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COMPARISON OF VOICE ANALYSIS AND POLYGRAPH AS LIE DETECTION PROCEDURES*

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Synopsis

Two voice-analysis techniques were evaluated as lie detection devices in a simulated theft experiment which utilized 174 subjects. One group of subjects (n = 137) were examined with the polygraph at the same time as voice recordings were taken. A smaller group (n = 37) was tested only with voice recordings. Both groups of subjects consisted of male and female university students.

The results failed to demonstrate that either of the voice-analysis techniques was effective in identifying the three basic roles (Thief, Lookout, Innocent Suspect) of the simulated theft. In contrast, the polygraph achieved an accuracy score of 76 percent, a value comparable to that obtained in previous studies using the simulated theft paradigm. Independent raters, who knew nothing about the characteristics of the persons examined, also obtained significantly high accuracy scores in the examination of the polygraph charts (50 - 60 percent).

Although the overall results obtained from voice recordings were not statistically significant, lower voice-accuracy was obtained with polygraph-tested subjects than with those who were examined without the polygraph.

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A subsidiary result concerns the ratings of tape monitors who were present during all interrogation sessions. Basing their judgments only on their immediate global impressions, they were able to discriminate between the thief, lookout, and innocent suspect with a significant degree of accuracy. This capability together with the highly significant accuracy scores of the polygraph examiners, demonstrate that the simulated theft procedure is valid for lie detection research, in that it induces in subjects a sufficient degree of emotional responsiveness and involvement to enable the polygraph examiners and tape monitors to differentiate among the three basic roles of the simulated theft situation.

The failure of the voice-analysis techniques to detect these differences cannot, then, be attributed to insufficient emotionality in the subjects. Rather it would seem to be a matter of insensitivity or other inadequacy in the devices themselves in their present state of development.

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Chapter 1. Objectives and Background

The present research had two objectives: to evaluate the capability of voice analysis as a lie detection technique and to compare the efficiency of two such devices with that of the polygraph. To achieve these objectives, the "simulated theft" paradigm, developed by the author in previous research (Kubis, 1962), was adapted to the needs of the present experiment. Before beginning a description of this experiment, a brief review of the underlying rationale of lie detection procedures will be presented to provide a meaningful background for the proper evaluation of this research.

Emotional Expression

The basic characteristic of an emotional reaction is its widespread and diffuse aspect. All parts of the body are involved, internal as well as external. The hormonal responses to an emotional situation rapidly induce a variety of physiological perturbations among which blood pressure, respiration, and the psychogalvanic response have attained popularity as lie detection indices. While the use of these systems is sometimes identified with the specific area of lie detection, the physiological outputs are actually quite general, and have been accepted as valid expressions of an entire gamut of emotional responses. The particular problem in lie detection, which is still not completely resolved, is the proper identification of the emotional components associated with lying.

As for external expression, all parts of the body have long been known to participate in and reflect various emotional experiences. The body shows emotion in the face, voice, hands, legs, and body posture; and in their complex dynamic interactions. Since these body expressions serve as signs and signals, they have recently been studied in the light of communication theory. Essentially, the body expressions are seen as nonverbal communications. Both momentary feeling states and longer lasting emotional attitudes, reflected in

the external expressions of the body, can be viewed as messages to be decoded by an empathic observer. Mehrabian (1972) states that "Any behavior that is observable can serve as an outlet for feeling and is thus, in principle, communicative" (p. 179). Basing his conclusions on observations of psychiatric patients, Deutsch (1947) states:

> The correlation of psychological (verbal) with postural expression shows, that in states of instinctual conflict, the defenses and the repressed emotions are readily reflected in bodily behavior (p. 211).

"Body language," it would seem, is perfectly general, applicable to normal and patient populations.

Behavioral responses expressive of emotional states are, then, divided into two classes: Those external and directly visible (or audible), such as changes in facial pattern, hand position, posture, rate of speech; and those internal and not directly accessible, such as physiological responses and mental attitudes. With sources as varied as these the problem of inconsistent messages is a serious one for investigators to unravel. Of specific relevance to this discussion is any inconsistency between verbal response and internal belief which is deliberately contrived by the speaker. This is the problem of lying; and its possible detection depends on the patterning of internal and external behavior induced by the discrepancy of subjective knowledge and its verbal expression.

From among the wealth of expressive indicators, several distinct combinations have been proposed as possible lie detection criteria. The physiological indices, such as blood pressure, respiration, and the psychogalvanic response, have been studied experimentally and used practically in criminal and civil investigations. This literature is extensive and easily available. Two more recent proposals for lie detection involve nonverbal behavior and voice analysis. These deserve separate treatment.

Nonverbal Indices Of Lying

It is safe to assume that most adults have observed others in evasive situations, such as consciously trying to

deceive or mislead. In general, too, most have learned how to interpret the behaviors associated with such evasive tactics. As a result of these experiences, most people feel that they can often tell whether a person is lying or telling the truth merely by observing his nonverbal behavior.

It would seem that "nonverbal behavior may escape efforts to deceive, may evade self-censoring, or may betray dissimulation" (Ekman and Friesen, 1969, p. 88). With this general hypothesis, Ekman and Friesen explored the capability of different parts of the body to send deception clues. They assumed that the face had the greatest "sending capacity"; the legs and feet, the poorest. As sources of leakage and deception clues, the legs were best, the face the poorest. They used only one subject, a hospitalized psychiatric patient whom they photographed in an interview in which she tried to conceal how upset she was. This film was shown to two groups of observers: one group was shown the face and head, the other saw only the neck and body. The observers were to describe the feelings of the patient. The results were inconclusive since the hypothesis, that differential messages would be sent by these two general areas of the body, was not verified.

In an extensive series of experiments, Mehrabian(1971) also explored various nonverbal behaviors that could betray the true feelings of individuals. Most of the situations required subjects to make verbal presentations to a judge on issues they strongly approved or strongly disapproved. They were to maintain or create an impression of truth-telling in some situations; in others, they were to create an impression of lying. In the first two experiments, the subjects were viewed through a one-way mirror by observers who scored various aspects of the behavior, such as body position, movements of body members, facial expressions, verbalizations, and vocal activity. In the third experiment the subjects' behavior and speech were videotaped without their knowledge and later rated on the same behavioral characteristics. The results demonstrated that:

> . . . when being deceitful communicators nodded and gestured less, exhibited less frequent leg and foot movements, assumed less immediate

> positions relative to their addresses, talked less, talked slower, had more speech errors, and smiled more (Mehrabian, 1972, p. 103).

As previously indicated, experimental interest in this field is rather recent, while folk-lore and common experience have always acknowledged that concealed information must find an outlet in bodily expression. This "common-sense" knowledge has long been accepted as axiomatic among criminal investigators. The careful search for bodily clues of deception during preliminary interviews with the suspect is strongly advocated by Reid and Inbau (1966) in their text Truth and Deception. Various criteria by which to distinguish truth-telling from lying are also advocated. As an example:

> A truth-telling person will not be upset by the suggestion of fingerprinting, or footprint implications, whereas a liar will probably manifest considerable concern by such reactions as a delay in his answer, by looking away from the examiner, or by squirming around in the chair (1966, p. 14).

Whether he is aware of them or not, the polygraph operator will always be exposed to the nonverbal communications of the person he is interviewing or interrogating. The important issue is the determination of how much the nonverbal behavior is being utilized in the final decision process. If the polygraph operator is also the person who does the pre-test interviewing (and in most instances this is the case) how much of his final decision has already been determined before the polygraph examination has actually begun? It should be obvious that research in this area is urgently needed.

Voice Characteristics During Deception

Voice-Emotion-Stress

Studies of, and training in, the vocal and temporal parameters of speech have always been considered the province of rhetoric and drama. This area has been rather neglected by psychologists whose research has focused more on personality and emotion as related to differences in vocal expression. Even here, results have been somewhat disappointing. Myers

and Merluzzi (1971) report in a recent review that relationships between specific emotions and definite vocal patterns have neither been clear nor consistent. Recently, the development of voice spectrum analysis has opened up a new and intriguing technique for the study of these relationships, and the search for vocal characteristics that would have wide application still continues. At the present time,

> . . . progress is being made in relating complex physical characteristics of speech to emotions and emotional stress. The primary problems are intersubject and intrasubject variability; thus, using only physical characteristics of speech as a determination of emotions or stress is still unreliable (Myers and Merluzzi, 1971, p. 4).

Much of the work in analyzing the speech spectrum in order to discriminate among emotional states has been initiated by Russian scientists. Some of the earliest research in spectrum analysis was developed in conjunction with the Russian space program, because of the expectation that this procedure would prove valuable in assessing degrees of stress in cosmonauts. The early interest of Russian scientists in the particularly intriguing problem of discriminating positive and negative emotions continues to the present (Popov et al., 1971).

