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The Distracting Influence of Radio Speech Upon Performance in Silent Reading

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THE DISTRACTING INFLUENCE OF RADIO SPEECH UPON PERFORMANCE IN SILENT READING

BY

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Introduction

Like many of the complexities of modern living, the radio poses a question for the teacher and the director of student personnel. Does this radio hinder the student in his study? Among the students themselves--college students--two opinions seem to obtain. One group protests rather strongly that the radio does not hinder but actually aids study. The other holds that the effect of the radio is indifferent--it neither aids or hinders. Increasingly rare is the student who insists that the radio hinders him in his work. The experimental evidence that can be advanced does not give an unequivocal answer to the question. Theory, of course, says that if either is to receive full benefit, one or the other--the radio or the study--must be relatively unattended to, and, it might be added, that is the study. This work is an attempt to answer the question by experimental evidence. Briefly, it will be a comparison of the performance of a group of subjects under conditions which as far as is possible duplicate the actual study situation with the radio operating, with their performance on an alternate form of the test used, under conditions of normal quiet.

Chapter One

The Background

"The principle of an experiment on distraction is simple: while an assigned task is being performed, irrelevant stimuli, 'distractors,' are introduced, so as to see whether the performance is impaired in any respect. . . . A distractor must not be such as would necessarily interfere with the performance. If the task calls for comparing two tones, extraneous sounds would be more than distractors since they would mask the tones. Visual distractors would be used in such a case. When the task demands the use of the eyes, auditory distractors are usually employed." (35:704)

The experimental literature on the problem reveals that when such extraneous stimuli are so introduced into the working environment of the subject, three effects may result. The distractor may become effective and have a detrimental effect upon the subject's performance. Or it may have a beneficial effect, aiding directly or indirectly the measured efficiency of the subject in the given task. Finally it may have no measurable effect whatsoever. Sometimes two, or even all three, of these results are to be found in the work of the same investigator. Proleptically, the experimental work that has been done on the effects of distraction shows results that, in some respects, are so equivocal and contradictory that Poffenberger (26) significantly entitled his discussion of the subject "Some Unsolved Problems of Human Adjustment."

But, at the same time, several of the investigators have given a rather

clear-cut picture of the behavior of the individual working under conditions of distraction. What effect distractors have on the simpler processes, such as the lowering of olfactory threshold, need concern us only long enough to note their existence and to admit their historical significance. The investigations of various distractors on more complex processes, which shall concern us here, show very often, as has been observed, disparate results. More often than not, however, the results which are prima facie opposed one to the other may be resolved or harmonized when differences in experimental procedure and technique are taken into account. Some of these investigations were the outgrowth of practical problems; others had their origins in more purely academic concerns. Both of these springs have given rise to many significant and interesting investigations of the influence of distraction. These actual effects on the work itself we shall discuss later. Let us first see how the subject behaves under distraction.

This objective behavior of the individual subject during distraction is one aspect of the topic on which there is agreement. Several experiments give consistent and harmonious results.

Starting with the hypothesis that additional energy of some sort must be put into his work by the subject in order to overcome distraction, Morgan (23) carried out an experiment in which he could record the force with which the subject did the assigned task. He placed the subject before an apparatus with a row of ten numbered keys, somewhat like a typewriter. A single letter was automatically exposed by this apparatus and immediately the subject translated it into a number, according to a previously learned code. He then struck the

key labeled with the translated number, whereupon the apparatus at once exposed another letter to be translated and the proper key struck. This went on continuously for the whole of the working period. Unknown to the subject, who was working alone in a room apart, though the experimenter observed him through a peekhole, was the fact that the force with which he struck the keys was being recorded. Together with the striking force there were recorded the reaction time and an inspiration index, taken by means of a pneumograph around the chest of the subject. After only a little preliminiary practice the subject began working in an isolated quiet room. After work in this quiet situation had been going on for a little while, buzzers, bells, and a phonograph record, singly and in various combinations, began to sound. These distractors were placed so that, when sounded together, they seemed to come from all parts of the room. They were sounded from ten-minute periods, and were followed by ten minutes of quiet, the work continuing to go on without interruption.

With over twenty subjects, Morgan found results which showed detailed variations, but which were in agreement on significant features. Because only a little preliminary practice had been given, the subjects showed progressive improvement throughout the course of the experiment. When the distractors were first introduced, there was a marked decrement in the speed and accuracy of the work; but within a short time the former level of output was attained and improvement continued despite the presence of the distractor. At the cessation of the noise the same decrement occurred but was less pronounced and more quickly overcome than that which took place at the onset of the noise. Then, as the quiet prevailed, further improvement began to show in the performance.

The objective record of the subjects is especially interesting. During the initial quiet period the force with which the keys were struck began to decrease. At the onset of the noise there was a radical increase in the pressure of the stroke, which remained strong during the entire noisy period. When the noise stopped, the force of the stroke fell to a new low level. During the noise, too, the reaction time was faster and the inspiration time less than they had been during the period of quiet. The breathing record and the observations of the experimenter showed rather marked speech activity on the part of the subject during the noise. Later some of the subjects reported they had applied greater force and had used articulation as deliberate expedients; others said that they had done so without consciously realizing it at the time.

Ford (10) used much the same technique and found substantially the same results. With a more refined technique, Davis (7) confirmed the findings of both Morgan and Ford. He measured the muscle action potential which he found to increase during distraction. He concluded that meeting distractions definitely increases muscular activity if action potentials are any indication of this activity.

Thus far it is obvious that a change in the conditions under which the subject is working, whether the change be from quiet to noise or from noise to quiet, is a distraction, though the former is more disturbing than the latter. The total situation in which the subject is placed manifests itself in his behavior, in his output, or in both. Any change in this situation will likewise manifest itself in one or the other or in both. To attempt to explain these results in terms of vying action systems, with the bigger and more

muscular system having the ascendency, is little more than verbal iteration of the fact. Rather it would seem that the subject had accepted the conditions of the experiment, namely, to do his best in speed and accuracy, come what may. When a disturbance in the environment tended to frustrate the carrying out of his intention, he used what means he had at his disposal to persevere despite adverse conditions. In the light of this we see that there is a brief period of adjustment at the time of the change in the working environment. During this adjustment, work showed a decrease in amount and in accuracy. But beyond this short acclimation period there was no significant change, and the work continued at its former level. Often it was found that an improvement appeared in spite of the presence of the distraction. There is evidence, as well, that some of the subjects expended more energy than was necessary to overcome the distraction. A more meaningful interpretation of these facts, as far as psychology is concerned, would seem to lie in regarding them as showing how effectively man can overcome a monotonous, and, per se, meaningless distraction, using extra energy to sustain and reinforce voluntary attention to a task which he had previously accepted. Though this reinforcement may show itself in increased muscular activity, is it not perhaps missing the psychological point involved to omit the essential and purposeful note of attention, and talk in terms of the accompanying changes in the neuromuscular mechanism?

Merely saying that the subject must expend additional energy in order to overcome distraction does not give the whole picture. Harmon (14) and Poffenberger (26) have shown that if the distractor is continued over a long period of time, an additional adjustment on the part of the subject takes place. A

distractor continued over a long period loses, somewhat progressively, its ability to command attention, and the subject's output is maintained without the expenditure of additional energy.

In his investigation, Harmon (op. cit.) measured the energy expended by the subject in terms of metabolic rate as determined by a respiration apparatus. He determined the metabolic output for adding a column of figures in a quiet room, in a room where the noise of a large number of typewriters was reproduced by means of a phonograph record, and finally in a room in which the noises of a busy city corner were likewise phonographically reproduced. As had Morgan and the others mentioned above, Harmon found that when the noise was introduced there was a temporary reduction in the output of work together with an increase of metabolism for each unit of work done. For the first few days this higher metabolic rate persisted during the noise, but after he had worked about a week under constant noise for twenty minutes per day, the metabolic rate of the subject was the same for work under quiet and noisy conditions. Again, after a relatively short disturbing period at the change in working conditions, the subject returns to normal output and metabolic rate, doing the same work with noise present as he does without the noise, but with no additional expenditure of energy. Speaking of his results, Harmon says:

> Individuals working day after day in a noisy environment to which they originally were unaccustomed, may become so adjusted to these conditions that it is no longer necessary to increase energy output in order to keep performance up to the standard. Habituation, in other words, makes for automatization of functioning, and in this case, the results of continued exposure to a fairly uniform distractor is to render it impotent. This, however, is likely to apply only to distractors that are relatively constant, steady noises such as one finds in a factory, office, or in a room overlooking a busy street. It is more difficult to adjust to intermittent or otherwise variable sounds like conversation or noises which rapidly change in loudness, complexity, or other qualities. . ." (15:277)

Nothing like the unity and agreement of results shown in this work on what might be termed the physiological behavior of the individual during distraction is found in the investigations of the effect of that distractor upon the performance itself. The opinion was previously ventured that perhaps a great deal of this disparity could be attributed to differences in experimental technique. This contention is bolstered by the fact that often the same investigator found different results with a simple change in procedure. What these differences are will be seen in a consideration of some of the work in the field.

Tinker (31) seems to have been the first to investigate the influence of a distractor upon performance on a test specifically designed to measure the higher mental processes--in this case the Otis Group Intelligence Test. Using fifty-six college students, he divided his subjects into two groups of twenty-eight each. To the first group he gave Otis, form A, without distraction, and a week later, form B with distraction. To the second group he gave form A with the distractor, and a week later form B under conditions of normal quiet. Two electric bells, placed at different sides of the examination room and rung intermittently during the test were used as distractors. Thus eliminating the constant difference between the two groups and the practice effect from the first to the second session, he was able to compare the tests given under distracting conditions with those given under normal conditions. He found "there was an average gain in score with the distractor of 0.09%--not a significant difference. On the average such a distractor neither aided nor hindered."

