar effects for the classical music on the nonsense syllables, but little or no

effect on the visual figures.

TABLE XIII

THE EFFECTS OF CLASSICAL AND LIGHT CLASSICAL MUSIC

Test Materials	N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Nonsense Syllables	19	.24	.33	1.44	20 - 10%
Visual Figures	19	.48	.44	.45	70 - 60%

Table XIV shows that plays and comedies made no significant differences on the memorizing of the materials.

TABLE XIV

THE EFFECTS OF PLAYS, COMEDIES, ETC.

Test Materials	N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Nonsense Syllables	9	.18	.22	.50	70 - 60%
Visual Figures	9	.47	.35	.78	50 - 40%

CHAPTER V

SUMMARY AND CONCLUSIONS

This study has attempted to solve in part a serious problem that has often confronted many students. Does the radio have a noticable effect on the individual who is studying? Related problems were also considered of which some were the following. Did the radio, under the experimental conditions, affect the sexes differently? Did the type of radio program chosen make significant differences? Were there differences in the group that did not often study with the radio? Did suggestion influence the results?

The materials used consisted of lists of nonsense syllables and visual figures, which were chosen primarily because they could be most easily matched for difficulty and were amenable to statistical treatment. Statistically, the data were dealt with by means of the "t" technique.

The results did not show significant differences, though they did show specific trends, and suggestions were consequently pointed out. The two types of materials seemed to be affected differently by the radio in all groupings, the nonsense

syllables showing negative and the visual figures showing positive results. Girls did not tend to be affected as greatly by the radio as were the boys. Popular music was by far the main choice of the subjects, classiscal music and plays or comedies following in order. Music tended to affect the memorizing of nonsense syllables unfavorably, visual figures favorably. Plays and comedies showed similar, but slight trends. Suggestion did not seem to affect the results.

What light do the findings of the present experiment throw on the conclusions or generalizations noted in the analysis of research in recent literature? Related literature has suggested that irrelevant and disturbing noises or music tend to have a permanent detrimental effect on the subjects. This may have been true also within the present group, though the results do not indicate that a significant number of the subjects were disturbed, and furthermore such disturbance was noted only in the nonsense syllables. The latter finding could be taken to be in agreement with a number of studies which indicate that music or noise is most detrimental to activity demanding concentrated activity of the higher thought processes. Such an argument would presuppose that the memorization of nonsense syllables requires a higher level of mental activity than the memorization of the visual forms.

Recent literature points to the advisability of

observing specific situations, rather than of taking at face value previous generalizations even though they are based on similar circumstances. Therefore it was attempted to observe students studying in their natural surroundings.

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TABLE XV

A COMPLETE LISTING OF ALL SCORES MADE UNDER THE VARIOUS CONDITIONS OF THE EXPERIMENT

Nonsense Syllables			Visual Forms		
Music	Silence	Difference	Music	Silence	Difference
.0	.0	.0	.4	.2	.2
.4	-.2	-.2	1.0	1.0	.0
.4	.8	-.4	.8	.8	.0
-.2	.0	-.2	.6	-.2	.8
.0	.0	.0	.8	.4	.4
.4	.4	-.2	.6	.8	-.2
.0	.6	-.6	.8	.4	.4
.4	.6	-.2	.6	.2	.4
.2	.6	-.4	.0	.2	-.2
.4	.4	.0	.0	.6	-.6
.4	.0	.4	.6	.4	.2
-.2	.2	.0	.4	.4	.0
.4	.2	.6	1.0	.8	.2
.8	.6	.2	.6	.6	.0
-.2	.0	.2	.6	.4	.2
-.4	-.2	-.2	.2	-.4	.6
.4	.2	.2	.2	.6	-.4
.6	.0	.6	.8	1.0	-.2
.4	.6	-.2	.4	.4	.0
.2	.6	-.4	1.0	.8	.2
-.2	.0	-.2	.6	.6	.0
.4	.2	.2	.4	.2	.2
.6	.4	.2	.2	.8	-.6
.0	.6	-.6	.8	.8	.0
.6	.2	.4	.8	.4	.4
.2	.2	.0	.6	.8	-.2
-.6	-.4	-.2	.8	.4	.4
.0	.0	.0	.4	.2	.2
.4	.6	-.2	.0	-.4	.4
.0	.4	-.4	.6	1.0	-.4
.4	.4	.0	.8	.6	.2
-.2	-.2	.0	.4	.2	.2
-.4	.0	-.4	.2	.6	-.4
.6	.4	.2	.6	.4	.2
.8	.2	.6	.2	.2	.0