Voice Analysis as a Lie Detection Technique

Myers and Merluzzi (1971) report only two studies in which judges attempted to detect lying solely by listening to the voices of speakers. In one report, the voices were presented over a public address system; in the other, they were on tape. In neither experiment was there a significant degree of correct identification of lying.

The electronic analysis of the speech spectrum might prove to be more diagnostic than ordinary signal acquisition and analysis by the human ear. Such electronic analysis is certainly more reliable and more objective, as it focuses exclusively on the physical characteristics of the sound. At the present time, two different instruments have been devised to explore this area, and though both make claims to measure "stress" or "psychological stress," their primary use seems to be directed at lie detection.

In the case of the Dektor Psychological Stress Evaluator, no experimental data have been made available. Publicity in the popular magazines, however, claims validity for the Dektor technique in criminal and non-criminal situations.

The second instrument, manufactured by Decision Control Incorporated, was "evaluated" by comparison with the polygraph in a study on three subjects. In a complex and lengthy report, Decision Control Incorporated, concluded: "The results of this study indicate that voice analysis provides results comparable to polygraph evaluations" (1971, p. 14). The nature of the report and the data presented make this conclusion difficult to verify; in any case the conclusion overshoots the data in that only three subjects were examined.

Before any such voice-spectrum instruments can expect to be accepted as valid, several requirements must be met by their manufacturers. Equipment developers must define more precisely what they mean by "stress," and must calibrate the physical output against known degree of "stress." In addition, they must establish that the "stress" their machines measure is identified with whatever "stress" it is that permeates the lying response. Here again, a great deal of research remains to be done.

Chapter 2. Procedure

As indicated earlier, the experiment was structured around a simulated theft. The subject acting as Thief had an accomplice, a Lookout; and both were interrogated immediately after the "crime." Serving as a control and completing the experimental triad, an Innocent Suspect was also interrogated about the theft. He neither knew nor saw the "culprits"; neither did he know what was stolen, nor how the theft was committed. Voice recordings were made of the interrogation procedure.

Interrogation was conducted under two modes: polygraph plus tape recording; and tape recordings of voice only. In the latter mode there was no change in overall procedure of the experiment, except in this, that when the subject was interrogated, the polygraph apparatus was not attached to him. In this way, the physical stress and annoyance occassioned by the polygraph attachments were avoided.

Since the tape recordings made of subjects' voices were later to be analyzed by each of the presently-available instruments (Psychological Stress Evaluator and Voice Stress Analyzer) it was desirable to be able to evaluate the accuracy of these voice-analysis procedures in both polygraph and non-polygraph situations. In the latter case, the possible effect on vocal responsivity of intrusive anxiety created by the inflated cuff could be avoided. On the other hand, the former case (polygraph attached) corresponds more closely to the actual experience of subjects interrogated with the polygraph. And it is against the established records of detectability of polygraph subjects that the voice-analytic detection successes were to be compared. Approximately 20 percent of the voice recordings were obtained under the voice-only (no polygraph) condition.

The examination involved a polygraph operator (Examiner) and a Tape Recording Monitor. The function of the Tape Monitor was to control the volume input of the subject's voice in order to optimize the adequacy of the tape recording. After each triad was examined, the Examiner and the Tape Monitor independently recorded their immediate impressions as to the actual role played by the subjects. In the case of the Tape Monitor this judgment was based on the general behavior of the subject, his general comments, and on the character of his vocal responses. The polygraph operators may be presumed to have used the same indices; for they said that their immediate global judgments were not too much influenced by the actual chart recordings being made. The operators felt they were much too busy with the technical details of operation to take serious note at the time of any subtle correlations among the various responses. In any case, the formal analysis of the polygraph records was made by the Examiner about two weeks after the examination. His task was to determine who was the Thief, the Lookout, and the Innocent Suspect in each experimental triad. Complete details of this procedure are described in the following sections.

The Simulated Theft

Students were recruited as subjects by means of posted notices and by ads placed in the school newspaper. Once they indicated their willingness to participate in an

"experiment," they were arbitrarily arranged in groups of three and given an appointment for the experiment. Because the subjects rarely arrived at exactly the same time, the Supervisor of the experiment was able to put one subject in one room and the other two in a separate room without the former seeing the latter. In almost all cases the three subjects did not know each other.

Once in the room the subjects were asked to fill out a form which requested census-type information. They were also asked to sign a pledge not to talk with anyone about this experiment for a period of a year. The census-type information enabled the Examiner to choose the appropriate questions for his interrogation.

The Supervisor then instructed the two individuals who were together as to the roles they were to assume. By drawing lots, one assumed the role of Thief, the other the role of Lookout. The Thief was to enter what he believed to be the unoccupied office of a female professor, open her handbag which was on the desk, examine the contents of the bag, and remove only the contents of the change-purse which was in the bag. The purse contained 21 dollars in bills wrapped around by a red ribbon.

The Thief's associate was to act as a Lookout, making sure that no one was around while the Thief entered and left the "professor's office." Since there were other offices nearby, and a students' activities room within 15 feet of the locus of the theft, the Lookout had an important and anxiety-provoking role in view of the uncertainties of students' and professors' whereabouts.

Although Thief and Lookout arrived near the professor's office together, they left the scene of the crime at different times so as not to attract attention or suspicion. Upon completion of his task, the Thief signalled the Lookout who immediately returned to the laboratory. In turn the Thief left the scene of the crime, examined what he had taken from the purse, hid it on his person, and then returned to the laboratory. The two accomplices were instructed not to talk to each other after the Theft was committed. As a result, the Lookout did not know what was stolen. While Thief and Lookout were waiting to be examined, the Supervisor made certain that no conversations were initiated between them.

Before being examined, the Innocent Suspect, who neither knew what happened nor who was involved, was given general instructions that there had "been a theft of some money in one of the faculty offices." He was advised that since he was not involved, he had no cause for worry. All that was required was that he answer the questions truthfully. (The Thief and the Lookout had already been instructed to deny all aspects of the theft, namely, the planning, participation, and execution.)

Within each triad, subjects were examined in a random order.

The Examination

Most of the examinations involved the use of a polygraph and a tape recorder with a lavalier microphone. The subject was seated in front and to the side of the polygraph, which was thus placed to minimize its peripheral visibility to the subject during the testing. The Examiner was to the left and behind the apparatus while the Tape Monitor was more or less directly behind the subject. Both Examiner and Tape Monitor were unaware of the role each subject had played in the experiment.

The examination consisted of three parts: Interrogation with Questionnaire, Modified Peak of Tension Test, and an Association Test. Each of these is described below.

Questionnaire

After the pneumograph bellows, the lavalier microphone, the PGR electrodes, and the blood-pressure cuff were attached, the subject was instructed to give a "Yes" or "No" answer to each of 30 questions included in the Questionnaire (cf. Appendix). To prevent excessive discomfort, the questionnaire was divided into four approximately equal parts, after each of which the pressure in the cuff was released and the subject given a brief rest.

Three types of questions were contained in the questionnaire: matter-of-fact questions, emotional standards, and critical questions. As a designation suggests, the critical questions were directly related to the theft. There were four of them, each repeated once, thus providing a total of eight critical questions. The critical questions were:

Were you an accomplice to the thief?
Did you plan this robbery with someone else?
Do you know who stole the money from Room 450?
Do you have the stolen money with you?

Preceding each of these were emotional standard questions. These involved matters of a personal or family nature. In previous research they had been found to produce a moderate emotional reaction. These, too, were repeated; but no emotional standard preceded the same critical question more than once. Examples of these are:

Do you have any brothers? sisters?
Are you married? single?
Have you served in the armed forces?
Have you ever been arrested?

Interspersed throughout the remainder of the questionnaire were the matter-of-fact or census-type questions, such as:

Are you a Law School student?
Do you live in a one family house? an apartment?
Do you own a motorcycle? car?
Do you live in Brooklyn? Staten Island?

Of the matter-of-fact questions, only those which followed a critical question were so structured as to elicit a "No" response. All emotional standards also elicited a "No" response. The purpose was to guarantee a constant verbal evocation for these three questions. Only with this precaution could valid comparisons be made among ratios of emotional standards to critical, and among ratios of matter-of-fact to critical. In other words, every triad of questions with critical question at center was answered by a "No." All other matter-of-fact questions, those preceding or following these triads, were answerable by "Yes." These "Yes" response provided a change in response attitude and made the questioning seem quite natural to the subject.

Peak of Tension Test

Upon completion of the questionnaire, the Examiner instructed the subject to say "No" to each of the following numbers (which represented dollars):

15 17 19 21 23 25

As may be observed, the series is calculated to induce a build-up of tension toward the critical number 21, the amount stolen. Following the critical number, one would expect a decrease of tension, since the subsequent numbers are irrelevant to the Thief. As for the Lookout and Innocent Suspect, no such regular rise and fall of tension was expected, since neither knew what amount had been stolen.

Association Test

The final test procedure included two lists of words used as association tests. These lists follow.