At least as significant as the general results, according to the author,

is the fact that there was a definite relation between the subject's performance on the normal test and his susceptibility to distraction. Those who did better on the test were hindered by the distractor, while those with poorer scores were aided by it. A grouping of the subjects into quartiles on the basis of test scores yields:

Upper Quartile. . . . 4.4% loss under distraction
Third Quartile. . . . 0.5% gain under distraction
Second Quartile . . . 0.2% gain under distraction
Lower Quartile. . . . 6.0% gain under distraction

In evaluating his own results, the author points out that the group used was small, and the findings only suggestive.

The work of Hovey (16) is, in some resptects, a more detailed continuation of Tinker's investigation. He entitled his work "Effects of General Distraction on the Higher Thought Processes." At the outset he points out that it is generally agreed that the standardized tests of intelligence are measures of the ability to solve problems and to handle abstractions, and can, in view of this, be safely considered measures of the higher thought processes. In order to determine the effect of distraction upon the higher thought processes, then, it would be necessary only to administer a reliable test of intelligence under distracting conditions and to compare the subjects' performance on that test with an alternate form given under normal conditions. With this procedure he sought to investigate the following problems:

1) The effects of distraction on certain higher mental processes.

2) The relationship between susceptibility to distraction and intelligence as measured by the Army Alpha tests of intelligence. Tinker, it will be remembered, found that there was a rather significant tendency in his group for those scoring high on the intelligence test to be more seriously affected by a

distractor than those who scored low.

3) Individual differences in the ability to overcome distraction.

4) Finally, how much, if at all, distraction affects the reliability of a mental test.

To attack these problems, two sections of sophomore students in psychology were divided into an experimental group of 171 and a control group of 123. Both groups were given six tests of the Army Examination, Alpha, form 8, under conditions of normal quiet. One and one-half months later the experimental group was given the same six tests of form 7 with the distractor, while the control group took the alternate form, but again in a room where normal conditions prevailed. When given the distracted test, the experimental group was told that there would be distraction and that they were to do their best despite the noise. Until these instructions were read at the beginning of the test, none of the subjects knew what the nature of the experiment was to be. The tests were timed and scored as they had been in the Army; but instructions were modified to meet the experimental conditions.

The distractors used were made especially severe. They consisted of seven bells and five buzzers variously placed about the testing room; a 90,000 volt rotary spark gap; phonograph records; two adjustable organ pipes and three metal whistles of different sizes; a circular saw thirty-six inches in diameter mounted on a wooden frame; a mounted camera with which a well-known photographer pretended to take pictures of the group; and a 5500-watt spotlight, which was flashed about the walls, but not into the eyes of the subjects. In addition to these stationary distractors, students entered the room at various times during the test strangely garbed and carrying queer-

looking pieces of apparatus. Still others performed specified stunts up and down the aisles of the testing room. In the room above, four students marched lock-step with a very heavy tread. Oftentimes several of these distractors were used simultaneously. Sometimes only one or two were used. During each of the six tests, more than one form of distractor was used more than once, with the exception of photography.

To make the experimental and control groups comparable, individuals in the one were paired off with individuals in the other on the basis of the normal pretest scores. For each score in the control group, one was found in the experimental group that differed from it by two points or less, and these two were isolated as a pair. Ninety such pairs were isolated with a correlation of 0.999. The two equated groups made these scores:

Control group, normal conditions:	Mean score 137.6
Experimental group, distraction:	Mean score 133.9
Loss through distraction:	3.7

Hovey states that this difference is probably significant, "but not large enough to warrant the inference that distraction greatly impedes thinking. It shows, conversely, that distraction is not a serious handicap to the group as a whole during 19 minutes of concentrated thinking." Nineteen minutes were spent in actual work on the test problems. The scores given are for the retest. The score for both groups on the pretest was 127.5. This means that the control group showed an improvement of 10.1 points, and the experimental group, a gain of 6.4 points. Skaggs (29) analyzes these results a little more fully, and puts a different interpretation on them:

> There is. . . a gain of 6.4 points in the case of the second condition. This looks as if the noise actually helped efficiency. The gain might,

however, be due to practice on the first form. The investigator wisely conducted a 'control experiment' with a control group. This worked on two occasions with the same materials, but a condition of quietness obtained on each occasion. A gain of 10.1 points was found in the case of the second work-period. This gain, then, was due to maturation and practice effects. Now for the argument. If the experimental group had shown a gain of more than 10.1 points there would have been evidence of increase in efficiency due to the noise, over and above practice and maturation. If the gain in the case of the experimental group had been just 10.1 points then there would have been evidence of just not any detrimental influence of the noise. If the gain for the experiment group had been less than 10.1 (as was actually the case) the evidence would be that the noise actually played a detrimental role, although it could not eliminate the practice effect.

In answer to the other questions posed at the beginning of the experiment, Hovey found, unlike Tinker, that susceptibility to distraction is not related to performance on the intelligence test; and that, since the correlation between test and retest was 0.87 for the experimental group and only 0.84 for the control group, the reliability of the intelligence test was improved under conditions of distraction.

The work of Brown and his colleagues (2), which constitutes one of the most thorough investigations in the field, grew out of an attempt to discover which men from among a number of applicants would be least affected by the distractions they would be subjected to while working as guides at a World Fair. Because it was impossible to measure the distracting effects of the actual working conditions, it was assumed "that a measure of the influence of distractors on a pencil and paper test would yield a fair indication of the influence of distracting conditions upon their ability to perform their actual tasks. This may be an unwarranted assumption." The tests used were the Otis Self-Administering Tests of Mental Ability, with four alternate forms available. The distractors were of two general types: 1) "sensory, consisting of

noises of various kinds." 2) "'Ideational,' i.e., meaningful material."

The experimental work can be easily divided into situations, with the authors' own titles.

"Situation I: Influence of Noise or Sensory Distraction on Mental Test Performance."

The distraction in this situation was the noise produced by striking a suspended Ford brake-drum with a sledge hammer; by blowing a siren and horn; by playing two phonograph records with holes punched off center. They were given simultaneously and successively and in various combinations. Though there was no objective measure of the intensity of the distraction, it was purposely made as severe as possible. The sound was picked up by a microphone and sent through an amplifier with a volume control.

In this situation sixty-three subjects were given form A of the Otis test with a thirty-minute time limit under normal conditions. After an hour, during which they took other tests, they were given form B with the same time limit under sensory distraction. When allowance had been made for the practice effect and the difference in difficulty of the two forms of the test, there was found a gain in mean raw score of 3.2 points in the test given under distraction. From this the authors concluded that "We can at least be fairly sure that the distraction did not decrease the mental performance."

"Situation II: The Influence of Ideational or Meaningful Distraction on Efficiency in Mental Performance."

This second type of distractor was tried after the first had shown no appreciable effect upon test performance. Short stories and abbreviated articles on topics of popular interest, interspersed with bits of humor, con-

stituted this 'Ideational' distractor. These were read over the same amplifying unit used previously, and to avoid adaptation to any one distractor or voice, a new voice presented new material every three minutes. Four hundred and eighty-eight subjects were given form A of the Otis test, with a twenty-minute time limit, under normal conditions; and then, immediately after, they were given form B under ideational distraction. Once more the difference in mean raw score was in favor of the test given under distraction. The difference, though not large, had sufficient reliability to justify the conclusion, "We can, therefore, be fairly certain that this increase in score under ideational distraction is a reliable one."

In both of these situations the distraction had been given on the second or retest. But when the order was reversed; that is, when the distractor was given on the first or the pretest, there was a difference in the mean raw scores of the two tests of less than one point for 195 subjects.

It was found, too, that there was a tendency for the amount of improvement under distraction to decrease with an increase in the duration of the test. Analysis of the tests showed that under distraction there was an increase in effort in terms of the amount of work done; but there was also an increase in the number of errors. In corroboration of Hovey, it was found that there was only a slight relationship ($r=.19$) between the ability measured by the test and distractibility.

Cornelli's results seem to indicate that distractors aid in the subject's performance (6). His five subjects were given the tasks of copying symbols and adding numbers, during which they were presented with a muffled noise, a pure sound, and bits of music. If 100 be taken as the average score for both

tasks under normal conditions, the scores became 114.6 and 108 with the noise; 118.3 and 110.6 with pure sound; and 116.5 and 121.3 with music. There was an increase in accuracy for additions under the three types of distractor; and copying symbols underwent no change in this respect.

There may be some significance in the fact that Cornelli found if the work was done for forty minutes in silence, preceded by ten minutes with noise, the score for work under distraction was increased. But if the work was done for ten minutes with noise, preceded by ten minutes of silence, the score was diminished.

Kornhauser studied the effect of noise on the production in typing of four subjects in a large Chicago business office. (21) He found that 3.2% more lines were written under conditions of quiet than under noisy conditions. But during quiet there was 23% more wasted lineage in the form of discarded letters, so that the net figures for total completed letters favored the work done under noisy conditions 1.5%.

The results of the work so far considered show that distractors have no significant influence upon performance. Just as many can be cited to show that distractors really do distract.

One of the most important of these studies was made by Weber. (33) He began by questioning whether horns, whistles, bells, students performing stunts, and even some phonograph records were, of their very nature, capable of distracting. They lacked, he thought, inherent interest, and apart from the initial attention to them at their onset, the subjects seemed to ignore them easily enough. He then sought to measure the effect of distractors that are ordinarily thought to be intrinsically interesting--good music and anec-

dotes. To avoid adaptation that would likely come in a long sustained performance, he gave his subjects tasks that called for but a minute or two of mental activity. These were computing, cancelling, learning nonsense syllables, solving picture puzzles, thought problems, defining and composing essays. Control performances were alternated with those of the experimental set-up.

