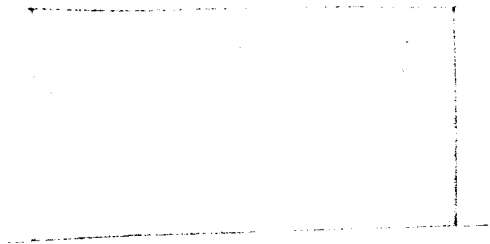


PL I, 42, 31

RESEARCH ON SIDE-TONE DELAY AS AN INTERROGATION DEVICE

By

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May, 1953

Final Report

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Contract Period: June 1, 1952 to May 31, 1953

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RESEARCH ON SIDE-TONE DELAY AS AN INTERROGATION DEVICE

I. Aims and Purpose of this Research.

The primary aim and purpose of this project was to obtain a successful interrogation device from the effects of side-tone delay, together with an appropriate procedure for its use with a minimum number of attachments.¹

The secondary aim, developed in this laboratory, was to obtain more easily interpreted polygraph records by use of side-tone delay in conjunction with the polygraph.²

1 Throughout the report this phenomenon is termed "Side-Tone Delay" and for brevity the initials STD are used. Previous investigators in this field have used other terms to denote this same phenomenon. For example, Professor John W. Black, Ohio State University, terms it "Delayed Side-Tone," while Professor Grant Fairbanks, University of Illinois, has referred to it as "Delayed Auditory Feedback."

2 The Polygraph was utilized for these experiments. It provides for the recording of five different responses -- blood pressure-pulse, respiration, galvanic skin reflex, arm movements, and thigh-leg movements. This polygraph is the only instrument equipped with arm and leg movement recorders.

II. How the Side-Tone Delay Was Produced.

Basically the side-tone delay phenomenon was produced in this laboratory by the following method:

The subject's speech was picked up by a microphone, which was connected to a tape recorder. At the recording head of this instrument the speech was recorded on a moving tape, and then this speech was reproduced when that part of the tape reached the playback head of the instrument. This reproduced speech was then amplified by the amplifier which, in turn, was connected to the subject's earphones.

Thus, the subject hears through his earphones what he has previously said. How later he hears his speech is dependent upon two equally important factors: first, the distance the recording tape must travel from the recording head to the playback head, and second, the speed at which the recording tape is traveling.

That is, the amount of delay depends upon the time it takes for the moving tape to go from the recording head to the playback head. If this interval of time is .20 seconds, the delay is .20 seconds. Naturally, if either the distance between these two heads is varied or if the speed of the tape is changed, the amount of delay will also correspondingly change.

III. Effect of the Side-Tone Delay on a Subject.

It was first believed that the general effect of delaying the side-tone on a subject was to retard his speech and cause a variance in his vocal intensity. This belief was based upon the findings of previous experimenters.³

B It was found at the laboratory that this phenomenon only occasionally occurred. It is thought by the investigators that the amount of difficulty experienced by the subject might be based upon his education, intelligence, social consciousness, or a combination of these three factors. In most cases it appeared that the more education and higher intelligence a subject had, the greater difficulty he experienced with the side-tone delay.

3 For example, Black, John W., "The Effect of Delayed Side-Tone upon Vocal Rate and Intensity," THE JOURNAL OF SPEECH AND HEARING DISORDERS, 16, 1951, 56-60; Lee, B. S., "Some Effects of Side-Tone Delay," JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA, 22, 1950, 639-640; and Lee, B. S., "Effects of Delayed Speech Feedback," JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA, 22, 1950, 824-826.

IV. The Gaining of Confessions Dependent upon Two Factors.

The use of the STD instrument in obtaining confessions, the primary aim of this project, is mainly dependent upon two things -- the interrogator and his procedure. No instrument or device can even partially fulfill the basic requirement of having a good interrogator, and he must have suitable procedures to use with the STD instrument.

The interrogator is the man in charge of the situation, and how he performs will determine whether the interrogation is a success or a failure. From this, one can logically conclude that the interrogator who is better qualified and trained will gain more confessions and information than the interrogator who is unqualified or who is untrained. This is true regardless of whether the STD instrument is or is not utilized during an interrogation.

Therefore, the better interrogator will obtain more confessions with the STD instrument than the poor interrogator. The STD instrument is certainly no panacea for the poor interrogator. In fact, the poor interrogator will not only obtain little information through the use of the instrument, he possibly will hinder the investigation.

V. Procedures.

Because the interrogator must have suitable procedures to use with the STD instrument, the investigators devoted the first five months of this project to developing and preliminarily experimenting with various interrogational procedures and techniques. A great number of criminal suspects were experimented with during these months in order to determine which procedures might be the most effective. Conclusions were reached as to their practicability, and the following procedures were deemed worthy for further experimentation. These are now listed and explained along with a statement as to their value.

It was decided that regardless of the type of procedure used, the subject should be instructed before the use of the STD as to what he would experience if he was not telling the truth. The actual wording of this instruction, of course, was based upon the subject's intelligence, but the following is a sample instruction:

"This instrument is a very sensitive device, and when you lie about a fact you have mental conflicts regarding that lie. These conflicts are indicated in your voice, and this instrument amplifies these conflicts and they are heard as actual stuttering and hesitations."⁴

4 When the subject asked why he even stuttered on the irrelevant questions (those questions not pertaining to the crime and to which the subject is telling the truth, e. g. , "Where were you born?"), the examiner replied:

"You are not really thinking about where you were born and about those other meaningless questions. You are waiting for the crime questions to be asked, and you are worried about whether the instrument will show you are telling the truth or show that you are lying. That's why you stutter on these meaningless questions."

A. Use of the Polygraph and Then the Side-Tone Delay Instrument.

1. The polygraph is used first to determine actual points of deception. Then during the oral interrogation the side-tone delay instrument is used at these points of deception. The STD switch is turned on at points of deception and is turned off when the subject is telling the truth.

This procedure was found to be of great value for several reasons. First, the interrogator knew before the use of the STD on which questions the subject was not telling the truth. Second, the STD is introduced after the polygraph, therefore, the interrogator's psychological position is greatly strengthened just as the interrogation begins.

However, the objection to this procedure is that an additional instrument, the polygraph, must be used as well as the services of a competent polygraph examiner.

B. Joint Use of Side-Tone Delay and Polygraph Instruments.

1. Manually manipulating STD switch at points of possible deception while the polygraph is in actual operation.

This method was found to be of value only when used for its psychological effect because the resulting polygraph records were too distorted for a correct interpretation. Naturally, no dependable comparison of polygraph responses could be made between the irrelevant and relevant (crime)

questions because of the switching on of the STD at the relevant questions. This introduced a strong stimulus that was not present during the irrelevant questions.