1) APPLE EAGLE HANDBAG PENCIL TABLE LOOKOUT ROADSIDE

2) WINDOW WARLIKE RIBBON SPRINGTIME OCEAN

The underlined words have direct reference to the theft. Those in the first list involve the Thief and the Lookout. The word RIBBON in the second list could have meaning only to the Thief.

The Peak of Tension and Association procedures comprised approximately 40 percent of testing time. They were used to provide additional criteria for the differentiation of the Thief and Lookout, a matter to which the questionnaire devoted only 25 percent of testing time(two of eight critical questions).

Post Examination and Debriefing

When the three test procedures had been completed, the Examiner instructed the subject to return to the Supervisor. After the last subject of a triad was examined, the Examiner and Tape Monitor, each working independently, recorded their impression as to who was the Thief, who the Lookout, and who the Innocent Suspect. This procedure provided a basis for evaluating the ability of the Tape Monitor to size up suspects merely on the basis of their behavior and voice characteristics. The Examiner potentially had an additional source of information -- the polygraph record. However, as mentioned earlier, the Examiners felt that, in view of the

continuing attention to mechanical details, position of next question to be asked, etc., very little immediate record interpretation was possible. As a result they considered their impressions of the person's behavior before, during, and immediately after the examination to be significant factors in their identification of the role each subject assumed in the experiment. Contrast between the success ratios of Tape Monitors and Examiners in these immediate global judgments if found, might suggest in fact, that the Examiners had made some use of the chart information available to them.

Meanwhile the subject who completed the examination was being debriefed by the Supervisor. He was also asked to rate his emotional reactions during each phase of the theft (Thief and Lookout) and during the interrogation itself (all members of triad).

One month following the completion of the experiment, all subjects were contacted for the drawing of prizes. This fulfilled the promise made during recruitment and during the initial instructions by the Supervisor.

Contacts with subjects tended to confirm the belief that no subject talked about the experiment before it was completed. Cooperation of subjects seemed particularly good in this matter.

Physical Facilities and Instrumentation

Physical Facilities

The experimental facilities included a suite of three adjacent rooms one of which was used for interrogating the subjects. The other two rooms were used to accomodate the subjects before and after the examination period. They were furnished with tables and chairs, and served as waiting and instruction rooms. The examining room contained the polygraph and recording instruments.

The room from which the money was stolen was one floor above, and at the opposite end of the corridor. Prior to its use for this project, it had been a testing room, though no different from others which were being used as offices by faculty. It was arranged to look like a faculty office, with books and reading material spread about on the desk.

With the handbag on the desk, it appeared that the faculty member had just stepped out for a moment.

Instrumentation

Two traditional field polygraphs (Stoelting) were available for use throughout the experiment. The one which provided the basic data was a compact Md 1 Executive. A Stoelting Deceptograph which was used for training the Examiners was always on hand for backup purposes.

A high quality recorder, Uher 4000 Report L, was used to record the interrogation sessions. Tape speed was 7-½ inches per second. A lavalier microphone was also used. In the early phase of the experiment, the microphone was generally placed on the table next to the subject. During the latter part it was uniformly placed over the neck of the subject and rested comfortably on his chest.

A preliminary model of the Voice Stress Analyzer was used in the evaluation of the voice records. The instrument, produced by Decision Control, Inc., extracts speech energies in two frequency bands, 100 to 120 hertz, and 500 to 800 hertz; and forms the ratio of the corresponding energies. This ratio is assumed to change with variation in stress. The instrument presents a visual record on paper tape of energy ratios extracted from a given speech signal. In the present research the speech signal was the word "No." The peak amplitude of the energy ratio is the value used to assess the degree of stress, and thus the degree of involvement in the simulated theft.

The Dektor Psychological Stress Evaluator was also used to analyze the same tape recordings obtained in the simulated theft. A brief account of its use has been provided by George F. Cake Co. in a page of advertising copy. An excerpt from this description follows.

> It makes use of specific voice qualities which reflect visually or aurally undetectable changes resulting from small changes in the degree of psychological stress . . . Either "yes" or "no" answers, narrative answers, or conversational

utterances may be used to accomplish the evaluation . . . the voice frequencies employed are well within the 300 to 3,000 hertz frequency band. (Advertising copy, George F. Cake Co.)

There are several levels or modes of analysis, and the first of these is analogous to that obtained with the Voice Stress Analyzer. Additional modes involve a sophisticated visual evaluation of frequency patterns. Expertise in these procedures requires extensive training. In this present experiment all analyses performed on the Psychological Stress Evaluator were done by an expert who had been trained at Dektor.

Subjects

All subjects were students at Fordham University. The majority ranged from 18 to 25 years of age; only three were younger than 18 and eight older than 25. The sample included 116 men and 58 women.

There were 57 complete triads. Of these 45 involved both the polygraph and tape recorder; 12 triads used the tape recorder alone during the interrogation. An additional classification of the triads showed that 18 were female in composition, 36 were male, and 3 were mixed. Of these 2 of the female, 7 of the male, and the 3 mixed triads were interrogated by the non-polygraph procedure.

As expected, a number of difficulties arose during the execution of the experiment. In triad 5, one subject confessed. Triad 39 was eliminated because of a strong suspicion that the subjects had previous knowledge of the details of the experiment. Triad 40 was also discarded because of nonresponsivity, possibly due to mechanical difficulties. Several other triads contained poor records in one or another component. These records were not discarded whenever two of the other components generated adequate tracings.

Examiners And Raters

Four Examiners were used. During the course of each simulated theft, one of the Examiners served as polygraph operator while another assumed the role of Supervisor for that experimental triad. Usually these roles were reversed

when several triads were available.

All four Examiners had graduate degrees -- two had Ph.D. and two, M.A. degrees. Two were male and two were female. All were psychologists with a strong background in the physiological bases of emotional responsiveness. Before beginning the experiment, they were given a short course in polygraph operation by an acknowledged expert in the field from another institution.

After completing the interrogation of an experimental triad, the Examiner filed the polygraph charts for a period of approximately two weeks, to allow specific memories of any session to fade before he started his formal analysis of the records. He rated the polygraph responses from all three components of the interrogations and then gave his decision as to the role of each member of the triad. This was done for each triad separately. For ready reference, this rating procedure will be called "Triad Analysis." This is to be contrasted with "Individual Analysis" wherein each individual record, isolated from its triad, is judged on its own merits. In the Triad Analysis, the rater has all three records of a triad for comparison, and should he be correct in two of the judgments, he would necessarily be correct in his judgment of the third record even though he never looked at it. In the Individual Analysis, the rater made his judgment of subject involvement (Thief, or Lookout, or Innocent Suspect) only on the basis of the tracings in that record alone. There were no clues from the previous or subsequent record since these belonged to different triads.

While Triad Analysis was done by the four Examiners, the Individual Analysis of polygraph records was reversed for two other experienced polygraph operators. With these data, then, both types of comparison were made: accuracy of polygraph and voice ratings under Individual Analysis; and accuracy of polygraph and voice ratings under Triad Analysis.

Chapter 3. Results

Despite the complexity of the procedures and analyses, the results can be readily classified into several interrelated categories. The first section will deal with the polygraph results: the accuracy of judgment in Examiner

rater, and the detectability of lying in male and female subjects. In a sense this introductory evaluation has to do with the validity of the experimental procedure. If the polygraph operator could not detect emotional variation in the responses of different role-playing subjects, there would be some doubt as to the adequacy of the polygraph as a criterion against which to test the validity of the voice analyzers as lie detection devices.

The second section will analyze the immediate global judgments of Examiners and Tape Monitors. These results should provide evidence as to whether behavior is a nonverbal communicator of the internal attitudes and feelings of the suspect and whether ordinary people can decode these messages with better than chance accuracy. The results provided in this section can also be used to validate the experimental procedure in that they may provide evidence that the experimental procedure does in fact induce specific behaviors in the suspect which reflect his guilty or innocent frame of mind.

In the third section the evaluation of the Psychological Stress Evaluator as a lie detector will be done under both analytic modes -- Individual and Triad Analysis. Further, the accuracy of the Psychological Stress Evaluator will be determined when used with the polygraph and when used alone. This comparison should indicate whether the stress induced by the polygraph attachments affects the adequacy of the voice records for lie detection purposes.

The final section will present the statistical analysis of the peak responses of the Voice Stress Analyzer (VSA) to the critical questions during the interrogation. Since no specific criteria for detecting deception have been provided by the VSA research manual, the procedure adopted was to make an analysis of the VSA responses for each of the eight critical questions, taken separately for each triad. Within each triad, the responses were ranked for each of the questions. The sum of the ranks for each experimental role (Thief, Lookout, Innocent Suspect) could thus be used to indicate whether there was differential voice responsivity among subjects assuming each of the three roles.