All of his sixteen subjects showed a loss in performance ranging from 8% to 57% for the various tasks. Music was found to be a less effective distractor than the anecdotes. This agrees with Cornelli's finding that music was the least bothersome of the three distractors used in his work, which is cited above.

Weber's observations of his subjects give what seems to be a characteristic picture of the behavior under distraction. These observations are outlined by Woodworth (35:707):

> 1) A general increase of muscular tension
>
> 2) Increased energy of the work movements: loud speaking, vigorous hand movements, eyes glued to the work or fixed on vacancy, postures of concentration such as bending forward and holding the head in the hands.
>
> 3) Movements of defense or avoidance: a shaking of the head, shutting the eyes, covering the eyes with the hand, agitation of the shoulders, turning the face to the wall. These defense movements were so violent, sometimes, as to be 'worse than disease.' . . .Some subjects got into a momentary condition of nervous restlessness in which they could not work, or into a state of vacancy and complete inhibition.

Results similar to these were reported parenthetically by Hovey, who says that many of his subjects were in a state of nervous exhaustion and had to rest for a while after the distracted test.

An especially significant feature of Weber's work is the introspective

report regarding the subjective experience of working under distraction. Often, the subjects reported, the distractor was merely a background to the task and only more or less disturbing. At times it would break through and, becoming the focus of attention, would make the subject forget his work entirely. Overcoming the distractor as a subjective experience lay either in a positive concentration of attention on the work to be done or in staving off the distractor. Both alternatives were not equally effective. The least decline in performance took place when the subject positively directed himself toward the task and did not take merely a negatively disregarding attitude toward the distractor.

Cason reports results similar to these. (3) He assigned his subject short tasks consisting of cumulative addition, problem solving, paired-associates learning, and two recreational reading activities. The distractors used were ordinary radio programs--what happened to be on the radio at the time--loud gum-chewing, and a person tinkering with apparatus in the same room in which the subject was working. Controlled performances were paired with the experimental. In spite of the fact that the subjects had a set to work and that the distractor caused them to exert greater effort, the general effects of the distractor were to make the conditions of work more difficult and to lower efficiency. In their introspective reports, the subjects said the talking on the radio programs was much more disturbing than the music. News flashes and comedy sketches were the most disturbing kinds of talking. Jazz music was the most disturbing kind of music and classical music hardly disturbed at all.

The effects of distraction on reading efficiency were investigated by

Fendrick (9) in a study somewhat similar to the one proposed here. He set up an experimental situation which he considered similar to the operation of a radio in a student's room during study time. His subjects were made up of a distracted group and a non-distracted group each composed of 60 college sophomores. Both groups had been equated on the American Council Psychological Examination. On the day of the experiment, each group went to its respective classroom for the regular fifty-minute class in psychology, but was given instead a uniformly prepared assignment to study. The reading material for this study was a twelve-page, single-spaced mimeographed chapter abstracted from a text in educational psychology, the theme of which was general health. The author insists that there was little probability that these students in general psychology had ever seen the chapter before. Thirty minutes was allowed for study, after which there was given a fifteen-minute true-false test of sixty items, based on the reading matter.

The distracted group was told that they were to read the assignment while a series of records was being played and that they were to attend as they ordinarily did when studying with the radio operating in their rooms. The non-distracted group was told merely to read the assignment with the same diligence used in preparing a class assignment. Lively semi-classical music played over a phonograph record for the thirty minutes of study time was used as the distractor.

"A consistent difference favoring the efficiency of study for the non-distracted groups was isolated with probable statistical significance." There was some indication, as well, that the music used more seriously affected those students functioning at higher intellectual levels.

Jensen (20) sought to determine the relative effect of the different types of music on typing skill, using as subjects twelve boys and thirty-eight girls from the fifth, eleventh, and twelfth grades in three typing classes. He measured the speed and accuracy of these three groups, all of whom had received thirty-seven consecutive weeks of typing instruction, under three conditions. In the first condition, the normal, measurement was made in a classroom free from all sound, except that which occurred in the ordinary class routine. Then the subjects typed while a jazz record was being played, and finally while dirge music played. To control practice effects, each of the three classes was tested separately under all three conditions three successive days. The order of presenting the distractors was varied as were the tests themselves. Thus when the data were considered, equal amounts of practice would accrue to each method.

Performance was measured by three different five-minute typing tests. Jazz music, the results indicate, had no effect upon the speed of typing, but considerably increased the errors and so decreased the efficiency in words typed per minute. Dirge music, on the other hand, had no influence upon the errors, but it did decrease speed. From this the author concluded that music, of both types, is a serious distractor to typists under the conditions of his experiment.

The possibility that the subject's own opinion might have some effect on the power of a distractor to aid or hinder performance was taken up in the unique work of Baker. (1) He attempted to demonstrate experimentally the effect two or three different attitudes might have on the performance of the subject under distraction, if those attitudes were kept as uniform as possible

from day to day and from subject to subject. These attitudes were to be induced before the subjects began the experiment proper. He divided his subjects into four groups. The first or control group was given no opinion regarding the effect of distraction, but was told that the purpose of the experiment was to determine just what that effect was. The first experimental group was told that distraction has a detrimental effect upon performance. The second experimental group was told that distraction facilitates performance. And the third that distraction first hinders, then facilitates performance. In addition to being told these effects, the subjects were shown dummy records with results that were in conformity with the attitude to be established.

The task given to the subjects was the adding of 6, 7, 8, and 9 successively to two-place numbers saying the totals aloud until they were told to stop at the end of thirty seconds. Ten such problems were completed each day by each subject during conditions of quiet and ten in the presence of the distractor which consisted either of dance music or of one or two people talking into a microphone. The experiment ran for ten successive days.

The results, in general, indicate that the groups conform to the suggestion given to them at the beginning of the experiments. That is, performance was aided if the subject was given the attitude that the distractor would aid; he was hindered if given the contrary attitude. "Examination of the data of the individual members in these groups, however, will show that the effects of the distraction were not constant or uniform."

In addition, Baker found not only that the attitude of the subject was an important factor in determining what the effect of distraction would be on his

performance, but that such an attitude was easily produced and could be superimposed on a previously existing attitude, if there were one. But in such a case there is evidence that the previous attitude and the newly induced one fluctuate back and forth, one being in the ascendancy now and again the other. The data secured on those groups in which a prepared attitude was not present are not clear regarding the effect of distraction upon performance.

It might be objected here that if the attitude of the subject determines the outcome of a distraction experiment, the only problem would be to determine what that attitude was. If the subject thinks he studies better with the radio going, he actually does. It must be remembered, however, that Baker's results show only general tendency, and by his own admission the effects were not constant or uniform for the individual subject. Furthermore, if it can be shown that a meaningful distractor really does hinder performance, despite the fact that the majority of the subjects hold a contrary opinion, the results will have just so much more significance.

Chapter II

The Experiment

The foregoing survey of the experimental work done on the problem of distraction rather leaves one with the impression that the results, save in the behavioral aspect, are somewhat contradictory and ambiguous. Apart from the differences of experimental procedure, which can account for some of this disparity, light can be shed on the difficulty by considering for a moment the mechanism of the distractor. But here we run into another difficulty. Dulsky (8) suggests that there are two alternatives open to psychologists who would discuss the meaning of the term distractor. "Either they accept the common usage of the term distractor (in which the effects of the stimulus refer to attention), or they may speak of distracting effects upon performance. When we speak of the distracting effects of extraneous stimuli upon attention, we mean that these distracting effects of extraneous stimuli are wrought because the distractor becomes the center of attention and thus shuts out the task, or causes the attention of the subject to be so divided between itself and the task at hand that performance suffers. Different experimental results will then be explained in terms of the variation from individual to individual or from situation to situation. The second alternative offered defines a distractor as a series of extraneous stimuli which, under these given conditions, have a harmful effect upon performance. There would be no reference to attention. Definition would be solely in terms of distractor and performance."

It would appear, however, that these are not alternatives in the strict sense of being mutually opposed stands, but rather that they are different stages of one process. Certainly only those stimuli which distract are distractors, and we can know that they distract by measuring their effect upon a given performance and, it must be added, by the subject's report that he was distracted. Introspection must always be kept in mind as the ultimate criterion of psychological work. But it is equally true that the same stimuli may distract now and not then, may distract one person and not another. Accordingly, the second alternative proposed seems to be too narrow. It merely says, in effect, that what distracts is a distractor and we know it distracts by measuring its effect upon a given performance. But it does not tell how or why stimuli distract at all, or why they distract one person and not another, or why they distract a particular person at one time and not at another. We have, it would seem, not mutually opposed and exclusive interpretations of the term distractor; but a statement that given stimuli distract and an attempt to explain how and why they distract in terms of attention.

The topic of attention in modern psychological treatises is given scant notice. Yet some reference to attention appears essential if any order is to be brought into the results of the experimental work on distraction. Of all the stimuli which are constantly crowding the avenues to our minds, only a relatively few are present in consciousness at any one time. Others wait their turn, as it were, and still others never reach the focus of consciousness in the ordinary course of events. As a point of departure for our own work, we can profitably take Gruender's descriptive definition of attention, which has the advantage of being based on purely empirical concepts. Attention is

". . . the voluntary or involuntary direction of our mind toward one object of sense or thought, or a definite group of such objects to the more or less complete exclusion of all others." (13:217) According to this, we may conceive attention to be somewhat like the field of vision. Only a very few objects occupy the center of the field. These we see clearly. As the periphery is approached we see other objects within the field with increasing dimness. So it is with attention. Only a very few objects are present in the focus of consciousness at any one time, but we are none the less aware in varying degrees of other objects present. And as the line of regard may be shifted so that what formerly occupied the periphery of the visual field now is in the focus, so attention may be shifted to something that a moment before occupied only the background of awareness.