This procedure was found to be of some value in those cases where it could be assumed before the examination that the subject would be lying about the matter under investigation. This assumption can only be made in those cases where the subject has been implicated in a trustworthy confession by one of his co-conspirators, or when the subject is a prisoner-of-war. In the latter case, the subject is probably withholding information about his equipment, deployment of his fellow troops, and other information that is of great value to an intelligence unit.

2. Side-tone delay in operation throughout the polygraph tests.

In the majority of the cases with this procedure the STD did not materially distort the polygraph recordings so as to prevent a correct interpretation from being made, since the stimulus of the STD was constant throughout the polygraph test.

The secondary aim of this project, developed by this laboratory, was to determine if more easily interpreted polygraph records could be obtained by the joint use of the STD and the polygraph. This procedure, that is, the STD in operation throughout the polygraph tests, appeared to be the only procedure feasible to determine the value of this aim. After completely reviewing all the records obtained by this procedure it was determined that many times the polygraph records were probably much

harder to interpret, because of the use of the STD, than they would have been without its use. Sometimes the records were completely uninterpretable because of the use of the STD. Many times the subject's attention and interest were focused on the STD and its effect, rather than to whether or not he was telling the truth on the questions being asked. In fact, the STD caused two subjects, later verified as innocent, to respond during the polygraph test as guilty. These guilty responses were in contrast to their innocent responses on the polygraph tests when questioned without the use of the STD.

This last procedure appeared to be the most desirable of the two possibilities listed under this category, Joint Use of Side-Tone Delay and Polygraph Instruments. The investigators originally thought that while the STD was operating there might be more difficulty on the part of the subject to answer his question smoothly when he attempted deception. Since the polygraph is believed to record mental conflicts and the fear of detection, it was thought that with the STD these conflicts might be translated into a speech impediment at the points of deception. In ordinary polygraph tests it has been found that some verified guilty subjects experience mental blocks at points of deception.

But it was found during this experiment that when an STD subject experienced mental blocks it had nothing to do with his truth telling. Rather, it was the effect of the STD which caused the subject to have these mental blocks, since they appeared on the irrelevant questions as well as the relevant

(crime) questions of both the guilty and the innocent. At no time during this experiment did mental blocks occur only on the relevant questions.

The following are the types of questions and answers that can be utilized when the STD and polygraph are used jointly:

- a. Direct, unambiguous questions requiring "yes" or "no" answers. This is the most commonly used type of polygraph question and answer.
- b. Direct, unambiguous questions with previous instruction given to the subject to use short-term answers. These answers also require the usual "yes" or "no" reply, followed by a very short sentence. Examples of this type answer are "Yes, I do," or "No, I did not".
- c. Direct, unambiguous questions with previous instruction given to the subject to use long-term answers. These answers also require the usual "yes" or "no" reply, but then a statement follows which repeats the essential points of the test question. For example, if the question was "Did you steal that \$1,000 last Saturday night?", the answer would be, "No, I did not steal that \$1,000 last Saturday night."
- d. Searching-type questions with narrative answers required, e. g., "Where were you last night at ten o'clock?"; "I was at Kelly's tavern drinking beer with the boys."

Of these four types of questions and answers, B, the question requiring a "yes" or "no" answer followed by a short sentence, appeared to be the most effective when both the polygraph and STD instruments were used at the same time. It was effective because the polygraph records were usually not too distorted to prevent a diagnosis of guilt or innocence while the subject experienced the STD effect. However, in some cases with this type question and answer, the polygraph records were too distorted because of the STD for an interpretation to be made.

When the subjects answered "yes" or "no" (type A answer), there was no apparent evidence that the STD affected them. Consequently, this type answer with the STD did not help to improve the interpretability of the polygraph records.

The long-term answer (type C answer) was objectionable in those cases involving subjects who experienced difficulty in speaking with the STD, because their resulting polygraph records were too distorted for a correct interpretation. This distortion was caused by several factors. First, the subject's polygraph respiration recording was drawn-out and thereby distorted because the time required to answer the question was more than usual. Second, the blood pressure-pulse recording was often distorted because the subject, in experiencing speech difficulty due to the STD, attempted to express his thoughts by moving his arms and hands. When these movements occurred, the blood pressure-pulse recorder indicated movements instead of natural responses.

The narrative answer (type D answer) has the same disadvantages as the long-term answer, that is, the resulting polygraph records are often too distorted because of the STD. In addition to this, the polygraph examiner experienced difficulty in having the subject follow instructions, which were to respond with a full and complete answer to the question. Usually the subject's answer consisted of one or two words. For example, if the subject was asked where he was last Saturday night, he would reply, "Home", instead of the answer the subject gave before the test, "I was home with my wife and kids watching television."

C. Use of Only the Side-Tone Delay Instrument.

1. Manual manipulation of STD switch during the interrogation at the points of possible deception.

Because there is no utilization of the polygraph with this procedure, the interrogator must assume beforehand that the subject is guilty. For this procedure to be most effective, the interrogator must have the STD on whenever he believes the subject to be lying. This necessitates guessing on the part of the interrogator as to when the subject will lie. Obviously, the effectiveness of the procedure is greatly diminished as soon as the interrogator makes an erroneous guess. Probably no confession will result from a guilty subject if many such wrong guesses occur.

Moreover, with this procedure the interrogator does not know before the interrogation if the subject is guilty or innocent. In the great majority

of cases the interrogator will still not know even after the interrogation.

2. The STD operating continuously and purely as an interrogational device.

- a. During the interrogation, while the STD is continuously operating, the subject is allowed to interrupt in order to make his denials. The examiner may then call the subject to task for his failure to express himself without stuttering and/or hesitation.

Again, the guilt or innocence of a subject cannot be reliably determined if this procedure is used unless the subject fully confesses or makes serious admissions against his interest.

- b. While the STD is continuously operating, the interrogator uses the technique of immediately stopping the subject from fully discussing the case while an appeal for the truth is made by the interrogator. When this appeal appears to change the tenor of the subject's denials, he is then allowed to make any explanation regarding his position in the case. In doing so he will experience difficulty due to the effects of the STD. When this difficulty is brought to the subject's attention it might materially aid in obtaining a confession.

Of the three possible techniques listed under this category, Use of Only the Side-Tone Delay Instrument, this last technique, 2b., appears to be most effective, providing the interrogator has mastered the art of inoffensively stopping the subject from registering his denials until the interrogator invites his comments. Using this technique the interrogator must also be familiar with the changes that occur in the subject's facial expressions, physical actions, and verbal comments which will acquaint the interrogator as to the proper time to invite these comments.