(Table XV is Continued on Page 40)

TABLE XV CONTINUED

A COMPLETE LISTING OF ALL SCORES
MADE UNDER THE VARIOUS CONDITIONS OF THE EXPERIMENT

Nonsense Syllables			Visual Forms		
Music	Silence	Difference	Music	Silence	Difference
-.2	.0	-.2	.8	.2	.6
.0	.2	-.2	1.0	.6	.4
.2	.6	-.4	.6	.4	.2
.4	.2	.2	.0	-.2	.2
.4	.8	-.4	.8	.4	.4
.0	.0	.0	-.2	.4	-.6
.0	.6	-.6	.6	.6	.0
-.2	-.4	.2	.4	.0	.4
.4	.8	-.4	1.0	1.0	.0
.8	.2	.6	.2	1.0	-.8
.4	.6	-.2	.8	.6	.2
.6	.2	.4	.2	.6	-.4
.2	.0	.2	.2	.4	-.2
.2	-.2	-.4	1.0	1.0	.0
-.4	-.2	-.2	.6	.8	-.2
.2	.4	-.2	.8	.4	-.4
.6	.8	-.2	.2	-.2	.4
.4	.6	-.2	.8	.8	.0
.6	.6	.0	.6	.4	.2
-.6	-.4	-.2	.8	1.0	-.2
.2	.6	-.4	.8	.8	.0
.2	.0	.2	.6	.8	-.2
.2	.2	.0	.2	.0	.2
.8	.4	.4	.8	.6	.2
.2	.6	-.4	.4	.2	.2
.2	.2	.0	.8	.2	.6
.6	.8	-.2	.4	.4	.0
.4	.2	.2	.8	.8	.0
.4	.2	.2	.2	.4	-.2
.0	.4	-.4	.0	-.6	.6
.4	.2	.2	-.4	.2	-.6
.2	.6	-.4	.6	.2	.4
.4	.4	.0	.8	.6	.2
.8	.2	.6	.0	-.2	-.2
-.4	-.2	-.2	.2	.0	.2

(Table XV is Continued on Page 41)

TABLE XV CONTINUED

A COMPLETE LISTING OF ALL SCORES
MADE UNDER THE VARIOUS CONDITIONS OF THE EXPERIMENT

Nonsense Syllables			Visual Forms		
Music	Silence	Difference	Music	Silence	Difference
.8	.4	.4	.2	.4	-.2
.0	.0	.0	.4	.4	.0
.0	.0	.0	.2	.8	-.6
-.2	-.4	.2	.4	.4	.0
-.2	.4	-.6	.0	.2	-.2
.2	.2	.0	.0	-.6	.6
.4	.8	.4	.6	.8	-.2
.4	.2	.2	.6	-.2	.8
.4	.4	.0	.6	.4	.2
-.2	.2	-.4	.6	.6	.0
-.4	-.2	-.2	.2	.4	-.2
.8	.4	.4	.6	.4	.2
.0	.2	-.2	.8	1.0	-.2
.0	.0	.0	.6	.4	.2
.4	.2	.2	.2	.6	-.4
.8	.4	.4	.0	.0	.0
.6	.2	.4	1.0	.6	.4
-.2	.0	-.2	-.2	-.4	.2
.2	.4	-.2	.8	1.0	-.2
.6	.8	-.2	-.2	.4	-.6
1.0	.8	.2	.8	.2	.6
.6	1.0	-.4	.2	.2	.0
.2	.0	.2	.6	.4	.2
.4	.8	-.4	.6	.8	-.2
.4	.6	-.2	.4	.8	-.4
.2	.6	-.4	.4	.0	.4
1.0	1.0	.0	.0	.6	-.6
.8	.8	.0	.6	1.0	-.4
-.4	-.6	-.2	1.0	.8	.2
-.2	.0	-.2	.2	.4	-.2
.4	.2	.2	.6	.8	-.2
-.2	-.4	.2	.4	.0	.4
.8	.4	.4	.6	.6	.0
.2	.2	.0	.8	.6	.2