Polygraph Results

Examiner Judgments

Since the polygraph was used as the basic instrument against which the voice analyses were to be compared, the results obtained from its use bear careful scrutiny. Table 1 presents the accuracy data for male and female subjects and for the combined results. The matrices of Table 1 permit the comparison of Examiner judgment, using Triad Analysis, against the actual status (role for each group of subjects. Within the male group, for example, of the 29 subjects who played the role of Thief, 25 were judged to be thieves by the Examiners. The four errors were divided equally among Lookouts and Innocent Suspects. Of the 29 Lookouts, 24 were judged as such by the Examiners. Four of the errors were judged as Innocent Suspects and one was rated as Thief. Overall Examiner accuracy with male subjects was 83 percent.

With female subjects, Examiner accuracy attained a 65 percent level. This percent of correct identification is considerably lower than the 83 percent obtained for male subjects. The reason for this difference is not readily apparent.

Using the combined data for all subjects, Examiner accuracy becomes 76 percent. In other words, three out of four suspects were identified correctly.

The results obtained for each of the matrices in Table 1 are very highly significant from a statistical point of view. The chi-square values are of the order of 96, 21, and 112 for male, female, and combined results respectively. These values are so large that they are not even included in the usual statistical tables. As a basis for comparison, the tabled value at the .05 level of significance is 3.84.

There is no doubt, then that the polygraph is used very effectively by the Examiner, yielding results that far exceed chance expectation. In turn, this implies that the experimental procedure does induce sufficient emotional arousal in the "guilty" subjects (Thief and Lookout) to enable them to be differentiated from the Innocent Suspect.

Further, the procedure is sufficiently precise as to enable the Examiner to distinguish the responses of the Lookout from those of the Thief.

Rater Judgments (Individual Analysis)

This section presents the results obtained by the two experienced polygraph operators who evaluated all polygraph records on an individual basis (Individual Analysis). The raters used different evaluative procedures, and it was anticipated that one of them (B) would attain a higher degree of accuracy because the procedure he used involved optimal exposure to the individual components of the polygraph records.* The results are presented in Tables 2 and 3.

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* Rater B evaluated and rated each physiological component of the polygraph chart separately and independently and made a role decision for each subject based on that component. After completing this procedure, he then made a role decision for each subject based on the total polygraph chart. Table 3 is based on the total chart. Rater A considered the total chart only.

TABLE 1. Accuracy of Examiner Judgments

Male Subjects (29 Triads)

		ACTUAL STATUS		
		Thief	Lookout	Innocent
EXAMINER RATINGS	Thief	25	1	3
	Lookout	2	24	3
	Innocent	2	4	23

(% correct: 72/87 = 83%)

Female Subjects (16 Triads)

		Thief	Lookout	Innocent
	Thief	9	5	2
EXAMINER	Lookout	6	9	1
RATINGS	Innocent	1	2	13

(% correct: 31/48 = 65%)

All Subjects (45 Triads)

		Thief	Lookout	Innocent
	Thief	34	6	5
EXAMINER RATINGS	Lookout	8	33	4
	Innocent	3	6	36

(% correct: 103/135 = 76%)

TABLE 2. Accuracy of Rater A in Judging Experimental Roles from Polygraph Records (Individual Analysis)

Male Subjects

RATER DECISION	Thief	Lookout	Innocent
Thief	13	2	8
Lookout	6	13	6
Innocent	9	11	18

(% correct: 44/86 = 51%)
Chi-square = 12.31

Female Subjects

RATER DECISION	Thief	Lookout	Innocent
Thief	6	4	1
Lookout	6	7	1
Innocent	4	6	11

(% correct: 24/46 = 52%)
Chi-square = 7.35

Male and Female Subjects

RATER DECISION	Thief	Lookout	Innocent
Thief	19	6	9
Lookout	12	20	7
Innocent	13	17	29

(% correct: 68/132 = 52%)
Chi-square = 19.64

TABLE 3. Accuracy of Rater B in Judging Experimental Roles from Polygraph Records (Individual Analysis)

Male Subjects

		Thief	Lookout	Innocent
RATER DECISION	Thief	18	2	2
	Lookout	6	12	5
	Innocent	5	14	20

(% correct: 50/85 = 59%)
Chi-square = 24.85

Female Subjects

		Thief	Lookout	Innocent
RATER DECISION	Thief	10	1	0
	Lookout	3	10	6
	Innocent	3	4	11

(% correct: 31/47 = 66%)
Chi-square = 22.51

Male and Female Subjects

		Thief	Lookout	Innocent
RATER DECISION	Thief	28	3	2
	Lookout	9	22	11
	Innocent	8	18	31

(% correct: 81/132 = 61%)
Chi-square = 46.67

Table 2 presents the results for Rater A. The outstanding features are: (1) Individual Analysis yields accuracies that are substantially lower than those obtained by the Examiners who utilized Triad Analysis; (2) though lower than Examiner accuracy, Rater A's percentages are highly significant; (3) Rater A is equally accurate in judging male or female records; (4) finally, as expected, judgments under Individual Analysis "tend towards innocence," that is, more innocent diagnoses are made than any other.

The results for Rater B in Table 3 exhibit a similar pattern. They confirm those found in Table 2, and reemphasize the fact that for these raters, using Individual Analysis, the records of female subjects are no more difficult to evaluate than records for male subjects. This contrasts with the results obtained by Examiners using Triad Analysis. As for the comparison between Raters A and B, it would seem that since both raters are equally competent, the procedure used by Rater B increased discriminability within the polygraph records and produced more accurate decisions.

The results of this section demonstrate that expert raters, working within the more demanding constraints of Individual Analysis, can with a significant degree of accuracy identify the role each subject played in the experiment. Neither of the raters were Examiners, and had no information about the subjects whose charts they had to evaluate. Nevertheless, their accuracy ranges between 50 - 60 percent, whereas only 33 percent is expected by chance. The basic inference is that the experiment did produce sufficient and differential emotional responsivity to enable the raters to identify the separate roles undertaken by the subjects in the experiment.

(Working afterwards under the conditions of Triad Analysis, Rater B obtained a total accuracy score of 77 percent, which is almost identical to the 76 percent obtained in Table 1 by the Examiners, who, of course, had also employed Triad Analysis.)

Immediate Global Judgment

As mentioned above, both Examiner and Tape Monitor, working independently, had recorded their decisions as to

the status of each member in a triad immediately upon the completion of its interrogation. From the nature of the case, the procedure involved Triad Analysis. The accuracy for these global impressions may be found in Table 4. The chi-square values corresponding to the percentages listed in Table 4 may be found in Table 5.

Taken together, the tables demonstrate that the immediate global judgments of Examiners and Tape Monitors are accurate to a significantly high degree. However, the overall accuracy of Examiners is higher than that of Tape Monitors. This would support the hypothesis, advanced above, that Examiners do in fact pick up important clues from the polygraph records during the examination, despite their assertions that attention to the mechanical aspects of the test procedure precluded any careful in-process analysis of responses.

TABLE 4. Percent Accuracy of Examiners and Tape Monitors in Their Immediate Global Judgments of Subject Status

	Male Ss		Female Ss		Combined	
	n	%	n	%	n	%
Examiners	105	61	45	73	150	65
Tape Monitors	90	48	39	72	129	55

TABLE 5. Chi-square Values* Corresponding to Percent Accuracy Data in Table 4.

	Male Ss	Female Ss	Combined
Examiners	36.04	32.40	66.27
Tape Monitors	7.45	25.96	18.23

* .01 level of significance, 6.64.

Of great importance for lie detection theory and practice are the results obtained by the Tape Monitors. They had no access to the polygraph charts. The only bases for their judgments were the general behavior and verbal comments of the subjects, and the vocal characteristics of the subjects' responses to the questions. Apparently these behaviors of subjects provided relevant clues to their true mental attitudes -- and this despite the subjects' attempts to appear non-committal and non-revealing.

One additional comment is in order. The accuracy of the Tape Monitors in detecting subjects' experimental roles implies that the experiment induced a sufficient degree of emotional responsiveness in the role-playing subjects to make them differentiable on the basis of their behavior. This provides additional evidence for the validity of the experimental procedure.

Psychological Stress Evaluator (PSE)

The tape recordings were analyzed separately by an expert polygraph operator who was also qualified as a PSE analyst by Dektor. These tapes were evaluated under both analytic modes, Individual and Triad Analysis. In the analyses presented in this section, subjects were divided into those who were examined with the polygraph and those who were interrogated without it.

Individual Analysis

The accuracy of the PSE operator working with individual records is presented in Table 6. As the results indicate, the percent accuracy remains very close to the chance value of 33. In other words, the tape recordings of the voice reveal no basis for discriminating between the Thief, the Lookout, and the Innocent Suspect. Although the accuracy figure is slightly higher for the non-polygraph subjects, the difference is not significant.

An additional comparison was made between the accuracy obtained with the PSE apparatus and that with the polygraph, still utilizing Individual Analysis for both. In evaluating the polygraph records of the same subjects whose voice characteristics were analyzed by the PSE operator, Raters A and B

obtained accuracy scores of 58 percent and 61 percent respectively. It is rather clear, then, that the polygraph records of the group of subjects are more discriminable than the voice records which were obtained at the same time. In other words, the interpretations of the physiological responses (polygraph) and the vocal responses to the same questions are not correlated.