The obvious objection to this procedure is that unless the subject confesses, the interrogator does not know whether the subject is innocent or guilty. This particular drawback, not being able to establish the guilt or innocence of a subject, applies to all procedures in which there is no utilization of the polygraph. In a great majority of cases guilt or innocence can be readily determined by a competently conducted polygraph examination.⁴

⁴ As a matter of fact, all of the procedures proposed in this project fall far short of the effectiveness of the ordinary polygraph techniques. With a competently conducted polygraph examination, the guilt or innocence of a subject can be determined in over 95 per cent of the cases, and over 60 per cent of those reported guilty confessed to the examiner. (These statistics are based upon those of the _____ laboratory in _____ during a five-year period ending December 31, 1952.)

VI. Side-Tone Delay Instrument Is Not a Lie-Detector.

During these experiments the investigators never considered the STD instrument to be a lie-detector or an instrument to be used in place of the lie-detector. The investigators never found any significant correlation whatsoever between the results of the STD tests and the subject's guilt or innocence. Therefore, the STD instrument should not be considered as a type of lie-detector.

VII. The Testing of Criminal Suspects.

After developing and preliminarily experimenting with these various procedures for five months, in November, 1952, a more suitable arrange-

ment was made with the _____ Judge of the

Municipal Court _____ The Judge agreed to steadily supply this

laboratory with criminal defendants who appeared to be guilty, yet who

claimed innocence. Before this time criminal-case subjects were only

irregularly submitted to this laboratory by various judges of the Municipal

Court _____ 5

_____ was in charge of Boys Court, and this court was believed by the investigators to be the most representative for this laboratory's purposes since it handles criminal preliminary hearings for boys ranging in age from 16 to 21. Also under this court's jurisdiction are adults who have been implicated in crimes with boys in this age group. Most of the cases referred to this laboratory by Boys Court were of a felonious nature, however, misdemeanors were sometimes included.

5 Throughout the entire contract period many other subjects, besides those arrested for felonies and misdemeanors, were experimented with on the STD instrument. Mainly in this group were applicants for trusted positions in various companies. These subjects were questioned concerning their general honesty, honesty at former places of employment, previous arrests, and bad habits such as excessive indebtedness, gambling, and drunkenness. Also included in these experiments were those people involved in quasi-criminal matters, such as bastardy cases from the _____ Municipal Court.

The first of these subjects arrived on November 12, 1952. From that time until January 19, 1953, appointments were made for the examining of 51 of these subjects, of whom 26 appeared and agreed to be tested. During this period the investigators' main effort, besides determining the guilt or innocence of a subject, was in having the subject experience speech difficulty because of the STD. The results of these examinations follow:

Table One. Outcome of the Examinations*

	<u>White</u>	<u>Colored</u>
Innocent	6	12
Guilty	1 (1 confession)	6 (3 confessions)
Indefinite	0	1

* As determined by the Polygraph and/or full confessions.

Table Two. Speech Difficulty While STD Operating**

	<u>White</u>	<u>Colored</u>
Innocent	2 Fours, 3 Twos, 1 One	2 Fours, 3 Threes, 3 Twos, 4 Ones
Guilty	1 Two (conf.)	1 Four (conf.), 1 Three, 1 Two (conf.), 3 Ones, (1 conf.)
Indefinite	None	1 Two

** Scale of Speech Difficulty

Five	-- Great difficulty
Four	-- Some difficulty
Three	-- Little difficulty
Two	-- Very little difficulty
One	-- No apparent difficulty

From January 19 to February 11, 1953, 17 additional Boys Court subjects as well as other subjects were experimented with in this laboratory. During this period the investigators' main attention was directed towards obtaining confessions from the subjects by use of procedures with the STD rather than having the subjects experience speech difficulty because of the STD. The results of these experiments with the Boys Court subjects were:

Table Three. Outcome of the Examinations*

	<u>White</u>	<u>Colored</u>
Innocent	6	5
Guilty	3 (2 confessions)	3 (1 confession)
Indefinite	0	0


 * As determined by the Polygraph and/or full confessions.

Table Four. Speech Difficulty While STD Operating**

	<u>White</u>	<u>Colored</u>
Innocent	3 Fours, 1 Three, 2 Twos	1 Four, 3 Twos, 1 One
Guilty	2 Fours, (1 conf.) 1 Three (conf.)	2 Twos (1 conf.) 1 Two
Indefinite	None	None

** Scale of Speech Difficulty

Five	-- Great difficulty
Four	-- Some difficulty
Three	-- Little difficulty
Two	-- Very little difficulty
One	-- No apparent difficulty

As shown by Table Two and Table Four, very few subjects stuttered or hesitated to any extent when the STD was operating. This is especially significant in Table Two, since with these subjects the investigators concentrated on having the full effect of the STD occur. It was originally thought that the more difficulty a guilty subject had in speaking because of the STD effect, the more likely he was to confess. However, Table Four indicates that about the same percentage of confessions was gained when the interrogator concentrated on the interrogation procedures rather than having the STD effect occur.

Therefore, since January the investigators were not too concerned about the effect of the side-tone delay per se, but they concentrated on the procedures to be used with the STD instrument so that confessions could be more easily and readily obtained. These and the other experiments since then have proven that most guilty subjects confess, even though their speech was unaffected by the STD device.

VIII. Examples of Experimental Cases.

The following ten cases were selected as representative examples upon which various conclusions were based as to the value of the STD. In these ten cases the subjects were males of varying intelligence and education. With the STD all these subjects were interrogated as guilty, even when the interrogator believed them to be innocent. Opinions are expressed at the end of each case concerning the value of the STD in that particular case. These expressed opinions were found to be duplicated in other cases.

1. The subject, a 17 year old with a 10th grade education, was arrested for attempted burglary. A store window was broken, and the burglar was frightened away because the breaking attracted the attention of several persons. One of these later identified the subject as the perpetrator. The subject denied the accusation.

Test 1: Polygraph, no STD, short-term answers. The records indicated he was guilty.

Test 2: Polygraph and STD operating simultaneously with short-term answers. Again the polygraph records indicated he was guilty. Subject had very little speech difficulty because of the STD.

Interrogation with STD: Subject made no admissions, and after 30 minutes STD turned off and subject's earphones removed.

Interrogation without STD: Within 30 seconds the subject fully confessed to the crime and also confessed another attempted burglary. When

asked why he hadn't confessed earlier, he stated, "I wanted to wait until this thing (pointed to the STD earphones) was taken off."

Opinions: The STD did not help to improve the polygraph responses, and it greatly hindered the interrogation.

2. C. S., J. K., & P. H. were accused of assault and battery upon a young couple, as well as threatening them with a knife and promising to "blast them" with a gun if they made an outcry. All three subjects denied any knowledge concerning this occurrence.

C. S., 18 years old, high school student:

Tests 1, 2, & 3: The STD and polygraph operated simultaneously with short-term answers. No speech difficulty. Records indicated he was guilty.