What determines which of the many claimants for attention shall actually receive it? It is not possible to designate any one cause that will account for all cases. Sometimes it is a matter of the strongest stimulus forcing its way into the center of consciousness, but we know that it is possible to attend to the ticking of a watch in a noisy room. Often it is our own choice that determines the object of attention, but, again, we know that at times we attend to things against our wishes. Interest of the object, likewise, does not explain attention, but looms as an important factor in it. Clearness seems to be an effect of attention rather than its cause. Finally the bodily attitudes that we have come to look upon as more or less characteristic of the attentive person cannot explain attention. They accompany attention and seem to be instinctive adjustments that aid in the reception of favorable stimuli and the exclusion of distraction.

Turning once more to the problem of attention and distraction, we see present many of these factors. But more than that, we see that some are more important than others. The experimental literature seems to leave little doubt that the distractor which has no meaning in itself does not distract. Noises produced by whistles, bells, sirens, and even by most music cause only a momentary loss in performance with a rather rapid adaptation on the part of the subject, who returns soon to his former level of production. In terms of distraction related to attention it would appear that the noise is merely a change in the working environment which momentarily attracts attention from a voluntarily accepted task. If the distractor has no meaning in itself, a negative attitude is adopted toward it, and attention is positively centered on the completion of the work to be done. Bodily attitudes that some subjects assume consciously or unconsciously--such things as grimaces, holding the head in the hands, wrinkling the brow, and talking aloud--seem to be aids in the positive direction of attention and in the warding off of distraction. It appears that the whole organism is mobilized for the task.

Not so consistent are the results found when the distractor is meaningful in itself; that is, when the distractor used is the human voice not merely as sound but as the vehicle of meaning. The present study will be conducted along this latter line. What is the effect of a distractor which is meaningful in itself upon performance in a task which calls for the degree of close attention necessary in highly complicated thought processes? Here we have two rival claimants for attention, both of a meaningful nature and both possessed of inherent interest. Will the subject be able to dismiss this distractor as most of them in previous work have been able to dismiss noise, or will the

factors of interest and meaning inherent in the distraction be too much to permit the subject to shrug it off and complete his task? We should not forget the practical aspect of the study--the effect of the radio operating while the subject is studying. The same factors seem present in the experiment as are present in the study situation. On the one hand we have the study process which calls for a great deal of attention and thought, and on the other hand the radio program which, for the most part, is meaningful in itself.

It was possible to duplicate the study process--at least those processes and abilities used in studying--by the use of a college-level reading examination, which will be described later. But to duplicate a commercial radio program that would be constant and that could be justifiably introduced into the testing situation without informing the subjects of the reason for the test would be difficult. In lieu of this a short-wave radio broadcast was written and electrically transcribed. It consisted of conversation, devoid of the usual technicalities, between the operator of the University short-wave station and three other operators in different parts of the country. The program, which is appended, was played over a loud speaker while the test was going on. Even though an attempt was made to make the conversations as universally appealing as possible under the circumstances, additional precaution was taken to avoid adaptation by the use of four voices with a constant shifting of the conversation from one to the other at about four-minute intervals. Some music was interspersed, but it followed the logical sequence of the program and consisted merely of two short vocal selections. It is not necessary to add that every effort was made to make the conversation such that it would

attract and hold the attention of college students. That it did every minute of the time cannot, of course, be assumed. But by the same token neither does any commercial radio program guarantee interesting material for all of its time.

The Test

The test upon which the effect of distraction was measured was the Iowa Silent Reading Test, New Edition, Advanced Test, with two alternate forms, Am and Bm. Both forms measure a rather wide range of mental ability of a complex nature and correlate highly with standardized tests of intelligence. (12) From these correlations and from similarity in content, it is safe to assume that actually these tests measure much the same ability and processes as do intelligence tests. For the present purpose, however, they have the additional advantage of measuring these processes in a way which more closely approximates the normal study period of the college student.

Because of the fact that the testing time had to be limited to a period of fifty minutes, it was possible to administer only six of the seven subtests in each form. Just what these six tests consist of and their mode of measurement can best be understood by taking the authors' own description of them.

> Test 1. Rate and Comprehension
>
> The accurate and meaningful measurement of rate of reading involves the control of the comprehension level at which the reading takes place. In this test the pupil is asked to read two somewhat diverse types of prose at a rate which, for him, is best for clear comprehension. The first deals with science content and the second with social science material. Comprehension exercises designed to reveal the completeness of the pupil's understanding of the content are based on each article. Thus the test is a measure of the rate of reading under specific comprehension conditions.

Test 2. Directed Reading

Silent reading comprehension is a composite of many skills and must therefore be tested by many types of material in a great many different ways. Research shows that there is no general silent reading ability. One who reads one kind of material well may read another type of content poorly. This part of the test is designed to measure the student's ability to comprehend general and specific situations expressed in the content without unduly stressing memory. While this test is designed to measure the ability to comprehend and answer questions of a rather detailed type, it makes a special effort to avoid exercises which depend upon pure identification or matching of words.

Test 3. Poetry Comprehension

One important phase of silent reading is the reading and understanding of poetry. This test, by a series of questions based upon a poem, measures the student's understanding of the poem as shown by his ability to find passages which answer questions.

Test 4. Word Meaning

Much of the difficulty which certain pupils have in studying their textbooks is due to lack of knowledge of the more or less technical words in the subject, rather than to lack of any general 'silent reading ability.' To a certain extent children must be trained specifically for assimilative reading in each subject, and this training must consist primarily of a development of a vocabulary in that subject.

Terminology in any subject is more than a mere list of words: it is a catalogue of the important concepts in that subject. A pupil's failure to grasp any portion of the subject matter will be indicated by vagueness regarding the meaning of the terms involved in that portion of the subject. Tests which will measure special or technical vocabulary of a school subject are tools of fundamental importance which a teacher may use in order to aid in determining the ability of pupils to study the subject efficiently. This test has been designed, therefore, to measure a pupil's understanding of significant words in four high school subjects: social science, science, mathematics, and English.

Test 5. Sentence Meaning

The sentences comprising this test are stated in such a way that in each case the meaning of the sentence as a whole must be comprehended. So far as possible, the content difficulty of the sentences has been kept on a level with the comprehensional difficulties involved. In general, the sentences are arranged in ascending order of difficulty of response. All key words or basic words in the exercises were checked against the word lists of Horn and Thorndike, and the social frequency of each word was determined in connection with the formulation of these exercises.

Test 6. Paragraph Comprehension

> Two specific aspects of paragraph comprehension are included in this test. It undertakes to measure not only (1) the ability to select the central topic of the paragraph, but also (2) the ability to identify details essential to the meaning of the paragraph. For each of the ten paragraphs of this test, question A pertains to the first aspect and questions B and C to the second. The method of scoring the results on this test should add to its analytical possibilities. (12)

It was found that, with the elimination of the last test, it was more convenient to take as the measure of performance the gross score rather than the standard score suggested by the authors of the test. Similarly, alteration had to be made in the administration of the test in view of the fact that the distractor was auditory. Had the instructions been given orally by the tester in as full extent as directed in the testing manual, it would be impossible to determine if a loss in score would be due to the fact that the distractor was effective or that it merely drowned out the voice of the tester, as any noise would likely do. Accordingly the instructions were so modified that the subjects were merely told to read for themselves the directions printed at the beginning of each of the tests in the booklet. Stop and go signals, together with brief oral directions, were given before each subtest. This modification of procedure, of course, makes it impossible to compare the results obtained with the established norms for the test. However, the only concern here was the comparison of the test results under normal conditions with those under distraction, and since the alteration was constant for both conditions, it would not be a factor in the final results.

The Subjects

In the present investigation, the subjects used were college students, freshmen and sophomores, most of whom were taking psychology courses.

Although one hundred were actually tested twice in the course of the experiment, it was possible, for one reason or another, to use the scores of only ninety. But since each student was tested twice one hundred and eighty scores enter into the final results.

The Procedure

It was thought best to keep the subjects in entire ignorance of the purpose of the experiment--or even of the fact that an experiment was going on. All of them took testing more or less as a matter of college routine. Being told that they were to appear for a psychological test instead of regular class caused no speculation. The testing was done in a lecture room which is situated next to the amateur radio station of the University so that it was easy to make the subjects believe that the distractor had nothing to do with the testing, but was an unaboidable accident. After the subjects had been seated and the testing had been going on for about a minute, the program was begun and continued for about a total of fifty minutes. The actual time that the subjects worked on the tests was a little less than forty-five minutes. Placing the loud speaker over which the program was broadcast outside the closed door of the testing room made the sound seem to originate in the adjacent radio room whence it was supposed to come. To make the situation more realistic, a member of the psychology faculty, who was aiding in the testing, left the room very obviously to see what he could do about shutting off the radio. In a little while, he returned and whispered to the tester with much gesticulating, thereby giving the general impression that the situation was beyond his control. The tester, in the intervals between subtests, apologized profusely to the subjects for the deplorable conditions

under which they had to work, but urged them to do their best. That the nature and purpose of the experiment were not recognized by the subjects is brought out by the fact that only twenty per cent of the entire group, when the group was questioned afterwards, said that they thought there was some connection between the short wave radio broadcast and their taking of the test.

Two groups of approximately fifty subjects each were used to obtain the comparative data on performance under normal and under distracted conditions. Actually the number used in calculation was a little less--forty-eight in one group and forty-two in another. The difference between the mean gross score on the test taken under conditions of normal quiet and that taken under distraction constituted the essential measure. In the simple procedure of giving the test to the two groups under normal conditions and then giving an alternate form under distraction, two additional variables arise--and the literature indicates that they may be significant. They are the practice effect from test to retest and the question whether any difference would be found if the distractor was present on the first or the second test. The former was controlled by alternating the form of the test within each group; and the latter, by giving the distraction to one group on the first test and to the other on the retest. Thus the two large groups, which might be designated simply X and Y, were divided into smaller subgroups, X-I and X-II; and Y-I and Y-II.