Triad Analysis

After completing the Individual Analysis, the PSE operator was supplied with a partial code which grouped subjects by triads. With this information he reanalyzed his records and reassessed the status of each subject within a triad. The results of these decisions are presented in Table 7.

TABLE 6. Accuracy in Judging Experimental Roles by Means of the PSE (Individual Analysis)

Polygraph Subjects

		ACTUAL STATUS		
		Thief	Lookout	Innocent
ANALYST RATING	Thief	6	5	8
	Lookout	7	3	2
	Innocent	6	7	5

(% correct: 14/49 = 29%)

Non-Polygraph Subjects

		Thief	Lookout	Innocent
ANALYST RATING	Thief	4	6	4
	Lookout	6	5	4
	Innocent	2	1	4

(% correct: 13/36 = 33%)

Combined Groups

		Thief	Lookout	Innocent
ANALYST RATING	Thief	10	11	12
	Lookout	13	8	6
	Innocent	8	8	9

(% correct: 27/85 = 32%)

TABLE 7. Accuracy in Judging Experimental Roles by Means of the PSE (Triad Analysis)

Polygraph Subjects

		ACTUAL STATUS		
		Thief	Lookout	Innocent
ANALYST RATING	Thief	1	4	4
	Lookout	4	2	3
	Innocent	4	3	2

(% correct: 5/27 = 19%)

Non-Polygraph Subjects

		Thief	Lookout	Innocent
ANALYST RATING	Thief	6	5	1
	Lookout	4	5	3
	Innocent	2	2	8

(% correct: 19/36 = 53%)

Combined Groups

		Thief	Lookout	Innocent
ANALYST RATING	Thief	7	9	5
	Lookout	8	7	6
	Innocent	6	5	10

(% correct: 24/63 = 38%)

Even with the triad-coding information, the PSE analyst did less well than chance with the polygraph-tested subjects. However, the feature of particular interest in the table is the fact that he attained considerably higher accuracy with the non-polygraph subjects. Associated with this higher percentage accuracy (53 percent), is the chi-square value of 6.125 which is significant at the .02 level. It would seem that elimination of the stress associated with the polygraph harness may have provided clearer voice records which, in turn, enabled the operator to discriminate significantly among the experimental roles within a triad. This would seem to suggest that stresses other than those under interrogation can intrude into the voice records and confound the analysis.

If one were to accept the above hypothesis, voice analyses on subjects undergoing a polygraph examination at the same time should produce accuracy figures no greater than chance. (Actually, the accuracy of voice analyses with the PSE was a mere 19 percent where chance expectation is 33 percent. The difference, however, is not significant). From this point of view as well, it seems likely that the stresses associated with polygraph testing may permeate the voice records and make voice analysis less accurate.

Though the hypothesis presented above would appear to be the more likely, another possibly confounding influence may also have been operating. It was mentioned earlier that with polygraph subjects the microphone distance was often greater than the microphone distance in non-polygraph subjects. This distance factor may have had some effect on the tape records. However, the Tape Monitors never observed any differences. Moreover, Individual Analysis (Table 6) shows that accuracy of role identification is at a chance level for both polygraph and non-polygraph subjects.

Several other comparisons will place the PSE results in better perspective. The nine polygraph triads, evaluated by PSE analysis with accuracy of 19 percent, were also studied by Rater B who attained 78 percent accuracy in his Triad Analysis. The Tape Monitors also made their decisions on eight of the same nine triads, and their accuracy score was 75 percent for the same triads evaluated on the basis

of immediate global impression, lower than the raters and monitors, but still more than twice as great as that of the PSE analyst.

A similar comparison can be made with the non-polygraph subjects. The 53 percent accuracy for the PSE operator was surpassed by the 70 percent accuracy for the Examiners in their immediate global impressions (11 of the 12 PSE triads). Similarly, the Tape Monitors obtained 89 percent accuracy in their immediate global judgments for nine of the twelve triads.

These comparisons point up two facts. First, in the situation where the PSE operator got no significant results (polygraph subjects), an independent rater and the Tape Monitors obtained at least 75 percent accuracy. Although the Examiners, in their immediate global impressions, scored relatively low (44 percent) for these triads, this value exceeded the 19 percent obtained by the PSE operator. The second fact refers to the significant PSE result. Even in this case, both the Examiners and Tape Monitors again scored higher in their immediate global judgments. In other words, the PSE analysis yielded either insignificant or dubiously valuable results under the conditions of this simulated experimental theft.

Voice Stress Analyzer (VSA)

Reliability Considerations

Because calibration of each tape with the VSA was a delicate and time-consuming matter, it was decided to determine the reliability of the operational procedure. In the first set of reliability checks, the operator made two runs of the tape on the VSA, keeping the same calibration for both runs. The correlation between corresponding peak magnitudes on both runs was .996. When the same operator recalibrated the system before each run, the correlation coefficient was .871.

The second set of calibration checks involved two operators analyzing the same tape but each making an independent calibration of the system. The correlation coefficient in this case was .940.

The final set of reliability checks involved the peak-measuring procedure, a simple clerical task. Two persons independently measured the peaks on each of three tapes: one from the beginning, one from the middle, and one from the end of the experiment. The correlation coefficients for each set of paired measurements were .999, .985, .987.

These results thus demonstrated a high degree of reliability for all phases of the VSA operational procedure. The delicacy of the calibration operation is indicated by slightly lower coefficients in those situations where the same tape was recalibrated, either by the same individual or by another.

Triad Analysis

The VSA procedure generated a peak value for each vocal response of the subject. These values were listed in a computer printout for each question and so arranged that the members of each experimental triad were grouped together. The data for each subject were then rated by Rater B according to the same format used in the evaluation of blood-pressure, respiration, and psychogalvanic reactions. Once this was done, the patterns of responses were studied, and decisions made as to the roles assumed by the members of the triad. Since the patterns of each member of the triad were available for examination and comparison, the procedure involved Triad Analysis. The results of this analysis are presented in Table 8.

TABLE 8. Accuracy of VSA Procedure Under Conditions of Triad Analysis

Polygraph Subjects

		ACTUAL STATUS		
		Thief	Lookout	Innocent
RATER DECISION	Thief	9	11	9
	Lookout	10	10	9
	Innocent	10	8	11

(% accuracy: 30/87 = 34%

Non-Polygraph Subjects

		Thief	Lookout	Innocent
RATER DECISION	Thief	4	2	1
	Lookout	2	2	3
	Innocent	1	3	3

(% accuracy: 9/21 = 43%)

The results have been divided into two sections: those for polygraph subjects, and those tested without the polygraph. For neither group is the percent accuracy significantly above the chance value of 33 percent. Although not significant, the trend of the data is similar in one aspect to that observed with the PSE, namely, that accuracy of the voice-analytic technique is greater in the situation where the polygraph is not used.

Critical Questions and Role Differentiation

The Voice Stress Analyzer (VSA) produced a numerical value for each "Yes" or "No" response during the interrogation. These values were not considered as interval scale measures because the variances were not homogeneous for polygraph and non-polygraph subjects. This difference suggested that between-group comparisons might not be valid. At any rate, the ranking of peak measurements within a triad could be justified, and the utilization of such ranks across groups was also a valid procedure.

An example of the procedure may help in understanding the subsequent analysis. Below are the peak scores and their corresponding ranks for all three members of Triad 1 in response to the question, "Were you an accomplice to the thief"?

	Peak Score	Rank
Thief	40	3
Lookout	18	1
Innocent	31	2

These ranks were summed across three sets of 10 polygraph triads for each experimental role. The division of the 30 polygraph triads into three equal subsets was done on a chronological basis, thus making it possible to identify any systematic trends as the experiment progressed. Similarly, the ranks were summed for the seven ono-polygrap h triads in order to evaluate the effect of the stress induced by the polygraph attachments. The results are summarized in Table 9.

TABLE 9. Sums of Ranks of Voice Stress Analyzer Outputs for All Questions and All Roles

Question	No.	Role	Polygraph Subjects Gp.1	Gp.2	Gp.3	Sum	Non-Poly Subjects
Were you an accomplice to the thief?	3	T	23.0	15.0	23.5	61.5	13.0
		L	21.5	22.5	15.0	59.0	15.5
		I	15.5	22.5	21.5	59.5	13.5
	14	T	22.0	10.0	16.0	59.0	14.0
		L	19.0	21.0	21.0	61.0	15.0
		I	19.0	20.0	23.0	62.0	13.0
Did you plan this robbery with someone else?	6	T	22.5	20.0	23.0	65.5	19.5*
		L	17.0	19.5	19.0	55.5	14.0
		I	20.5	20.5	18.0	59.0	8.5
	21	T	19.0	18.5	22.0	59.5	13.5
		L	19.5	17.0	20.0	56.5	13.0
		I	21.5	24.5	18.0	64.0	15.5
Do you know who stole the money?	10	T	20.5	20.5	25.0	66.0	16.0
		L	18.5	20.0	15.0	53.5	13.5
		I	21.0	19.5	20.0	60.5	12.5
	25	T	24.0	17.0	17.0	58.0	16.0
		L	15.5	20.5	23.0	59.0	13.0
		I	20.5	22.5	20.0	63.0	13.0
Do you have the stolen money with you?	18	T	25.0*	16.5	20.0	61.5	16.5
		L	14.0	21.0	21.0	56.0	12.0
		I	21.0	22.5	19.0	62.5	13.5
	29	T	25.0	20.0	21.0	66.0	14.5
		L	16.5	19.5	17.5	53.5	14.5
		I	18.5	20.5	21.5	60.5	13.0

*Significant difference among three roles.