Interrogation with STD: Subject made no admissions.

J. K., 21 years old, high school graduate:

Tests 1 & 2: STD and polygraph operated simultaneously with short-term answers. No speech difficulty. Records indicated he was guilty.

Interrogation with STD: Subject made no admissions.

P. H., 20 years old, high school graduate:

Tests 1 & 2: Polygraph, no STD, short-term answers. Both tests indicated he was telling the truth on the questions pertaining to actual participation, but indicated he had guilty knowledge.

Test 3: STD and polygraph used with short-term answers. Subject had no speech difficulty due to the STD. This record was similar to his first two records.

Interrogation with STD: The subject readily admitted that he saw C. S. and J. K. accost the couple, that he heard J. K. threaten to shoot them, and that he knew C. S. had a knife.

Opinions: In this case the STD did not help to obtain a confession from the two verified guilty subjects, nor did it help the examiner in his interpretation of the polygraph records. The interrogator believed that P. H. would have confessed without the use of the STD.

3. The subject, a 17 year old with a 10th grade education, was arrested for armed robbery of a newspaper boy. The subject claimed that he was "being framed" by the newspaper boy and the one witness.

Polygraph tests: The subject was given four tests with yes and no answers, and no STD. His polygraph responses were ambiguous and inconsistent.

Interrogation with STD: Within 30 seconds the subject started to cry, however, he still maintained his innocence. Subject experienced some speech difficulty because of the STD.

Re-examination two days later: Again the subject was given four polygraph tests without any STD. This time the records indicated he was telling the truth.

The innocence of the subject was later definitely verified.

Opinions: The use of the STD may cause an innocent person to break down emotionally, but if it is properly used no false confession will result.

4. The subject, an AWOL Air Force Corporal, was accused of assault and battery and also armed robbery. He was arrested with a friend, but both denied being the perpetrator.

Tests 1 & 2: Polygraph and STD used together on both tests with short-term answers. Both polygraph records indicated that the corporal was guilty. The subject had little speech difficulty because of the STD.

Interrogation with STD: After six minutes the subject fully confessed and implicated his co-defendant as well.

Opinions: This subject's polygraph records were not too distorted to prevent interpretation, even though he did experience some speech difficulty. The interrogator believed that the subject would have confessed to the crime even without the use of the STD.

5. The subject, an 18 year old with a 9th grade education, was arrested for stealing a wallet from a man's pocket. The wallet was not found on the subject, although he was immediately arrested and searched. Subject denied the charge.

Test 1: Polygraph used by itself with yes and no answers. Records indicated that he stole the wallet.

Test 2: Polygraph and STD used jointly with short-term answers.

The subject experienced no speech difficulty. There was no significant difference in the subject's two test records.

Interrogation with STD: Subject made no admissions.

Opinions: The STD did not help to improve the polygraph records, nor did it help to gain a confession.

6. The subject, a 20 year old with a 2nd grade education, was arrested for attempted murder and assault with a deadly weapon. It was alleged that the subject stabbed the victim several times in the chest and throat. The subject denied the accusation.

Test 1: Polygraph, no STD, yes and no answers. Records clearly indicated that the subject was guilty.

Test 2: Polygraph and STD operating simultaneously with yes and no answers. Again the subject's record indicated he was guilty, but this time the polygraph records were much harder to interpret since distortion occurred in the record due to the slight speech difficulty induced by the STD.

Interrogation with STD: Although questioned for a long period of time, the subject made no admissions.

Opinions: The STD did not improve the polygraph records, nor did it help to obtain a confession.

7. The subject, a 17 year old Marine with an 11th grade education, was accused of attempted rape and assault with a deadly weapon. The subject claimed this was a case of mistaken identity.

Tests 1 & 2: Polygraph, no STD, yes and no answers. Records clearly indicated he was telling the truth.

Test 3: Polygraph and STD used together with long-term answers. The subject experienced speech difficulty and his polygraph records were distorted throughout because of the STD.

Interrogation with STD: Subject made no admissions against interest.

Later it was proven that the subject's alibi was the truth and that he was not the guilty person.

Opinions: The use of the STD definitely helped to distort the polygraph records when long-term answers were required. Interrogation with the STD instrument did not induce a false confession.

8. Two high school students, G. H. and C. B., both 17 years old, were examined in regard to an alleged breaking and entering, assault and battery, and assault with a deadly weapon. Both subjects denied doing what the complainants alleged, and both said that they were innocent bystanders.

G. H.:

Test 1: Polygraph used, no STD, yes and no answers. Records indicated he was telling the truth.

Tests 2 & 3: Polygraph and STD used together with long-term answers.

No speech difficulty because of the STD, although these records were distorted in comparison to the first test record.

Interrogation with STD: Subject maintained his innocence.

C. B.:

Test 1: Polygraph, no STD, yes and no answers. Record indicated truth-telling on all questions but one, a minor issue under investigation.

Test 2: Polygraph and STD used together, with yes and no answers. The record was similar in its indications to test 1. The subject experienced little speech difficulty.

Interrogation with STD: Readily admitted doing the act which the polygraph had indicated that he had done, but vehemently denied doing what the polygraph had indicated he had not done.

Opinions: The use of the STD with the polygraph did not help to improve the polygraph records, in fact, it distorted G. H. 's records. The use of the STD did not induce any false admissions from either of these subjects. The interrogator believed that C. B. would have admitted the minor issue without the use of the STD.

9. The subject, 37 years old with 2 years of college education, was arrested for drunken driving. The subject claimed he was merely a passenger

in the car, and that another man was the actual driver.

Tests 1 & 2: Polygraph, no STD, yes and no answers. Both records indicated that he was the driver.

Test 3: Polygraph and STD operated simultaneously with yes and no answers. Subject's polygraph responses were similar to those of the first two tests.

Interrogation with STD: No speech difficulty noticed. During the interrogation the subject laughed at the interrogator and said, "Stop trying to fool me with this ... (STD)."

Opinions: The STD did not improve the interpretability of the polygraph records, nor did it help to gain a confession. In fact, it hindered the interrogation because the subject knew something was amiss and believed that he was being tricked.

10. T. W. was arrested for assault and battery on the complaint of the victim, G. F. In court, T. W. claimed that both G. F. and G. C. severely beat him when he did not permit them to "crash" a New Year's dance. T. W. also stated that later that night his mother was "cussed out" by G. F., and so he and several of his friends did assault G. F. G. F. and G. C. both deny being at the dance or assaulting T. W. G. F. also denies swearing at T. W.'s mother.

G. F., a 19 year old high school graduate:

Test 1: Polygraph, no STD, yes and no answers. The polygraph

record indicated he was telling the truth.

Test 2: STD and polygraph used jointly with yes and no answers. Subject had very little speech difficulty. Record similar to test 1.