The X group was given the test under normal conditions, with X-I taking form A and X-II taking form B. A week later the same group was given the test under distraction, this time X-I taking form B, and X-II taking form A. On the same day as this latter test--actually ten minutes after the X group

had finished its distracted test--the Y group took the test under distraction. Y-I took form A, and Y-II took form B. A week later the Y group took the test again, this time under conditions of normal quiet, with the test forms reversed within the group itself. This procedure, which is presented in Table I, yielded controls of all the variables not under measurement, and made, as far as results were concerned, the distracted or normal conditions the only difference between the two occasions on which each group took the test.

Table I

Outline of Experimental Procedure

	X Group N. = 48	
	X-I N.=22	X-II N.=26
Pretest Normal	Form A	Form B
Retest Distractor	Form B	Form A

	Y Group N. = 42	
	Y-I N.=18	Y-II N.=24
Pretest Distractor	Form A	Form B
Retest Normal	Form B	Form A

Chapter III

The Results

The previously described experimental procedure yielded results that can best be understood by keeping in mind several points. We want to know, first of all, just what effect, if any, the distractor had upon test performance. That effect might be beneficial to, or it might hinder the performance of the subject. This can be found out, obviously, by comparing the tests taken under distraction by all the groups with those taken under conditions of normal quiet. In pursuance of this the entire group can be broken down into the X and Y groups, and each of these compared with itself under the two conditions. These X and Y groups can, in turn, be broken down into subgroups and the results more closely analyzed.

Several other questions can be considered. Is there any evidence regarding the relative difficulty of the two forms of the test? Is the effect of the distractor constant over the entire testing period or does it vary from time to time, giving indication of whole or partial adaptation on the part of the subject? Is the effect of the distractor different for those scoring high on the normal test than it is for those scoring low? All of these points will be considered in this chapter.

The difference between the mean gross score of all the groups under distraction compared with the mean gross score under conditions of normal quiet provides the most significant measure in the results of this study. The

comparison is presented in Table II.

Table II

Comparison of All Groups in Performance under Normal Conditions and under Distraction

Group	No.	Condition	Form	Sequence	Mean	S.D.	P.E.m
All	90	Normal	A&B	Test and Retest	197	35	2.4
All	90	Distr.	A&B	Test and Retest	169	30	2.1
				Loss under Distraction:	28		
Loss in per cent: 14.2					Critical Ratio: 9.0		

The test taken under distraction shows, then, a loss of 28 points in mean gross score, or a loss of 14.2 per cent, over the entire testing period of about forty-five minutes. Considering this result statistically, we see that the ratio of the difference between the mean scores for the normal and the distracted tests to the probable error of that difference is 9.0. So large a critical ratio justifies the conclusion that the difference is a significant one and not due to chance factors operating to produce it. Taken from this aspect, the distractor has a serious detrimental effect upon reading test performance.

If each of the large groups, X and Y, is taken separately and compared with itself under conditions of normal quiet and distraction, further conclusions can be drawn. These groups, it will be recalled, are differentiated on

the bases of the sequence of the distractor. Group X had the distractor on the retest and Group Y on the pretest. Table III, below, makes this comparison, and allows us to see the relative effect of the distractor when its presentation is varied.

Table III

Comparison of Groups X and Y with Themselves under the Two Conditions

Group	No.	Condition	Form	Sequence	Mean	S.D.	P.E.m
X-I& X-II	48	Normal	A&B	Pretest	184	36	3.5
X-I& X-II	48	Distr.	B&A	Retest	172	31	3.0
				Loss under Distraction:	12		
Loss in per cent: 6.5					Critical Ratio: 2.6		
Y-I& Y-II	42	Distr.	A&B	Pretest	166	28	2.8
Y-I& Y-II	42	Normal	B&A	Retest	211	26	2.6
				Loss under Distraction:	45		
Loss in per cent: 21.3					Critical Ratio: 11.8		

These results show that a statistically reliable difference is found between the means of the test given under conditions of normal quiet and that given under distraction if the distraction is given on the first or pretest. If, however, the distractor is given on the second or retest, the difference,

statistically speaking, is not so significant, though taken in the gross it is more than just an appreciable difference. There is, it would seem from this, more probability that those subjected to the distractor on the pretest will be adversely affected than those who are submitted to it on the retest.

Further analysis is possible by breaking the results down still further so that each subgroup is compared with itself under the two conditions of normal quiet and distraction. It will be recalled that the larger groups X and Y, determined by the sequence of distractor, were broken down into subgroups on the basis of sequence of the test form. Subgroups X-I and Y-I were given form A on the pretest, whether that test was normal or distracted; and subgroups X-II and Y-II were given form B on the first test. The results of this analysis are presented in Table IV on the following page.

Table IV

Comparison of Each Subgroup with Itself under the Two Test Conditions

Group	No.	Condition	Form	Sequence	Mean	S.D.	P.E.m
X-I	22	Normal	A	Pretest	194	27	3.8
X-I	22	Distr.	B	Retest	176	30	4.2
				Loss under Distraction:	18		
Loss in per cent: 9.2					Critical Ratio:		3.2
X-II	26	Normal	B	Pretest	174	34	4.4
X-II	26	Distr.	A	Retest	169	33	4.3
				Loss under Distraction:	5		
Loss in per cent: 2.8					Critical Ratio:		0.8
Y-I	18	Distr.	A	Pretest	167	24	3.7
Y-I	18	Normal	B	Retest	203	23	3.6
				Loss under Distraction:	36		
Loss in per cent: 17.7					Critical Ratio:		7.0
Y-II	24	Distr.	B	Pretest	164	31	4.2
Y-II	24	Normal	A	Retest	218	26	3.5
				Loss under Distraction:	54		
Loss in per cent: 24.7					Critical Ratio:		10.8

Table IV makes it possible to compare the two forms of the test for relative difficulty. The mean gross score on form B for all four subgroups, under both conditions, test and retest, is only 179, while that for form A is 187. Form B, then, was, in this experiment, an average of 8 points more difficult than form A. This difference in the difficulty of the two forms, together with the preceding finding that the distractor is likely to be more effective on the pretest than on the retest, may partially account for the extreme difference in loss under distraction by X-II, 5 points, and Y-II, 54 points. The former group had the seemingly more difficult form of the test first and under normal conditions, with the easier form on the retest under distraction, so that with the presence of the easier form and distraction on the retest, the measureable effects of distraction would likely be at a minimum. The latter group had the supposedly easier form on the retest under normal conditions; but it had the more difficult form on the pretest under distraction, so that all the odds were working against it.

Does the loss under distraction continue at an even rate over the entire testing period, or is there a large loss at the beginning with variations in loss as the period progresses? This question can best be answered by dividing the six tests given during the period into three groups of two each, with a corresponding time division of approximately 15 minutes for each two tests. The loss in each succeeding group can then be noted. Actually the times of each two tests taken as a group do not divide evenly into 15 minute periods. Test 1 and 2, together, took 16 minutes, 45 seconds; tests 3 and 4 consumed 12 minutes, 30 seconds; and tests 5 and 6, 13 minutes, 30 seconds, for a total working time of 42 minutes and 45 seconds.

On the first two tests, which took approximately the first fifteen minutes of the period, there was a loss of 26.9 per cent under distraction. On the second two tests, 3 and 4, there was a loss of 5.6 per cent. And on tests 5 and 6 there was a loss of 10.3 per cent. Too many contingent factors are present to attempt anything like a certain explanation for this difference in loss over successive thirds of the testing time. One factor that might account, at least in part, for the difference is that the fourth test, which would occur in the second period, the period of least loss, is perhaps the easiest test of the six. This test consists of a large number of relatively short items, presenting a given word together with four alternatives, one of which must be chosen as a synonym for the given word. It seems to depend less than any of the others upon utilizing the information given elsewhere in the test itself. In other words, each item in this particular test is brief and relatively self-contained. This interpretation, it must be kept in mind, is only probable. On the other hand, the figures might be taken to indicate some adaptation to the distractor; but if adaptation is present, these figures show that it is not progressive and that it is apparently never complete.

Correlations derived for the large groups, X and Y, would be unsatisfactory and of undeterminable significance in view of the number of variables involved--sequence of presentation and test conditions. Even when the correlation between the normal and distracted tests of the smaller groups, X-I, X-II, Y-I, and Y-II, are sought, we must recognize their limitations because of the small number in each of these groups. Because of this small number, the correlations were arrived at by the rank-difference method. Translated

into product-moment coefficients they are:

X-I . . . . r = .86±.04

X-II . . . . r = .84±.04

Y-I . . . . r = .73±.08

Y-II . . . . r = .87±.03

There might be significance in the fact that the smallest group, Y-I, consisting of only 18 subjects, yields the lowest correlation. For the larger groups, the correlations are relatively high, averaging around .85, a fact which might indicate that still larger groups would yield even higher correlations. A conservative interpretation of the figures as they now stand would indicate that, by and large, there is no significant change in ranks from the test taken under normal conditions to that taken under conditions of distraction. Indeed, the group which suffered most under distraction, Y-II, yields the highest correlation. It would appear that the distractor does not materially affect the reliability of the test.

A final measure which may be obtained is the difference of loss suffered under distraction by those scoring high and those scoring low on the tests. If the entire group is divided into quartiles, the first quartile being the highest quarter of the scores, we have the following losses:

Quartile	Loss in Per Cent
1	17.8
2	13.8
3	12.8
4	13.8

Those scoring highest on the normal test do appear to suffer the greatest loss under distraction. The figures taken at face value, however, do not indicate a progressive loss as the scores become lower. But, at the same time,

the differences between the lower three quartiles are so small that they lack statistical significance and no judgment can be based on them.