(See Table XVI for Statistical Evaluation of Above)

TABLE XVI

THE STATISTICAL EVALUATION OF ALL SCORES
MADE UNDER THE VARIOUS CONDITIONS OF THE EXPERIMENT

Test Materials	N	Mean Score With Music	Mean Score Without Music	"t" of Difference	Significance Level
Nonsense Syllables	104	.24	.27	1.17	20 - 30%
Visual Forms	104	.49	.45	1.15	20 - 30%

SAMPLE TEST

Directions for the experimental assistant:

You are entrusted as the experimental assistant in the psychological experiment to be presented to your partner. Your main duty is to see that the following directions are carried out exactly, without any exception. You can easily see what kind of an experiment this would be were you not present to supervise it. It would be quite a muddle!!

(1) Read direction no. 1 of your subject's experiment. (This serves a double purpose. It will tell you what must be done before the experiment can actually begin. Also it will give you the opportunity to choose ahead of time your radio program, since you will later also take the experiment yourself - of course then you will become the subject and your partner will be the assistant.)

(2) When the radio program mentioned in direction no. 1 has already been turned on, give envelope no.2 to the subject who will open it and will read the directions. When the subject has read the directions he will ask you to time him for 2 minutes. At the end of the 2 mins. ask him to close the envelope and give him a seal with which he should seal it. Then lay the envelope aside and give him envelope no. 3. The same procedure is repeated with each succeeding envelope until the experiment is completed. AT NO TIME SHOULD YOU READ ANY PART OF THE SUBJECT'S EXPERIMENT (except for direction no.1) since you later will also take the experiment and advance information would destroy the results.

(3) Before opening envelope no. 4 the radio should be turned off.

(4) Reminders:

a. Time the subject for exactly 2 minutes - begin timing after the subject has finished reading the directions on each sheet and says, "time me."

b. Do not open the envelope - let the subject do it.

c. " " seal " " " " " " " " " " before he gives it back to you.

d. Turn the radio off before the subject opens envelope no. 4.

SAMPLE TEST

As you know, this is an experiment in psychology, but only if you follow all the directions carefully will you be contributing to it success.

Direction no. 1.

What type of radio program do you listen to when you are doing your studies or homework? And if you don't listen to the radio while you study, then which type of radio program do you think you would like to listen to most while studying. In any case, consult the radio program in your newspaper, and then tonight, or tomorrow, or when it is most convenient for you and your partner, turn on that special program and be prepared to spend 30 minutes on this experiment. (If possible, try to be alone, or ask others present not to disturb you for those 30 mins.) Do not open envelope no. 2 until you are actually listening to that special radio program. You will need a pencil and a watch with a second hand.

You will be working with a partner. He will handle all the material and will give it to you when needed and also will time you for the required 2 minute intervals. Please be sure that you are the one who breaks the seal on the envelope when your partner gives it to you, and also seal it again before giving it back.

SAMPLE TEST

Direction no. 2 (Do not read the following until you are actually listening to the radio program mentioned in direction no. 1)

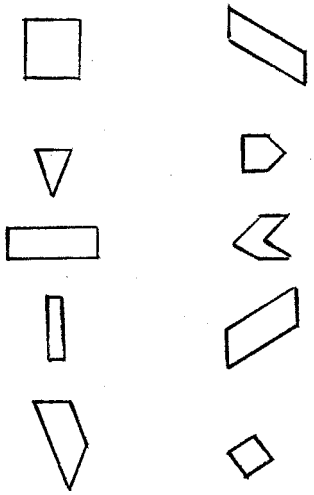
You see under these directions 2 lists of nonsense syllables or words without a meaning. Please learn these two lists (know the words), for you will be asked later to pick out these syllables which will be dispersed or scattered in a large list of other nonsense syllables. There are 10 words - learn each of them. You have two minutes to learn this list. Now ask your assistant to time you.