Interrogated with STD: Made no admissions against interest.

G. C., an 18 year old high school student:

Test 1: Polygraph, no STD, yes and no answers. Polygraph record clearly indicated he was telling the truth.

Test 2: Polygraph with STD, yes and no answers. Subject had no apparent speech difficulty. This time the polygraph records indicated that he was lying!

Interrogated with STD: Made no admissions against interest.

T. W., an 18 year old high school student:

Before his first test the subject confessed that G. F. and G. C. were not at the dance, that they did not strike him at any time, and that he made up the story about G. F. "cussing out" his mother.

In order to make sure this was the truth and not a statement given because of previous threats on the part of G. F. or G. C., T. W. was given two polygraph tests. The first test was of the regular type -- no STD, yes and no answers. The second polygraph test included the STD with short-term answers. On both polygraph records the responses clearly indicated that he was telling the truth. This proved that his confession was trustworthy and that G. F. and G. C. were verified innocent.

Opinions: When the STD was used during G. C. 's second polygraph test, it caused him to respond as guilty although he is verified innocent. However, the use of the STD did not induce either G. F. or G. C. to make a false confession.

IX. Instrumentation.

B During the first five months of the contract period, while the investigators developed and preliminarily experimented with various procedures and techniques, (instrument specialists employed by the investigators) were developing various side-tone delay instruments. Their aim was to design and construct an instrument that would prove practical from an interrogator's standpoint.

The first instrument built was designed on the principle of a constant tape speed of about 40 inches per second along with a variable-distance between the recording and playback heads. The recording head was fixed in position and the playback head was movable on a track, which was designed to preserve the alignment. The tape, in the form of an endless loop, was carried over two light low-inertia pulleys, one of which was fixed, the other having a spring mounting which maintained a constant tension on the tape. The sound quality was fair. The loop of tape, of overall length about 2 feet, appeared to give adequate results for periods up to one-half hour.

The overall quality of this instrument, however, was not by any means equal to the Magnecord equipment. Although lower quality amplifiers (Pentron) were used in this work, the main difference in quality was the noise inherent in the tape and in the head system.

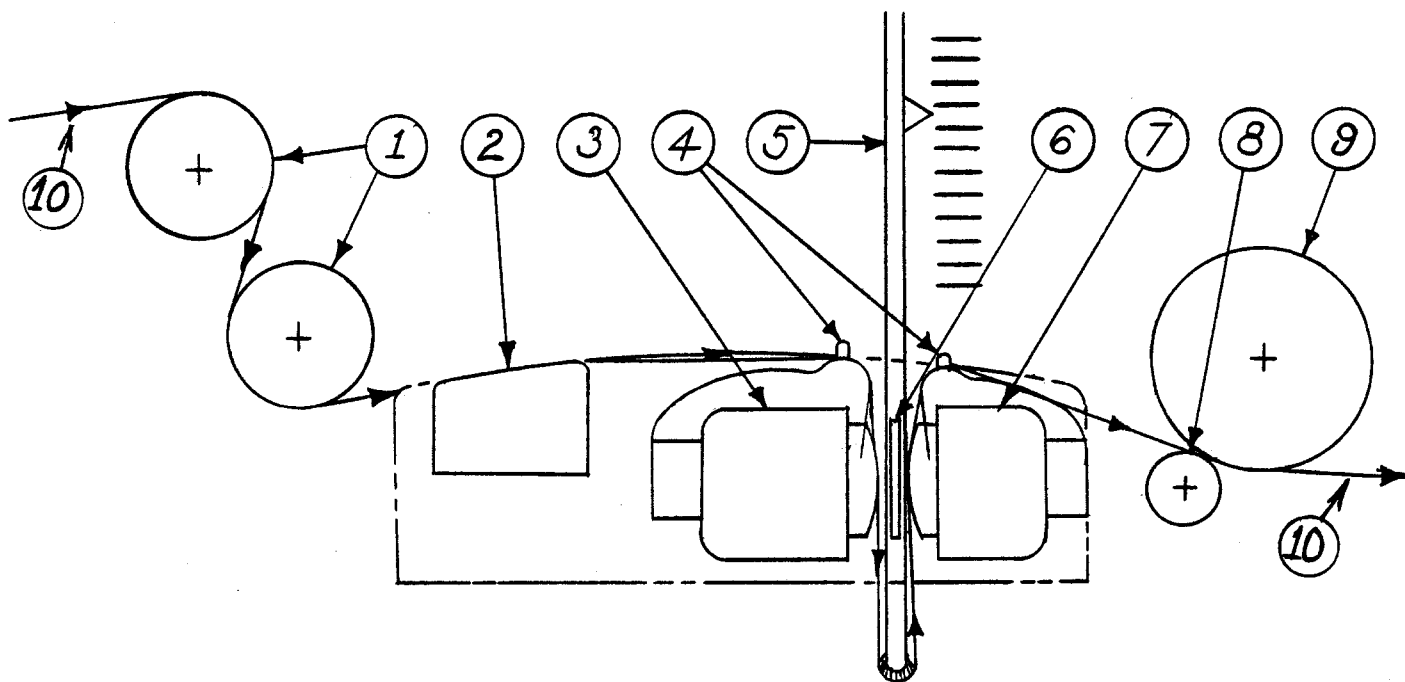
Consequently, a variable-speed constant head-separation device was designed and built. The heads were fixed in position at the minimum distance

(1 inch). The endless loop of tape was driven by a variable-speed DC motor, using a 6-volt storage battery. Since an overall speed range of at least 10-1 was desired with good torque over the range, the use of a resistance in the field was found to be inadequate. The desired conditions were made by varying the armature resistance and the field resistance simultaneously, but in opposite directions. In this way, a 25-1 speed range was obtained with good torque. The range of delay with this equipment was from about .02 to .40 seconds. However, the noise level of the machine was fairly high, apparently due to inadequate alignment and tracking of the tape.

It became apparent that construction of a higher order of accuracy was necessary. It was decided to modify the Magnecord recording unit by keeping a fixed relationship between the heads, and a constant tape speed by including means for varying the length of tape between the fixed record and playback heads. This was done by an arrangement of small pulleys, the middle one of which was varied in distance from the heads. In using this method, the amount of tape between the heads is twice the separation of the middle roller from the heads. When this apparatus was constructed and tested, it was found that the introduction of the auxiliary equipment in the neighborhood of the heads upset the shielding system and resulted in the introduction of a fair amount of noise. Consequently, the position of the heads was modified to the extent that they were turned at 180° so that the gaps faced each other and were about 1/4" apart. A shield was inserted between the heads and a small pulley mounted on a shaft running in micro ball-bearings was used to

Figure 1. VARIABLE-DELAY, MODIFIED TRIPLE-HEAD UNIT

(Front View)



- (1) Guide rollers.
- (2) Erase head.
- (3) Record head.
- (4) Tape guides.
- (5) Adjustable guide with pointer and variable-delay scale.