It cannot be insisted too strongly that when evaluating these results, we should keep in mind the small numbers involved and recognize the limitations of the statistical measures drawn from them. The comparison of normal and distracted tests is given significance and an approach to certainty because of the large number of subjects involved. When, however, the groups themselves are broken down into smaller groups, or the tests and times of the tests are cross-sectioned, the number being dealt with is so small that the most we can hope for is a rough indication of probable trends.

No systematic attempt was made to secure extensive qualitative data. After each distracted test, however, the subjects were asked to indicate by a show of hands how many thought they had been bothered by the distractor. All believed that their work had suffered. Several volunteered the information that music would not have bothered them half so much as the speaking voice had. They said that they could not work while the talking was going on.

What desultory observations were made by the experimenter on the behavior of the subjects working under distraction gives a rather interesting picture and one that is in agreement with that given by other observers. The subjects constantly shifted position; many of them read the test items with a determined lip movement. Some tried to bury their heads in their hands; and some even went so far as to lay down their pencils and strain to listen to the distractor.

Chapter IV

The Conclusions

One general conclusion seems justified by the results of the present experiment, namely, that the introduction of a meaningful distractor, consisting of the human voice as the vehicle of meaning, into the testing situation has a deleterious effect upon performance on a college-level reading examination. Comparison of the test scores of ninety subjects working under conditions of normal quiet with their scores under conditions of distraction shows a loss under this distractor of twenty-eight points in mean gross score, or a loss of 14.2 per cent. This result covers the entire testing period of forty-give minutes. That this loss cannot be attributed to chance factors is shown by the fact that the critical ratio, or the difference of the mean gross score of the distracted test and the normal test divided by the probable error of that difference is 9.0. This is certainly large enough to justify the conclusion that the loss in score on the distracted tests, as shown in Table II, is statistically significant.

The experimental procedure made it possible to measure the relative effect of the distractor when it was given on the pretest and when it was given on the retest. There seems to be a difference in effect. For, though there was an appreciable and probably significant loss under distraction when the distractor was introduced on the retest, it was not so great as the loss suffered when the distractor was given on the pretest. This finding has a kind of historical antecedent in the work of Brown and his colleagues. It will be

recalled that they found a consistent gain in the distracted test over the normal test, if distraction came on the second test; but if it came on the first test, there was less than one point difference in the mean scores of the tests taken under the two conditions. In retrospect, this result was more or less anticipated and the experimental procedure used here neutralized it. Practice effect, if due only to having handled the test and followed its make-up, would give the retest group an advantage under distraction that those who had the distraction on the pretest would not possess. In no case, however, was that practice effect sufficient to overcome the distraction. Even with the advantage of having handled and followed one form of the test on a previous occasion, the retest distracted group lost in score.

There is some indication from the study that the loss under distraction became less as time went on; but this diminution is not clearly progressive. In order to attribute the diminishing loss to adaptation, it would be necessary to assume that the distractor was equally interesting and equally effective in all parts; and that all parts of the test were equally difficult. Neither of these assumptions is justified. In fact, loss is smallest on that test which seems, by inspection, to be the least difficult of all. There is no justification, as far as the results go, for attributing differences in loss over successive periods to adaptation. An equally probable interpretation would be that the subjects suffer least from the distraction on those tests which are easiest. Again it might mean that at that particular time the distractor was uninteresting.

Relatively high correlations between the tests taken under distraction and those taken under conditions of normal quiet are indicative of the conclusion

that the reliability of the test is not seriously affected by the distractor. Those who ranked high on the normal test tended to rank high on the distracted.

Another indication in the results is that those scoring high on the normal test tend to lose more under distraction than those who score low. This certainly seems to be true, that the first quartile of scores suffers most; but the differences in loss between the remaining quartiles are so small that it is difficult to arrive at any conclusion using these figures as a basis. As unrefined measures, the percentages seem to indicate that the loss decreases as the score becomes less, which, in turn, may indicate that distractibility bears a ratio to the score on the normal test--the higher the normal test score the greater the distractibility.

As far as the present results are concerned, form B is 8 points more difficult than form A of the Iowa Silent Reading Test, Advanced. This, however, may be an artifact of the scoring method used--taking the raw score instead of the standard scores given by the authors of the test. In an attempt to account for this difference, it was found that, in the manual of directions, a slightly higher gross score was needed on form A than on form B to obtain the same standard score. Apparently the authors recognize that form B is somewhat more difficult than form A.

At the risk of boring by repetition, it must be insisted again that we recognize the limitations of these results and interpretations. Except when the large groups are considered as wholes, we must limit ourselves to the realm of probability because we are dealing with small numbers.

Turning to the more qualitative aspects of the study, it seems that the distracting situation presented to the subject two meaningful situations vying

for his attention. Obviously the test was replete with meaning and demanded concentration and thought. Similarly the distractor was a meaningful whole that was at least as interesting to the student as was the test. We have then, two vying situations, vying not simply for attention but for concentration and thought. Former studies have shown that a monotonous distractor or music--anything which does not have meaning for the subject--can attract and hold attention for only a relatively short time. As a result performance does not seem to suffer significantly. But when the distractor is meaningful and interesting in itself, its effects upon test performance are rather seriously detrimental. Apparently the simultaneous presence of two meaningful situations is too much for attention. Attention seems to shift back and forth so that neither situation is given the optimum. When one of those situations has no meaning or requires less concentration, apparently the other fares better. So that in the fourth of our six tests, which seems the easiest, and would therefore demand least concentration, there is less loss caused by the distractor than in any of the other tests.

The bodily aids which the subjects used during the distraction showed an attempt on the part of the subjects to try to direct attention to the task by utilizing every aid, but even the whole psycho-physical organism working to achieve attention to the test was not sufficient to overcome distraction.

Whether we can now answer the practical problem of whether the playing radio hurts the student's study depends upon how closely the experimental situation approaches the life one. Certainly actual study is a function of the higher thought processes and is closely allied in method to the reading examination used here. This factor would seem to be common to the experiment

and the study period. Is the radio a meaningful distractor as was the experimental distractor? Probably in most cases it is, for commercial programs are of a mixed type containing both music and speech, with a predominance of the one or the other according to the type of program. On the basis of the experiment we seem forced to conclude that such a radio program would seriously interfere with the study of the subject. If it does not, it is because the student is not really listening to the radio, and it is difficult to ignore the distractor. Probably what happens in most cases is that attention oscillates back and forth between the study and the radio program so that there is a loss in the effectiveness of the study per unit of time; and more time must be put in with the radio playing than need be put in under quiet conditions to accomplish the same result.

It might be asked further which distracted test situation, pretest or retest, more closely resembles the study situation with the radio going. Strictly both situations only approach the complexity of the actual study situation. Distraction on the retest was not so effective as it was on the pretest, probably because of the practice effect of having previously handled an alternate form of the test. But in both cases the subject had merely to follow explicit directions. But consider the complexity of the actual study situation. Here the student is, for the most part, entirely on his own. He must outline his own work, gather his own materials, and choose essentials for himself. So that while neither of the situations in the experiment even approaches the complexity of the actual study situation, we can say that the pretest distracted test, on which loss was greater, is more like it. Actual-

ly, then, we should expect even greater loss under distraction in the actual study situation.

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APPENDIX

The Distractor

In writing this script for the supposed short-wave radio conversation that was used as the distractor, little effort was made to be technically correct. Technical style and form, all but incomprehensible to the layman, were willingly sacrificed in the interests of material interest and verisimilitude. The entire program was thoroughly rehearsed by the four participants under the direction of the experimenter. The whole was recorded and played back over a loud speaker placed outside the door of the testing room so that the program seemed to originate in the adjoining radio room. The result would convince the not otherwise informed person that a short-wave broadcast was actually going on.

(Slow conversational tone)

W9 TDG: W9 TDG calling CQ; (pause) W9 TDG calling CQ; (pause) W9 TDG calling CQ; (pause) W9 TDG calling CQ; (pause) Hello, come in.

W6 RAM: W6 RAM calling W9 TDG; W6 RAM calling W9 TDG; W6 RAM calling W9 TDG. Come in, W9 TDG.

W9 TDG: W9 TDG calling W6 RAM. Hello. I would guess, by your call letters, that you are located somehwere out near the Pacific Coast, most likely in California. Am I right? Come back and give me some dope on yourself. I don't think that I have ever heard you on the air before, though I have worked your section of the country quite a bit. W9 TDG signing over to W6 RAM. Come in, W6 RAM.

W6 RAM: Hello, W9 TDG; W6 RAM back again. Your guess is a good one, in fact it is perfect. I'm out here in Oakland, California. My name is Paul Thompson. I've heard about you from some of my fellow hams out this way; but I'm sure you haven't heard me before, because this is the first time I have ever worked any distance. You see I'm rather new in the game, and I've stuck pretty much to local work up until now. This is the first time I've ever branched out. But I'm glad to know you, W9 TDG.

Well, now that we are acquainted with one another, I've got a favor to ask of you. A couple of the boys I go to school with -- I go to the University of California -- want me to try

to get a couple of messages through to their folks back home in the East. They can't exactly spare the money for telegrams and they think that we could relay what they have to say faster than a letter could do the trick. I'm quite excited about it myself, because I have never sent a message so far before. One of them is to two people living right in your city, Chicago; the other one you would have to relay to New York City. Will you accept the messages without charge? I've got them both ready. W6 RAM over to W9 TDG. Come in.