RJP	EWM
NSX	ZTD
LQA	BKO
CYV	BQO
UFI	HZD

SAMPLE TEST

Direction no. 3. You see under these directions 10 figures. Learn (try to remember) these figures for later you will be asked to identify them when scattered among a large number of similar figures. (Hint - Notice also in which direction the figures face. As an example, the following figure (↑) faces upwards. Therefore if later you were asked to pick out the correct figure, or a figure from the original list that you learned, you would encircle the first of the following four figures (↑ ↓ → ←) since you would have rembered that the correct figure faced upwards.

You have two minutes to learn these figures. Ask your assistant to time you, then begin.



SAMPLE TEST

Direction no. 4. (Do not read the following until you have turned off the radio program you were just listening to.)

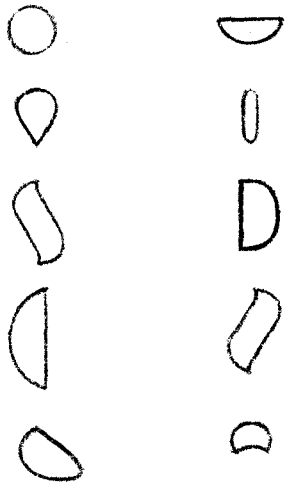
Again you see under the directions 2 lists of nonsense syllables, or words without a meaning. Please learn these two lists (know the words), for you will be asked later to pick out these syllables which will be dispersed or scattered in a large list of other nonsense syllables. There are 10 words - learn each of them. You have two minutes to learn the lists. Ask your assistant to time you, then begin.

FMR	NSB
CJT	WLE
YGO	UHD
IZK	PVH
XAQ	VLD

SAMPLE TEST

Direction no. 5. Again you see under the directions 10 figures. Learn (try to remember) these figures for later you will be asked to identify them when scattered among a large number of similar figures. (Hint - Notice also in which direction the figures face. As an example, the following figure (↑) faces upwards. Therefore if later you were asked to pick out the correct figure, you would encircle the first of the following four figures (↑ ↓ → ←) since you would remember that the correct figure faced upwards.)

You have two minutes to learn these figures. Ask your assistant to time you, then begin.



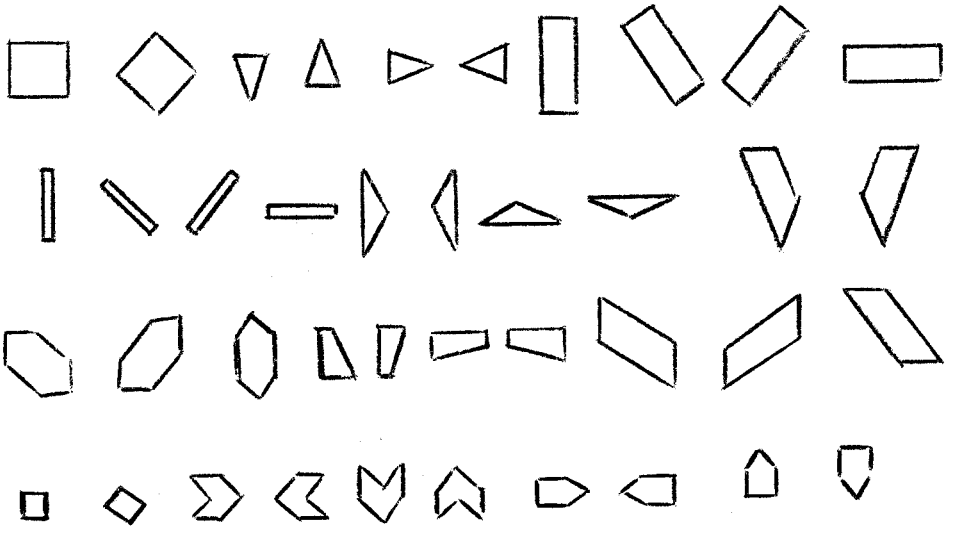
Direction no. 6. You see before you a larger group of nonsense syllables. Among these are scattered the first list of ten syllables that you were asked to learn. Draw a circle around every syllable that you recognize. Circle 10 of the syllables even if you have to guess at some of them. You have two minutes to do this. Ask your assistant to time you, then begin.