- (6) Magnetic shield between heads.
- (7) Playback head.
- (8) Tape drive capstan.
- (9) Pressure roller.
- (10) Recording tape.

position the tape. The separation of this pulley from the heads was controlled by a dial which operated the carriage. The dial was calibrated directly in delay in seconds. This device was extensively tested in the laboratory and found to give, with 15 inches per second tape speed, delay which could be varied between .07 seconds and .50 seconds. The overall sound quality of this instrument approximately equalled that of the original Magnecord unit. The apparatus was tested by means of a steady thousand cycle input from an audio frequency oscillator. The sound from the playback head was examined and found to be of adequate quality from the standpoint of wow, flutter, and noise. (See Figure 1.)

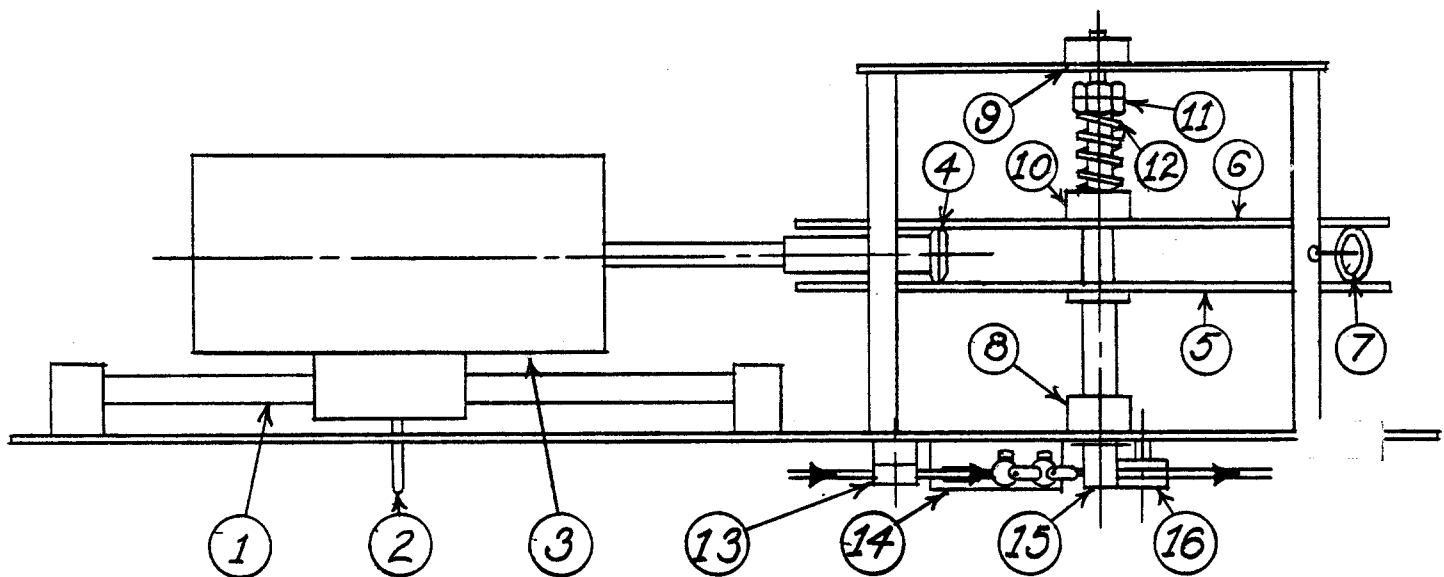
The instrument described in the preceding paragraph was installed in the laboratory on December 4, 1952, and was tested extensively with actual criminal-case subjects. The quality of reproduction steadily and rapidly deteriorated and after several weeks use it became completely inadequate.

Upon examination it was discovered that the recording tape was not properly tracking over the heads because of a major mechanical flaw. Apparently the mechanical ruggedness of the equipment was inadequate for the conditions of use. Thus, the effectiveness of this instrument was greatly limited. In an attempt to correct this flaw a number of minor adjustments were made, which somewhat rectified the problem at first, but did not fully correct the flaw.

A small drive pulley was then constructed for use with the standard Magnecord equipment. This attachment permitted a delay of .30 seconds

Figure 2 VARIABLE-SPEED DRIVE, UNMODIFIED TRIPLE-HEAD UNIT

(Top View)



- (1) Motor rails.
- (2) Delay control handle.
- (3) Motor.
- (4) Shaft extension and "O" ring drive.
- (5) Main drive disc.
- (6) Idler drive disc.
- (7) Idler drive rollers with "O" ring tires.
- (8) Main bearing.
- (9) Outer bearing.

- (10) Self aligning ball bearing.
- (11) Spring tension nut and lock nut.
- (12) Pressure spring.
- (13) Tape guide rollers.
- (14) Triple head unit.
- (15) Tape drive capstan.
- (16) Pressure roller.

Not shown:-

Oscillator unit and required electrical connections.

with the 7-1/2 inch per second tape speed. This instrument was used while a new instrument was being constructed.

B On January 15, 1953, the investigators requested the construction of a more refined variable-delay instrument, since it was believed that its refinements would eliminate some of the difficulties encountered in previous instruments. The refinement by the [redacted] laboratory consisted of a variable tape speed which was incorporated with the erase, record, and playback head assembly of the standard Magnecord. In order to accomplish this, a standard Magnecord recording unit was completely dismantled and then rebuilt with a variable tape speed. Also, the standard Magnecord synchronous motor was adjusted so as to drive a disc at variable distances from the axis. The newly constructed drive was free from wow and had a 1-10 speed range, which meant the tape speed was 3" to 30" per second. This provided an easily adjustable variable in the side-tone delay from .041 to .416 seconds. The standard Magnecord endless-loop tape device was utilized in place of the standard two-reel device. This instrument was delivered in March, 1953. (See Figure 2.)