W9 TDG: Hello, W6 RAM; Hello, Paul. Yes, I'll accept both of your messages. I can probably take care of the Chicago one myself. I can relay the one to New York sometime today, probably right away. You will have to hold on for a minute till I get a pencil and some paper. (Pause for a time and then continue.) All right, Paul. I'm all set here. You can come ahead with your messages any time. W9 TDG over to W6 RAM.

W6 RAM: Hello, W9 TDG; W6 RAM back. Thanks very much. Neither of them is very long. I'll read them slowly so you can take them down. All set. Here's the first:

Hear message number 11, from W6 RAM, Oakland, California, to Mr. and Mrs. Walter Roach, at 4212 S. Union Ave., Chicago, Illinois.

Dear Mother and Dad, (slowly)

I have just had an offer of a job for the entire summer.

The salary, over and above what would be necessary for living expenses, would pay my tuition and buy my books for the next semester. But I would have to stay out here in California for the entire summer, because the job starts just a few days after school lets out. Maybe I could come home and see you, but only for a few days. Is it all right to give my word that I will take the job? Hurry and answer, because the offer is open for only a day or so more. Please say yes.

And that is signed: Love, Bob.

That is the first one, W9 TDG. Did you get it all or do you want me to repeat some of it for you? Am I going too fast? Come in.

W9 TDG: Hello, W6 RAM. You don't have to repeat. I got it all. I'm taking it down in shorthand so you don't have to worry about your speed. Now let me have the one that you want me to relay on to New York. W9 TDG over to W6 RAM.

W6 RAM: All right, W9 TDG. Here is the second one:

Hear message number 12, from W6 RAM, Oakland, California, to Mrs. James Haynes -- and that, by the way, is spelled H-a-y-n-e-s; and the address is 450 W. 50th St., New York, New York.

Dear Mother,

I broke off a piece of my tooth yesterday in a ball game and it's beginning to hurt me. I would like to go to the dentist and have it fixed, but I'm low on funds, and I don't

like to wait until my allowance comes. Would you please wire five dollars immediately. Thanks. My love to you and the rest of the family. Tell Bill to start driving out here about the middle of May if he wants to see the sights on the way and still get out to the university in plenty of time for the commencement exercises.

That one is signed: Love to all, Dan.

Did you get it all, W9 TDG? Come in.

W9 TDG: Hello, W6 RAM. Yes, it came through all right. I caught them both in full so I don't have to read them back to you. I think that I can deliver the Chicago one myself. I know that neighborhood pretty well, and it shouldn't be hard to find the people it's addressed to. I'll relay the second one to New York just as soon as I can. Tell your friends not to worry, that both their letters will get through. Now, if you have nothing more to add to them I want to ask a favor of you. I wish you would test with me. What do you say? Come in.

W9 TDG over to W6 RAM.

W6 RAM: Hello, W9 TDG. No, there is nothing more to add to them. Certainly I'll be glad to test with you. Go right ahead any time you want to. I'm all set.

W9 TDG: W9 TDG testing with W6 RAM. All right, here I come. I'm going to play a phonograph record. That will probably be best.

Tell me how it comes through to you.

(Play record -- about five minutes.)

That's all of it. How do I sound? How is the volume and the quantity? Come in.

W6 RAM: W6 RAM back again. There was a little interference at first, but I got most of it. Your modulation is fine, and your quality is good. I got you very clearly.

Well, I'm afraid that I've got to say good-bye now and do some studying. Thanks very much for taking the messages. I'll tell my friends that they got through all right. Now that we know one another, let's not be strangers. I'm on the air at about this time every day, so call me again, soon, W9 TDG. Or it might be better if I called you. Yes, I think it would, because I need the practice. I'll try to call before the week is out, so be looking for me. This is W6 RAM, Oakland, California, signing off with W9 TDG and throwing the switch.

(W9 TDG pauses for about two minutes after and then proceeds to call again.)

W9 TDG: W9 TDG calling CQ, New York; (pause) W9 TDG calling CQ, New York; (pause); W9 TDG calling CQ, New York; (pause). (Noise of tuning across the band.) W9 TDG calling Cq, New York. Answer us. (Pause for about a half-minute.)

W2 KOE: Hello, W9 TDG; Hello, W9 TDG. This is W2 KOE, Bronx, New York. I just picked up your CQ call and I am answering you. Come in again.

W9 TDG: Hello, W2 KOE. I was hoping that you would get my call. How are you? I haven't heard from you in quite a while. Will you take a message? It's for your neck of the woods. I'm relaying it for a ham in California that I picked up for the first time a little while ago. He seems to be a very nice fellow. He's rather new in the game. Try calling him some time and tell him I told you about him. His call letters are W6 RAM. The message he just gave me is urgent but it's not very serious. Will you take care of it? Come back.

W2 KOE: Hello, W9 TDG. W2 KOE back again. Sure, I'll take care of your message. But hold on a minute until I get set. (Pause for about half a minute.) O.K. you can come right ahead with it.

W9 TDG: Hello, W2 KOE. Well here it is, all the way from California.

Hear message number 12, from W6 RAM, Oakland, California, to Mrs. James Haynes, 450 W. 50th St., New York, New York. That Haynes is spelled H-a-y-n-e-s. And the letter reads:

Dear Mother,

I broke off a piece of my tooth yesterday in a ball

game and it's beginning to hurt me. I would like to go to the dentist and have it fixed, but I'm low on funds, and I don't like to wait until my allowance comes. Would you please wire five dollars immediately. Thanks. My love to you and the rest of the family. Tell Bill to start driving out here about the middle of May if he wants to see the sights on the way and still get out to the university in plenty of time for the commencement exercises.

And it's signed: Love to all, Dan.

That's all there is to it. Do you want me to give it to you over again? Tell me how you've been and what you've been doing.

W2 KOE: Hello, W9 TDG. W2 KOE back again. You don't have to repeat. I caught it all. I'll get it off as soon as I can. I don't want some poor fellow out in California suffering from a toothache. The address is across town; but I think I can get it through by telephone. Hang on a minute and I'll see if there is a phone listed at that number. Let's see. The name was James Haynes and the address was 450 W. 50th St. Let's see. Haynes -- Haynes. There are quite a few of them listed here. Here it is, James Haynes. Well, There are six of them. But none of them is in the four hundred block on 50th St. (Pause.) Wait a minute. Here's a Janet Haynes -- at the same address. That must be the one all right. I'll call the number

a little later.

(Pause.)

Say it has been quite a while since we heard each other. I've been working New York state almost exclusively, so I guess that's why. I haven't been trying for any DX lately at all. The set has been perking fine. But I'm a little bit down in the dumps because I'm getting a razzing from the family and I'm the butt of all their jokes. It was funny the way it came about. You remember how we used to spend all the time talking about the various doings of hams in time of trouble. Well, at meals I always talked about the same thing and boasted about the good we hams were doing. I used to tell about the public service that we gave in times of flood and so on. I think that the family was getting pretty much fed up on it, but they couldn't say much because they had to admit that it was true. Finally, one day at dinner, that smart-aleck kid brother of mine read an article to the family and it certainly put me in my place.

One of our fellow-hams, it seems, was in a sad plight. He had a set somewhere on the coast here and had picked up a distress signal from a ship that had been torpedoed by a submarine. Well he immediately relayed the call to the coastguard, giving them the position he got in the S.O.S. When something like half the entire navy got there, after travelling about 200 miles, they found nothing but the calm blue sea. So they came

back and hauled this gent off to the Bastille. They were going to throw him in and throw the key away on him for everything from disturbing some sailor's sleep to sabotage and subversive activity. But, when they investigated, they found out that he wasn't seeking to destroy the armed guardians of our country after all. He had just made a mistake. He thought he had been tuned in on the short-wave band when he was actually listening to a commercial network program that happened to be re-enacting the sinking of some boat during the World War. He took it to be the real thing and went to work on it. The result sort of made the navy mad and embarrassed him. But everything came out all right. The judge merely gave him a lecture about thinking twice before he called out the combined forces of the nation again, and then let him go.

Well, that was the end of the article, and after all of my boasting and talk about what service amateur radio operators were rendering, this struck my family as extremely funny. The only thing that I could say was that anybody is liable to make a mistake -- which is a pretty weak answer. Now whenever I say anything about amateur radio, they ask me how we are getting along with the navy, or how many passengers of sinking ships we have saved lately. Of course, they are only ribbing me, but it's got me down. I can't say anything any more without being answered by some wise crack. (No pause.)

Now this message you gave me might give me a little moral

courage and might help to save my face; but a fellow with a toothache is not a sinking ship. You haven't heard about any victims of submarines that I could help out, have you? Well, all kidding aside, W9 TDG, what activity has been going on in and around your place since I last heard from you. You do a lot of work. Have you done anything of particular interest lately? Come back again. W2 KOE over to W9 TDG.

W9 TDG: Hello, W2 KOE. I can appreciate your feeling down in the dumps, but I wouldn't let it get me down. We haven't helped to rescue the passengers of any sinking ships; but we did a couple of things since I last talked to you that we are rather proud of. We don't like to boast, but we think they are pretty good.

A friend of ours here at school plays with a small dance band a couple of nights a week. He used to be interested in radio himself and dropped in occasionally to see what was going on. One of the members of this band he was playing in was stricken with acute appendicitis. His family lived somewhere in Honolulu, and nobody had the necessary five or ten dollars to send them a cable. This friend of ours knew we sent messages to various parts of the country and he asked us to help out. We got in touch with a ham that we knew in San Francisco. He, in turn, got in touch with one in the Hawaiian Territory. Conditions were favorable so we were able to contact the

family and receive a reply in less than half an hour. So we count that as one of our outstanding pieces of work.