MOE	TDZ	BKO	BCQ
BGO	HZB	GBO	ZTD
IFU	NSX	ZHD	ZDH
HSD	OGB	EZD	EWM
HZD	DZH	RJP	BGQ
MWE	UFI	OKB	TZD
LQA	KBO	GOB	CYV
DTZ	KOB	BKQ	WEM

SAMPLE TEST

Direction no. 7. You see under these directions a large group of figures. Among these are scattered the first group of 10 figures that you were asked to remember. Draw a circle around every figure that you can identify as one of the first list of ten figures. Circle 10 of the figures even if you have to guess at some of them.

You have two minutes to do this. Ask your assistant to time you, then begin.



SAMPLE TEST

Direction no. 8. You see before you a larger group of nonsense syllables. Among these are scattered the second list of ten syllables that you were asked to learn. Draw a circle around every syllable that you recognize. Circle 10 of the syllables even if you have to guess at some of them.

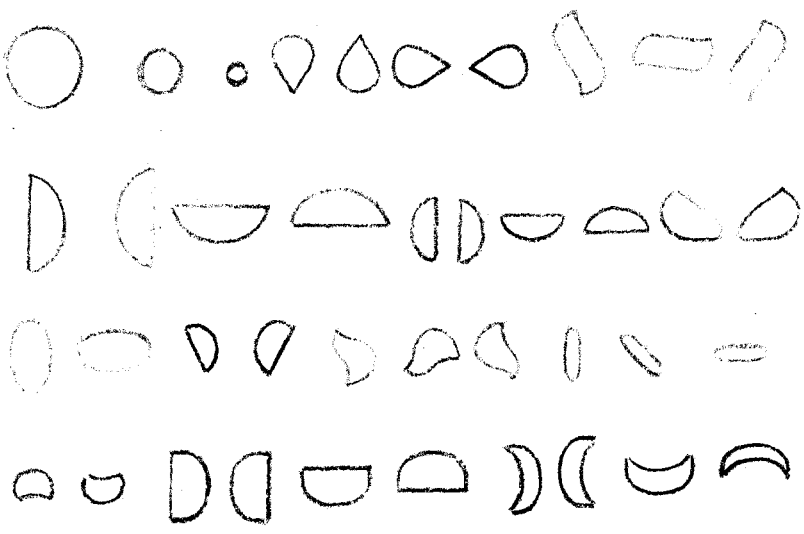
You have two minutes to do this. Ask your assistant to time you and then you may begin.

GIZ	LEW	UHD	PUH
PVH	VLE	VHP	WLE
QAX	CJT	LDV	LVD
VID	HVP	ULD	NSB
VLD	DLV	FMR	PVE
BSN	XAQ	DHU	LWE
YGO	HDU	VPH	IZK
ELW	HUD	UHB	SNB

SAMPLE TEST

Direction no. 9. Again you see under these directions a large group of figures. Among these are scattered the second group of 10 figures that you were asked to remember. Draw a circle around every figure that you can identify as one of second list of 10 figures. Circle 10 of the figures even if you have to guess at some of them.

You have two minutes to do this. Ask your assistant to time you, then begin.



SAMPLE TEST

Direction no. 10. Please encircle the appropriate answer, or fill in the blanks where indicated.

Name ..... Age ..... Sex - M or F

Last year of schooling completed .....

Do you often study with the radio on? -- Yes or No

Does the radio actually help you to study? -- Yes or No

What program did you listen to for this experiment .....

.....Time of Program ..... A.M. or P.M.

What other types of programs do you listen to while studying?

(In order of preference) .....

.....

.....

Any additional comments that you would care to make .....

.....

May I thank you sincerely for your help in completing this study. There is no doubt that without your help and the help of your friends this study could never have been possible.

(Please also seal this sheet before handing it back to your assistant.)

APPROVAL SHEET

The thesis submitted by William Edwin Tatter has been read and approved by three members of the Department of Psychology.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Arts.

Nov. 22, 1951
Date

Vincent V. Herr SJ.
Signature of Adviser