This variable-delay instrument proved to be the most durable so far tested because of its improved design and better construction. It provided the interrogator with an instrument which did not have disturbing wow, flutter, or noise. The investigators thought that this improved instrument would provide a better evaluation of the variable side-tone delay because of these refinements. It was believed that more subjects would be affected

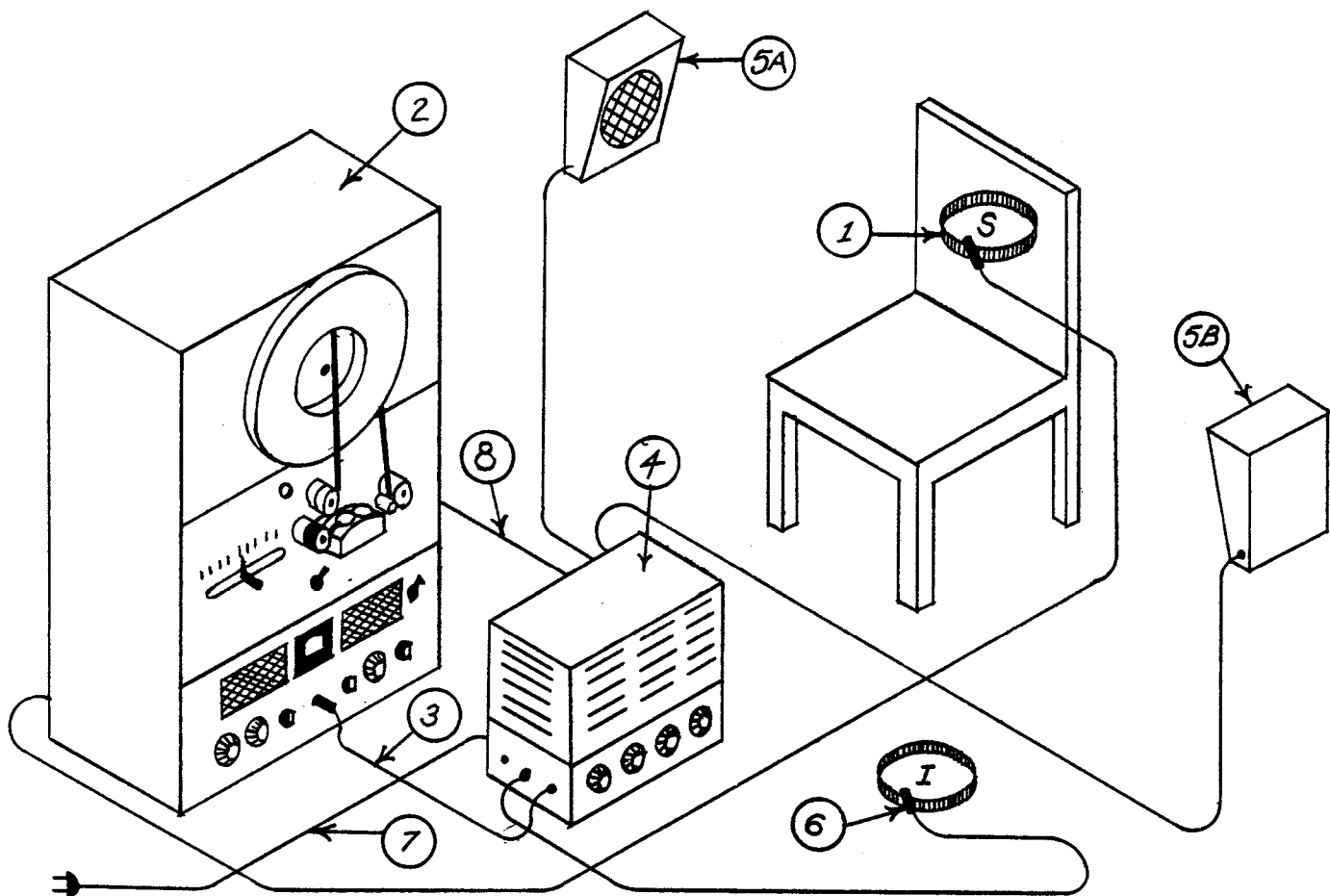
by the side-tone delay phenomenon with this improved instrument and that more confessions might result. However, in actual criminal cases it was found that the subjects, who were not affected by a preadjusted .20 seconds delay, were usually not affected when the variable-delay device was used. This was true even though the entire range from .041 to .416 seconds was utilized. Furthermore, the subjects who were affected to any extent by the preadjusted delay of .20 seconds were seldom affected to any greater extent when the delay was increased or decreased. Also, the percentage of confessions did not increase with the use of this improved instrument.

In February, 1953, the investigators decided that possibly better results could be obtained if the subject was not required to wear earphones. On May 12, 1953, additional apparatus was added to this variable-delay equipment so that it would be unnecessary for the subject to wear earphones. The elimination of the subject's earphones was accomplished by adding two throat microphones, an auxiliary amplifier, and two external speakers.

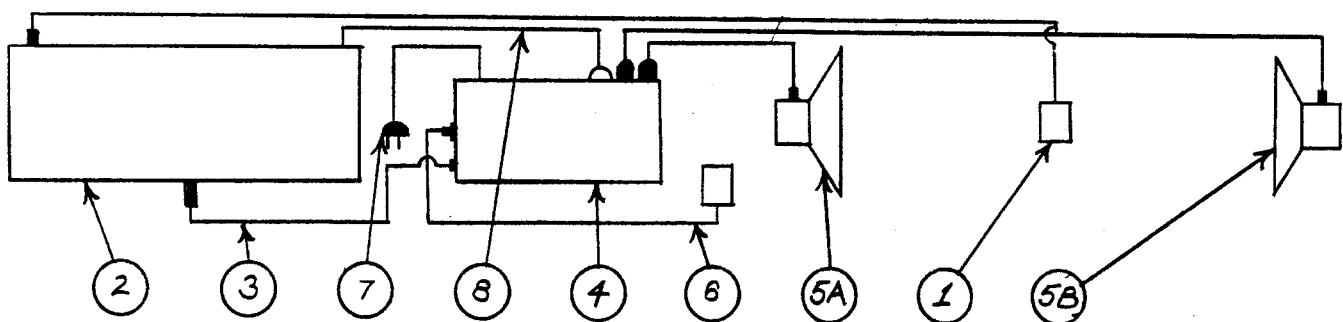
The microphones are of the crystal-contact type and were adapted as throat microphones since no commercial ones were available. The subject's microphone is connected to the standard Magnecord amplifier, and the amplifier's meter switch becomes the STD off-and-on switch. The Magnecord's monitoring jack is the outlet from this instrument and it is connected directly to the auxiliary amplifier. The subject's speech goes through this auxiliary amplifier to the two external speakers. The second throat microphone is used by the interrogator, but this microphone is connected directly

Figure 3. VARIABLE-DELAY, EXTERNAL SPEAKERS:

Pictorial and Schematic Diagrams



- (1) Subject's microphone and cord.
- (2) Magnecorder amplifier and special recording panel.
- (3) Interconnection cable.
- (4) Auxiliary amplifier.
- (5A & B) Speakers and speaker cords.
- (6) Interrogator's microphone and cord.
- (7) Power input (117 V., 60 cy. AC.)
- (8) Power cord from Magnecorder amplifier (Plugs into auxiliary amplifier)



to the auxiliary amplifier, thence to the two external speakers. (See Figure 3.)