Another time it was worth about one hundred and fifty dollars on a printing job for a man here in the city to know where a certain priest would be at a certain date. The priest was Father Hubbard, the Glacier Priest, who has done a lot of exploring in Alaska. I'm sure you have heard of him. Well anyhow, Father Hubbard was in Seattle at that time; and he was going on a lecture tour. This man who had to get in touch with him had previously heard about us. So he came and asked if we could get in touch with somebody in Seattle who would find Father Hubbard's address. We got in touch with a ham in Seattle and gave him the problem. He did a little telephoning and ended up by jumping in his car and bringing the priest back to the mike. He and this Chicago man had a long talk which settled everything. That's another one that we have down in our log book in capital letters.

But I'm really sorry that we have no sinking ships on our list, but maybe those will do till submarines start their activity on Lake Michigan. Perhaps then we can oblige you. There is nothing much more of any special interest around here. By the way our friend W2 IX over in Brooklyn should be on the air about this time. You are much closer to him. Do you want to see if you can get in touch with him? Come back. W9 TDG over to W2 KOE.

W2 KOE: Hello, W9 TDG. W2 KOE right back.

Congratulations on the work you did. You are a lucky stiff. I never get any opportunities like that. Maybe if I did my family would have more respect for my ability. You're right about W2 IX. He should be on the air now. In fact I was talking to him last night and he told me I should call him about this time today. If you will stand by for a while I'll see if I can pick him up.

W2 KOE calling W2 IX (pause); W2 KOE calling W2 IX (pause); W2 KOE calling W2 IX (pause); W2 KOE calling W2 IX. Answer please. Come in.

(Pause.)

W2 IX: Hello, W2 KOE; and hello, W9 TDG. This is W2 IX, Brooklyn. How are you both? I was wondering when we were going to have another one of those three-way sessions again. I've been tuned in on you both since you began talking. I heard W9 TDG's CQ call and I was going to pick it up, but you beat me to it, W2 KOE.

Say, W9 TDG. I'd like to add my congratulations on that Hawaiian message that you got through on your set. I just heard you two talking about it. It was a nice piece of work. I remember it was mentioned in Amateur Radio as one of the outstanding contributions of the month to public service by an amateur radio operator. I was going to call you and mention

that it was in the last issue, but I didn't get a chance. Anyhow, you probably saw it yourself. How does it feel to be famous?

Come up out of the doldrums, W2 KOE. A little family ribbing is nothing to worry about. Wait until they begin dismantling your set and then begin to worry. I've had my outfit for about five years now, and every week my mother threatens to sweep the whole mess into the ash heap. Luckily, it's been only a threat so far -- knock on wood. But I better not keep the family awake at night any more or she might really carry out her threat. I don't like the look in her eye the day after I've been on the air till about three a.m.

You're pretty fortunate, W9 TDG, in being situated as centrally as you are. You can work both coasts without much trouble. I've been trying to work DX with a fellow in Portland, Oregon for about the past year. But I'm not doing so well. The most I ever got was about two minutes of uninterrupted conversation after about an hour of trying to contact him. But the situation seems to be getting a little better; that is, it's a little better if I stay up until about three o'clock in the morning to work him. But that's where the family come in -- and do they come in!

Say, speaking of the trials and tribulations of a ham operator, I nearly had heart failure with my experience Easter Sunday. I was talking to a fellow in Philadelphia when all of

a sudden everything went dead. I thought that it might be just a little interference of the usual sort, so I waited a little while and called him back again. But the only response I got was a loud squeal. I tried him several times again and the same squeal was the only answer I could get. Then I tuned across the band and everything was dead silence. I called several people I knew would be on the air at that time, and still no response. I couldn't see anything wrong in the set-up, and I had visions of my years of hard work being blasted or reduced to nothing but a loud squeal. There was nothing I could do so I cut it off. When I tried it again in the evening, everything worked fine. Several people told me that the same thing had happened to them. Nobody knew what the cause of it was. I didn't find out till the next morning when I saw an article on some kind of sunspots. These things had shot off the surface of the sun into space and had raised heck with all teletype and radio transmission. As I get it, they were only some kind of magnetic particles, but they certainly gave me a good scare.

You are near me, W2 KOE, did it happen to you? While you're at it tell me how I'm coming in. I have about half power on and I am about three or four inches away from the mike. W2 IX over to W2 KOE.

W2 KOE: Hello, W2 IX, and hello, W9 TDG. W2 KOE coming in again.

Your modulation is fine, W2 IX, but your volume is a little bit heavy. However, it might be better to leave it that way or else W9 TDG might not be able to hear you well. He's quite a bit further away from you than I am.

No, I wasn't on the air when the sunspots caused all the furor, but I certainly heard a lot about it afterwards. It seemed to be the only thing that hams were talking about that evening. I guess some of them thought that Orson Welles was heading another Martian attack on the earth. Will you ever forget the excitement that program caused? The reason I mention it is that I have just been reading a discussion of it and having a big laugh over it. Some psychologists and sociologists are digging up data on it for a study of mob hysteria. They are going around asking people what their reactions were when they tuned in on the program and thought that it was an actual news broadcast of the Men from Mars coming down on us. It was something like my ham who sent the navy to rescue the passengers of the sinking ship. Some of the answers they are getting are pretty funny. I've got some of them written down right here. I'll give them to you.

Some of the people in Providence, Rhode Island, called up the town utilities and demanded that the city's lighting system be shut off for an immediate blackout. One woman said that she tried to take poison because she thought that kind of death would be preferable to one at the hands of the invaders.

Another woman was returning with her husband from a day at a country fair. When they heard the broadcast over the car radio she said that she had a premonition all that day that she should have gone to church instead of to the fair. A man down south was running from the terror in the dark and caught his chin on a neighbor's clothesline. He said he thought he had been hit by a death ray. A colored woman told her family that they might as well finish the half a chicken that was in the icebox because they wouldn't be there in the morning. The funniest ones I think are these: A woman whose husband tried to convince her that it was merely a radio story by turning to different stations and showing that bands were playing, but she said that that did not prove anything because Nero fiddled while Rome burned. Then there was the woman who kept consoling herself during the blackest moments by repeating to herself, "Well, anyway, I won't have to pay the butcher bill."

Maybe some one can derive a theory of mob hysteria out of all that, but as far as I can see it just proves that people sometimes do funny things. But I would like to see the result when they are all finished. I hear that the radio chain that carried the story has about a million law suits on its hands as a result. It's defence is that the program was advertised in the papers, before, during and after the broadcast as a dramatization of one of H. G. Wells' stories.

Hello, W9 TDG, are you still hanging on? You know, I have

been trying to remember where I had heard the name of Father Hubbard before. I knew that I had heard it before but I could not remember where. I remember now. I heard him lecture not so long ago. I don't recall how we happened to get the tickets, but anyway I went with my mother; and frankly I expected him to be pretty dry. But I was certainly surprised. He has a whole bushel of anecdotes about his travel and work among the Eskimos. He told us about one time he was making a trip with a dog sled somewhere up north, and one of the huskies had a litter of puppies on the trip. He had to wrap the puppies in bags and even put some of them inside his shirt. Then when they would stop to camp he would give them back to the mother, and then take them away from her when they started up again. His stories went on like that for about an hour and he certainly made a hit. I recommend him to both of you.

Say, W9 TDG, old man. We have been talking back and forth here without bothering to see if you were still on the air. Would you please come back and tell us how we are coming in?

W9 TDG: Hello, W2 KOE; and hello, W2 IX. Yes I'm still here and listening to you two. You're both coming in very clearly, but W2 IX is a little too strong even out here. Try cutting down on your power just a little bit.

I've been having some trouble with my transmitter here recently. It will go along for a few minutes with plenty of zip

and then it will die down so that I can't be heard above a whisper. A little while ago I tried playing a record out to that ham in California that I was talking about. He reported that I came through clearly. But that's the way it goes. One minute it's fine and the next minute it's nearly dead. Maybe it's all right now, though, because I spent a lot of time tinkering with it and tightening things up.

So I'm going to play another record and I wish you two would listen carefully to it and tell me if there are any noticeable fluctuations in your reception, and when they occur. A record will probably be the best way of doing it. Now listen carefully and see where the fluctuations in volume occur. If you both agree I'll know that there is still something wrong with the set. Well, here it comes. I hope you will both like my selection of a phonograph record.

(Phonograph record is played -- about five minutes.)

There, that's all of it. Now tell me how it came through.

W2 KOE, how did you get it? Any fluctuations? W9 TDG over to W2 KOE. Come in.

W2 KOE: Hello, W9 TDG, W2 KOE back again. There was no fluctuation in my reception at all. It was very smooth. I think the transmitter must be all right now, because it sent very well for about five minutes solid. How did you get it, W2 IX? Come in.

W2 IX: Hello, W2 IX back again. Yes, I got it the same way that W2 KOE did. It was very smooth; the volume was good and the modulation was fine. I don't think you have anything to worry about any more. Come in W9 TDG; and I don't like your taste in records.

W9 TDG: W9 TDG back again. Thanks very much both of you for your reports. That's a worry off my mind. I'm sorry you didn't like the record, W2 IX. The next time I'll submit a list to you and let you choose the one you would like to hear. O Yeah. Well, thanks anyway. I'm afraid I'll have to be dashing off to class now. I'm sorry to leave you two. But I'll be hearing from you again soon or you will hear from me. So long now. This is W9 TDG signing off with W2 KOE and W2 IX, saying goodbye and throwing the switch.

The thesis, "The Distracting Influence of Radio Speech upon Performance in Silent Reading", written by Thomas Michael Kennedy, has been accepted by the Graduate School with reference to form, and by the readers whose names appear below, with reference to content. It is, therefore, accepted in partial fulfillment of the requirements for the degree of Master of Arts.

Father Doyle	May 31, 1940
Father Herr	May 29, 1940