If the VSA apparatus operated without error, the Innocent Suspect would be perfectly identified by his peak score. According to the manufacturer's research manual, the non-stressful (truthful) responses should yield higher values than the stressful (lying) ones. Consequently, the sum of the ranks for Innocent Suspects should be largest among the three roles. Inspection of the "Sum" column in Table 9, which combined the results of the three subgroups, reveals that the value for the Innocent (I) role is not uniformly the largest of the three roles, in the values given for each question.

An equally important result is the absence of a consistent pattern from subgroup to subgroup. For example, the (T) role in Group 1 (in response to the first "Accomplice" question) scored highest; in Group 2, it scored lowest. It again scored highest in Group 3. Such wide fluctuation is not the uniform trend one would expect in a valid and reliable instrument.

A minimal expectation is consistency of the same group's responses to the same question. For example, the same question was asked at Q3 and Q14. In comparing the rank sums for these questions, moderate consistency is found among the three rank sums for these questions, moderate consistency is found among the three rank sums for Groups 1 and 2. In Group 3, however, the (T) score is largest for Q3 while it is lowest for Q14. Even within the "Sum" column, where results should be most reliable, there is only one perfect ordering between the four question pairs, a result in general agreement with chance, where one in six is the expectation.

The above observational comments suggest a lack of discriminative power in the VSA. This was verified in more objective fashion through the statistical evaluation of all the data by means of the Friedman Analysis of Variance by Ranks. The test involved each of the eight critical questions for each of the three polygraph groups and for the non-polygraph subjects. Among the 32 statistical tests, only two produced significant results, namely, Q6 (non-polygraph) and Q18 for Group 1. The absence of consistency in the patterning of these sums, between subgroups and between repetitions of the same question, suggests that the two significant results need no special explanation other than the chance hypothesis.

The results of both sets of analyses presented in this section provide no evidence for the valid use of the VSA as a lie detector. The present experiment did generate sufficient emotional responsiveness in the subjects to enable the polygraph examiners to successfully discriminate among the Thief, the Lookout, and the Innocent Suspect. Whether the stress induced, instrumentally, and experimentally, was too intense for effective voice analysis cannot be determined from the results. There is some evidence, though insignificant, that accuracy increases slightly in non-polygraph subjects. It is mentioned only because a similar trend was observed for the PSE data.

Chapter 4. Summary and Conclusions

The major purpose of this research was to evaluate the voice-analysis technique, as represented by two existing types of instrument, for its suitability in lie detection applications. The basis for evaluation was a comparison of voice-analysis techniques against an established technique, the polygraph, in terms of the success of each in detecting lying responses. Additionally, the results obtained with the voice-analysis instruments were compared to those yielded by trained polygraph operators and auxiliary experimenters making their judgments on the basis of direct observation of the behavior (verbal and non-verbal) of subjects being interrogated. Essentially the findings indicated the clear inferiority of voice analysis, in its present state of development, not only to the polygraph, but also to judgments made on the basis of simply observing subjects' behavior.

The experimental procedure involved the execution of a simulated theft of money by a pair of subjects, one of whom served as a lookout for the other, the thief. For each "guilty" pair, there was also an "innocent" subject who knew only that a theft had been committed. Each such triad was interrogated immediately following the commission of the "crime," and the judges' task was to determine the roles played by each: who was the Thief, who the Lookout, and who the Innocent Suspect.

Tape recordings of all the interrogations were made for voice-analysis purposes. Additionally, polygraph records were made of the interrogations of approximately 80 percent

of the triads. The remaining triads were questioned without the polygraph.

Interrogation proceeded in three stages. First, subjects responded to a questionnaire of the Relevant-Irrelevant type. Second, they took a modified Peak-of-Tension test involving the exact amount of money that was stolen. Third, subjects given an Association test to two series of words, which included critical words relating to the crime. The interrogation was conducted by two persons, the Examiner who actually posed the questions, and a Tape Monitor whose function was to control the volume for the tape recording.

Following the interrogations, decisions as to the role played by each member of a triad of subjects were made in a variety of ways by a number of researchers associated with the experiment in different capacities. The Examiners and Tape Monitors made judgments immediately following the interrogation, using as the basis for their judgments their overall, global "impressions" of the subjects' behavior during interrogation. Additionally, during the polygraph examination the Examiners could see the chart print-out as questioning proceeded but had limited opportunity to note the details of the record at this time.

Approximately two weeks after an interrogation, each of the Examiners made a careful, formal analysis of the polygraph records, using established criteria in which they had been trained. They analyzed the records in sets of three (triads) and indicated which record was that of the Thief, the Lookout, and the Innocent Suspect.

At a later time, two other experienced polygraph operators (not actual Examiners of the subjects) also analyzed the polygraph records. These raters evaluated each record on an individual basis, independently of any other records, and rendered a judgment as to the role that subject played in the experiment.

The third type of evaluation involved the analysis of the tape recordings by each of two current voice-analysis techniques: The Dektor Psychological Stress Evaluator (PSE) distributed by George F. Cake Co., and the Voice Stress

Analyzer (VSA) manufactured by Decision Control, Inc. In point of time, the behavior of the subject was evaluated first; his polygraph chart, second; and his voice recording, last.

The results may be summarized as follows. On the basis of immediate global impression, both Examiners and Tape Monitors identified subjects' roles in the "theft" to a significantly high degree, with the Examiners who could see the polygraph charts, not surprisingly doing somewhat better than the Tape Monitors. The accuracy with which these immediate impressionistic judgments could be made provides evidence that the paradigm of the simulated theft is a valid experimental procedure for lie detection research in that it does in fact induce differentially detectable behavior in subjects.

Analysis of the polygraph records produced the following results. Evaluating the records they had obtained in triads, Examiners attained an overall accuracy of 76 percent. Each role (Thief, Lookout, Innocent Suspect) was identified with approximately equal success.

There was some indication of differential detectability of lying according to sex of the subject; the Examiners were notably more accurate in evaluating the records of male than of female subjects (83 percent versus 65 percent). The reason for this difference is not readily apparent.

The success of the Examiners leaves no doubt that the polygraph was an effective instrument of detection in their hands, of sufficient precision to discriminate degrees of guilt (Thief vs Lookout), as well as distinguishing guilt from innocence. Here, again, this success supports the validity of the simulated theft as an experimental paradigm in the study of differential emotional reactivity.

When the polygraph charts were analyzed on an individual basis (not in triads) by the two other experienced polygraph operators who had not participated in the actual interrogation, subjects' roles in the experiment were again identified with a significant degree of accuracy. On the other hand, the constraints of individual analysis did produce accuracies somewhat lower than those obtained in triad analysis by the

Examiners (50-60 percent versus 76 percent). Errors, when made, tended to be in the direction of an "innocent" verdict. Contrary to the results obtained in triad analysis, accuracy with female subjects was slightly, but not significantly, higher than with male subjects.

The results obtained with the voice recordings were generally insignificant. The operator of the Dektor Psychological Stress Evaluator analyzed the tapes of both an individual and a by-triads basis. Working with individual records, he obtained accuracies close to 33 percent, a value almost identical with chance expectation. In the triad analysis, the PSE analyst did worse with polygraph subjects (19 percent accuracy). However, he did significantly better with non-polygraph subjects, attaining an acceptably high accuracy of 53 percent. It is possible that the absence of stresses, attendant upon being fitted up with the polygraph attachments, produced clearer voice records for the non-polygraph subjects.

This cannot be the entire explanation, however, for the overall poorer showing of the PSE. For example, the nine polygraph triads evaluated by PSE analysis with an accuracy of 19 percent, were identified by the Examiners with an accuracy more than twice as great (44 percent). As for the non-polygraph subjects' records, the 53 percent accuracy of the PSE operator was surpassed by even the Tape Monitors, who obtained 83 percent accuracy in their immediate global judgments of these triads. In sum, the PSE analysis yielded either insignificant or non-competitive results.

The Voice Stress Analyzer generated a numberical value for each "Yes" or "No" response during the interrogation. These values were transformed into judgments comparable to those obtained from the PSE analyst. It was found that neither polygraph or non-polygraph subjects attained a significantly greater value than the chance expectation of 33 percent. However, the trend observed with the PSE, toward slightly greater accuracy with non-polygraph subjects, was also apparent with the VSA.