Thus, the subject's speech can be delayed any desired time by means of the variable-speed constant head-separation device, while the interrogator's speech can never be delayed. Since the interrogator's and subject's voices are heard through the same auxiliary amplifier and speakers, they both sound alike. Therefore, it was thought that the subject would be less likely to suspect that his voice was being delayed since both voices sounded alike.

B Through experimentation at the laboratory it was found that two external speakers were much more effective in inducing the STD effect than one speaker. With only one speaker the subject can turn his head and focus his attention away from the source of his delayed speech. The best results were obtained when the two speakers were placed equidistant from each side of the subject.

However, in testing this laboratory's personnel with the external-speaker system, it was their opinion that it was very noticeable that the instrument itself was causing the STD effect. With the earphones, the subjects believed that they were at fault since their voices seemed directed at them without delay. Because the external-speaker system so obviously delays the voice, it is believed that this arrangement will not help to obtain confessions; in fact, it will hinder the interrogator.

X. Conclusions.

1. Experiments in this laboratory indicated that the .20 second delay was much more effective in producing the STD phenomenon than any other delay ranging from .02 to .50 seconds. The conclusion, that the .20 second delay was the most effective, was in agreement with the findings of other experimentors in this field.⁶

2. The difficulty in speaking encountered by the subjects at this laboratory was far less than expected, even with the .20 second delay. In fact, the investigators were greatly surprised at the little difficulty the subjects had in speaking with the STD. The reports of other experimentors seemed to indicate that most subjects would automatically experience great difficulty in speaking.⁷

⁶ Guttman, Newman, "An Analysis of Articulation as a Function of Delayed Auditory Feedback," M. A. Thesis, University of Illinois, 1951.

⁷ Included in the Summary of N. Guttman's thesis, ibid, was the following:

"Each of 16 male subjects read the same passage aloud under the following conditions of time delay: Unamplified, zero delay, no headset; amplified, zero delay; amplified .10, .20, .40, and .80 sec. delays; amplified, zero delay. Data were obtained from phonetic transcriptions of the readings.

In almost all measures the peak of disturbance was at .20 sec. In comparison to zero delay total articulatory errors at the peak were approximately 400% more numerous, articulatory rate decreased 30 to 40%, phonetic output increased 8%, and error rate increased 300%.

Rate of error increased from one error every three seconds for zero delay to more than one per second at .20 sec. Each of the

(continue at bottom of next page)

These results indicated to the investigators that possibly the amount of difficulty the subject experienced due to the STD might be related to his educational background, intelligence, social consciousness, or a combination of these three factors. This hypothesis was based upon the fact that previous experimentors apparently only used college students as their subjects, while many of the subjects at this laboratory were uneducated, and their lack of social responsibility was often demonstrated by their numerous arrests.

Their examinations at this laboratory was something very serious to these subjects since their liberty depended on the results of the examinations. No explanation as to the how and the why of the STD could be given to them, since the psychological value would then be completely destroyed. Also, because so much was at stake for the subjects, the investigators could not expect complete mental or physical co-operation from them, especially from those who were guilty.

3. Since it was found that the .20 second delay was the most effective in producing the STD phenomenon, an unmodified Magnecord unit (PT63-J Amplifier and PT63-AH Recorder) which affords a delay of .20 seconds, is sufficient as a STD instrument. Any further instrumentation beyond this is unnecessary if future experiments are to be conducted

individual types of error, substitution, omission, addition, and miscellaneous, also peaked at .20 sec.

Rate of articulation, similar in pattern for each of the three measures of output, varied significantly with delay and was slowest at .20 sec."

in using the STD as an interrogation device.

4. During this experiment almost every criminal-case subject, considered innocent by the investigators, was interrogated with the STD to determine if its use would induce a false confession. Not one of these innocent subjects made any admissions against interest, however slight, when interrogated as guilty. Therefore, it is believed that no false confessions or admissions will result from innocent subjects when the STD instrument is properly used.

B 5. It was found that approximately the same percentage of guilty subjects confessed when the variable-delay instruments were used for the interrogation as when the one fixed-delay instruments were used. The total percentage of confessions from interrogated guilty STD subjects amounted to approximately 56 per cent. This figure of 56 per cent can be contrasted to the percentage of criminal confessions gained at the [] laboratory between January 1, 1948 and December 31, 1952. During this five-year period, when no side-tone delay instruments were used on the subjects, approximately 62 per cent of the interrogated subjects did confess to the crimes under investigation.

Thus, when one reviews the past year in its entirety, it appears that the side-tone delay did not increase the percentage of confessions. When a confession was gained by the use of the STD instrument, it did not materially reduce the time required for obtaining the confession, nor did it make the interrogation any easier. Furthermore, the

investigators believe that the great majority of those who did confess would have confessed anyhow without the use of the STD instrument!

In fact, there is a good possibility that the use of the STD actually stopped a number of subjects from confessing their crimes. This was definitely proven to be true in two cases when, after fully confessing, the subjects stated that they did not confess earlier because of the STD and that they waited until the STD instrument was turned off before doing so. Also, it is believed that during many other interrogations the guilty subjects were so confused or bewildered by the STD effect that they were no longer concerned about their crimes and were not listening to what the interrogator said. When the subject is actually distracted by the effects of the STD, the interrogator's persuasiveness is lost and there is very little likelihood of obtaining the confession.

6. It is the opinion of the investigators that the future holds very little hope for the side-tone delay instrument as an effective interrogation device.

7. Also extensively tested in this laboratory was the hypothesis that the use of the STD would produce more easily interpreted polygraph records. The investigators considered this so important that they added it to the project as its secondary aim. Various types of answers (yes or no, short-term, long-term, and narrative type answers) were experimented with during polygraph tests when the STD instrument was also being operated.

In the great majority of instances the STD was ineffective in producing the desired results, and in many instances the STD affected polygraph records so that they were more difficult to interpret. In fact, on two occasions the use of the STD actually defeated the purpose of the polygraph tests. On these occasions the side-tone delay caused two verified innocent subjects to respond as if they were actually guilty.

For these reasons the investigators believe that the STD instrument should not be used in conjunction with the polygraph.

XI.

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- A. Accompaniments of Word Intelligibility.
- B. Adaptation to Delayed Side-Tone.
- C. The Effect of Delayed Side-Tone upon Vocal Rate and Intensity.
- D. The Effect of Noise-Induced Temporary Deafness upon Vocal Intensity.
- E. Formal Spoken Vocabulary of College Students.
- F. The Intrinsic Intensity of Oral Phrases.

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- G. Intelligibility of Speech Heard at High Altitude and Sea Level.
 - H. The Pressure in the Oral Cavity in the Production of Consonants.
 - I. Some Influences of Delayed Side-Tone upon Intelligibility.
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