The conclusion of this research is that neither of the presently existing voice-analysis instruments may be accepted as valid "lie detectors" within the constraints of an experimental paradigm.

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Appendix:

Supervisor Instructions

To Innocent Suspect

Your task is to enter the examining room and answer truthfully any questions which will be asked.

There has been a theft of some money in one of the faculty offices. You will be questioned about possible participation in it. For example, if you were asked "Did you steal the money or serve as an accomplice in this robbery?" you would, naturally, answer (NO). Since you know nothing about it and are completely innocent, there is nothing to worry about.

It is imperative that you do not discuss the nature of the questions or the research itself with anyone -- not any of your friends nor your family.

Also, don't ask the examiner any questions because his time is limited. I'll answer your questions after the test.

How well you comply with these directions will determine whether you are eligible for cash prizes.

Are there any questions?

To Thief and Accomplice

(To Both) Please choose one of these lots. When you open it you will know your role in this research. Sign your name on the lot. (Supervisor notes name on lot.)
Now: put it in your pocket. (If no pocket, in shoe.)

There is a handbag belonging to a woman faculty member in room 450 in this building, Dealy Hall.

(To Thief) You (point to Thief) must enter this room, open the handbag and rob the purse of all its contents. Leave the handbag and the purse in the room.

You may approach the room in any manner you like, but do not get caught.

While you are robbing the handbag you will have the help of your accomplice (point to accomplice).

(To Lookout) Your job is to act as his (her) lookout, to warn him (her) of approaching students or faculty. You will warn him (her) in a manner which you both agree on, if danger is imminent.

You, however, are not to take the money. Neither are you to be close enough to the Thief (point to Thief) to know what has been taken.

(To Thief) And neither should you tell him (her).

Now, when you complete the robbery, signal the lookout to leave.

(To Lookout) After the Thief signals, you are to come back alone, immediately. Return to Room _____.

(To Thief) When the lookout has gone and you are a safe distance from room 450, examine what you have taken. Count the money. Put everything you have taken on your person. Return to Room _____ as soon as possible, but don't run.

(To Both) When you return, you will be taken to the examining room where you will be asked questions about the robbery of the handbag.

The examiner knows that the handbag will have been robbed but he does not know who did it.

Neither of you are to admit any guilt or participation in this matter. For example, if either of you are asked "Did you steal the money or serve as an accomplice in this robbery?" you are to say (NO). Is that clear?

Remember, deny any participation in or knowledge of the robbery. Answer NO to all questions about the robbery.

If you comply with the directions that you have been given, you will be eligible for cash prizes.

Any questions?

Debriefing Subjects

As you realize, this experiment aims to evaluate several physiological indices as measures of emotional adaptation.

Your cooperation is appreciated.

Remember, you are eligible for a prize--once the experiment is completed.

We will get in touch with you about this at that time.

Examiner Instructions

Pre-Test Period

This is a lie detection machine similar to the ones used in police work. The innocent person has nothing to fear, since the procedure clearly proves his innocence. The matter is quite different for the guilty person. These machines have an excellent record in identifying the criminal. And the criminal has a difficult job concealing his guilt. (PAUSE)

I'd like you to sit in this chair so that I can attach you to the machine. Please remove any ring or watch you have on. (STRAP IN)

Routinely attach (1) Pneumograph bellows
(2) Lavalier microphone
(3) PGR electrodes
(4) BP cuff (Inflate momentarily.)
in order listed above. When putting on BP cuff tell S:

This cuff may cause your hand and arm to turn red and also get a bit uncomfortable. If it gets too uncomfortable, just let me know.

Are you in a comfortable position? Please don't make any movements; they only spoil the records. Your cooperation in avoiding movements is necessary so that we don't have to waste any time retesting.

Before Interrogation

First, I will ask a number of questions, some of which will be about the robbery. To all questions give only a YES or NO answer. Some questions will be repeated more than once.

There are no trick questions. All of them can be answered by a YES or NO.

READY? O.K. I'll inflate the cuff.

Part I. Interrogation Form

1. Is your name _____?
2. Do you have any brothers? sisters? pets? NX
3. Were you an accomplice to the thief?
4. Are you a Law School student?

5. Are you married? single? NX
6. Did you plan this robbery with someone else?
7. Do you live in a one-family house? an apartment? NX

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8. Did you graduate from high school?
9. Have you served in the armed forces?
10. Do you know who stole the money from room 450?
11. Do you live (on off) campus? NX

12. Are you an American citizen?
13. Have you ever been arrested?
14. Were you an accomplice to the thief?
15. Do you live in Brooklyn? Staten Island? NX

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16. Are you a college student?
17. Do you have any brothers? sisters? pets? NX
18. Do you have the stolen money with you?
19. Do you own a motorcycle? car? NX

20. Have you served in the armed forces?
21. Did you plan this robbery with someone else?
22. Do you live (on off) campus? NX
23. Were you born in 19__? (Fill in date)

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24. Are you married? single? NX
25. Do you know who stole the money from room 450?
26. Do you live in a one-family house? an apartment? NX
27. Were you born in the United States?

28. Have you ever been arrested?
29. Do you have the stolen money with you?
30. Do you live in Brooklyn? Staten Island? NX

Alternate NO Questions

31. Are you a School of Commerce student?
32. Were you born in Europe?

Alternature Pre-Critical Questions

33. Were you ever fingerprinted?
34. Were you operated on for appendicitis?

Part 2. Numbers Test

This time I am going to say some numbers.

These refer to money, so that one means one dollar, and 15 means 15 dollars.

Now when I say a number, you are to say NO to each number I say.

Is that clear? Fine, here are the numbers I will say.

(Inflate BP cuff) 15 17 19 21 23 25

Part 3. Association Test

Now I'm going to say a number of words. I want you to say the first word that comes into your mind when you hear each word that I say. READY?

(Inflate BP cuff)

APPLE EAGLE HANDBAG PENCIL TABLE LOOKOUT

ROADSIDE

(Stop, deflate cuff)

(Inflate BP cuff)

WINDOW WARLIKE RIBBON SPRINGTIME OCEAN

Final Instructions

Good. Thank you.

Now go back to the supervisor for the final instructions.

ANTICLIMAX DAMPENING CONCEPT

by

Cleve Backster

For years there have been certain phenomena in lie detection which have provided reasons for concern among conscientious examiners. For example when the overall verification question has been used such as: "Have you lied to any question on this test?", many persons whose guilt was later verified, would exhibit no response, even though proving themselves good responders to the principal relevant questions. Many other persons whose innocence was later verified, would exhibit considerable response when this question was asked. The same type of reverse response has also occurred when the intent question has been used such as: "Do you intend to lie to any question on this test?"

A great deal of difficulty has also been experienced by many examiners, where strong response is obtained on one relevant question and a conflicting lack of response to another question related to the same crime. For example, a suspect, whose guilt was later verified, may have shown strong and consistent response when answering "No" to the question: "Last Tuesday night about 9:30 did you rob the Plaza Theater?", and yet show no response when also answering "No" to the question: "Last Tuesday night did you leave your hotel room at any time between 8:00 and 11:00?" Also, where relevant questions embrace more than one specific issue, difficulty has been experienced on frequent occasions when strong deception response was exhibited on one crime covered by the test. However, no deception response occurred regarding a second crime covered, although it was later verified that the subject was guilty of both of these crimes.

How can we explain such inconsistencies as those covered by the above examples? Intensive research effort has been expended in an attempt to isolate basic difficulties which are common to each of the above mentioned problem areas. As the result of this effort a concept has materialized which has been termed Backster "anticlimax dampening" concept. Understanding the basic concept involved and following

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certain technique rules brought about by this concept can materially eliminate the above-mentioned confusion areas. The anticlimax dampening concept is formulated on the well-validated psychological principle that a person's fears, anxieties, and apprehensions are channeled toward the situation which holds greatest immediate threat to his self-preservation or general well-being. A mother may sleep soundly as noisy freight trains pass her home yet quickly awaken at the slightest whimper of her baby. This illustrates the ability within us to tune in that which may indicate trouble or danger by having our sense organs and attention set for a particular stimulus and oriented in a manner that will dampen any stimulus of lesser importance.

The guilty suspect has his sense organs and attention set for that question which he feels will jeopardize his well-being. During a polygraph examination, this tuning in on the principal threat to his security most always involves directing his concern toward the more intense relevant questions he expects the examiner to ask. He will basically perceive, but may not be materially affected by relevant questions of lesser intensity, and often would not be moved by any other type of question which fails to touch upon any equally strong threat to this well-being. In the majority of the technique trouble area examples earlier mentioned, the more intense relevant questions took priority over those of lesser intensity. This can occur to an extent where concern over the more intense relevant questions may completely dampen response to the lesser relevant question which is an anticlimax to the guilty person.

The problem of the over-all verification question regarding lying to any question on the test, and the intent question concerning intention to lie to any question on the test, involves a basic situation which is of secondary importance or anticlimactic to the guilty person, as compared to the more intense relevant question which threatens his well-being.

When comparatively weak relevant questions are used, even though relating to the same crime, many persons will exhibit greatly subdued response to them, or no response whatsoever. Although seemingly important from an investigative standpoint, the material covered by these weaker questions does not fall within proper focus of the suspect being examined.

When two distinctly separate crimes are included in the same test, the suspect who is guilty of both of them may respond only to that crime which he feels to be the greatest threat to his well-being.

By understanding anticlimax dampening effect we have many new avenues open to us for technique advancement. As well as being able to adequately cope with the above-mentioned problems, we can carefully introduce certain questions or other stigma into a test structure which will be strong enough to be of concern to the innocent suspect, but will be strictly anticlimactic to the guilty suspect who is focused on the more intense relevant questions. When such planned stimuli are injected at carefully selected locations, we can also channel natural anxieties away from the relevant questions where they very often appear for lack of any other opportunity to dissipate themselves. This greatly diminishes the problem of "general nervous tension" which has been a plague to many polygraph examiners for years.

NON

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THE POLYGRAPH AS A DISPOSITIONAL AID TO THE JUVENILE COURT*

By

Ralph Compton Pino

All states provide a juvenile court system[1] whose jurisdiction involves youth under some specified age,[2] (with the maximum age generally being between sixteen and twenty-one). This jurisdiction can be waived in order to bind a defendant over to the adult criminal justice system in cases of "appropriate" seriousness.[3] The juvenile system is distinct from the criminal; it has different procedures;[4] it considers a far wider scope of human behavior as unacceptable;[5] it has a different substantive law and dispositional rationale,[6] and it contains many other features consistent with its expressed parens patriae philosophy. Adjudication of "delinquency" is possible for the widest range of behavior or status: from homocide to "waywardness."[7] The juvenile court judge routinely has broad power in disposition, being empowered to dismiss the case,[8] dismiss without a finding,[9] fine the defendant,[10] place the defendant on probation,[11] arrange for restitution,[12] refer to an agency or treatment facility,[13] or commit to a juvenile institution.[14] If committed to such an institution, a youth normally does not have statutory durational requirements to fulfill in order to become eligible for outright release,[15] a characteristic of all adult sentences except for those labeled as "purely indefinite" (as in the California penal system where the Adult Authority (Parole Board), actually determines the length of some sentences).[16] Although the juvenile court judge can only sentence to a juvenile institution,[17] it is possible for a juvenile commitment to extend beyond the youth's majority.[18]

"Settled practice recognizes three stages in juvenile proceedings, (1) the intake, (2) the adjudicatory hearing, and (3) the disposition."[19] These stages should be considered as distinct in that the problems involved and the "evidence"[20] used in each can be and is often quite different.[21] A wider

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scope of material is properly considered in disposition than in adjudication,[22] where material irrelevant to the particular issue should not be heard; e.g., past incidents.[23]

The purpose of the juvenile justice system is salvation, not punishment,[24] and all hearings should be conducted in the best interests of the juvenile[25] while maintaining the fullest protection of society in general.[26] The elements of retribution or revenge should not be considered in adjudication or disposition.[27] It should be noted, at this point, that disposition, not adjudication is the primary means of seeking revenge upon juveniles; to be found "delinquent" is one thing, but to be sentenced to a juvenile prison is clearly another.

Because of this recognized goal of reformation,[28] much work is allegedly[29] done prior to an individualized disposition. The youth's family, past behavior, attitudes, motivations, school records, and all other relevant information should be used in the selection of an appropriate disposition,[30] and the wider the choice of dispositional alternatives, the more selective this decision must be. The juvenile courts have traditionally relied upon the presentence investigations of probation officers,[31] police arrest reports, informal discussions with parents of the youth,[32] and often simply on the judge's memory of "seeing the juvenile here before,"[33] in establishing a disposition.

The juvenile courts have neglected or declined to use[34] the polygraph as an accurate, quick, reliable, and relatively inexpensive[35] means of obtaining information vital to a determination of the actual circumstances which brought the child to the attention of the court and as to a disposition in line with the best interests of the child and society.[36] The polygraph is not herein proposed as a replacement for existing methods, but as an additional and potentially valuable tool to be used in appropriate situations.[37] In most juvenile cases, all the facts necessary on which to base a finding of delinquency are not in dispute.[38] However, even in such cases, there may be a question of truth,[39] especially where a "confession"[40] is involved. In such a case, the truth must be found to enable proper treatment to begin if the goal of reformation is to be realized.[41] The polygraph can also be helpful in those cases where the juvenile denies his guilt in the face of what appears to be substantial evidence. If the juvenile is a good subject for

the polygraph test,[42] he should be given an opportunity to avail himself of that test and have the results be a factor in the dispositional decision.[43]

Using the polygraph in the dispositional stage avoids potential problems of presuming guilt (or "delinquency" if the reader prefers), provided it is not conducted prior to adjudication.

Since there is no right to a jury trial in juvenile hearings,[44] there is no problem of the polygraph taking the traditional factfinder's role from the jury.[45]

The problems of self-incrimination are often raised as reasons for keeping the polygraph out of the courts. This problem is largely fictitious since an individual compelled to take a polygraph examination will not, by definition, be a "fit subject" for such a test.[46] Furthermore, professionally competent operators should give the subject a final opportunity to leave the testing room without prejudice if they feel that he cannot voluntarily submit to the test.[47] The problem in regard to self-incrimination arises when the inquiry goes beyond the particular act or circumstances for which the juvenile was adjudicated delinquent; e.g., past criminal or "delinquent" activities. Here a safeguard must be constructed, either by limiting the examination to the specific act or circumstances for which the adjudication was made, or in allowing the scope of the examination to be broader and ruling that additional information (if any is attained), is to be used only with regard to disposition (treatment).[48] What must be prevented is the use of the polygraph in subsequent charges against the juvenile, be they delinquency or criminal in nature. If the doctrine of Use and Derivative Use Immunity[49] were extended to fit such proceedings, this would guarantee appropriate safeguarding of the juvenile's rights while leaving open avenues of information that are needed to adequately determined treatment of the adjudicated delinquent.

Conclusion

The polygraph is the most accurate means we have available for the detection of truth,[50] as such, it should be used in the crucial dispositional stage in juvenile proceedings. This is especially true since it is generally accepted that the commitment of a youth to a juvenile institution

makes the likelihood of his becoming "more of a criminal" far more probable than not.[51] The small percentage of error in the use of the polygraph[52] may cause a few "guilty"[53] juveniles to escape incarceration (note: it cannot cause a juvenile to escape adjudication, since adjudication is prior to the proposed use of the test), or to receive inadequate treatment,[54] but such error is certainly worth the much greater probability of preventing innocent juveniles from being incarcerated in juvenile institutions which are often indistinguishable from adult prisons.

The fact-finding process in the juvenile court may be likened to the diagnosis of a (communicable) disease. It is therefore to be as free from strictly legal judgments as possible and designed toward reaching the best possible method of treatment available in a given jurisdiction. To restrict the use of a device of proven diagnostic (i.e., truth-detection), value because of its inadmissibility in adult proceedings is contrary to the avowed purpose of juvenile courts.[55] In adult disposition, options are limited; in juvenile disposition, the thrust of the profession is to expand such options, consistent with its goals of treatment. To expand treatment options while restricting diagnosis is contrary to common sense and contra-indicated in situations so vitally affecting the future of our society.

Footnotes:

[1]See, for example, Massachusetts General Laws Annotated, chapter 119.
[2]Id. at Section 52. [3]Id. at Section 61.
[4]Id. at Sections 53,54.
[5]Id. at Section 52. [6]Id. at Section 1.
[7]Id. at Section 52; see also Robinson v. California, 370 U.S. 660, 82 S.Ct. 1417, 8 L.Ed.2d 758 (1962).
[8]Id. at Section 58. [9]Id. at Section 58B.
[10]Id. at Section 58. [11]Id.
[12]Id. at Section 62. [13]Id. at Section 58.
[14]Id.
[15]Miller, Dawson, Dix & Parnas, Juvenile Justice Process, Foundation Press, Inc., Mineola, N.Y. (1971), p. 1155; see also M.G.L.A., c. 120 Section 16.
[16]California Penal Code Section 1168.
[17]M.G.L.A. c. 119 Section 58.
[18]Id. at c. 120 Section 16.

[19]Id., see also c. 120 section 17 in regard to persons deemed dangerous.

[20]For example: evidence defined as inadmissible hearsay (McCormick on Evidence sections 244-253) is admissible in juvenile court proceedings.

[21]In re R., 83 Cal.Rptr. 671, 464 P.2d 127, 1 Cal.3d 855 (1970).

[22]Id.

[23]In re Wilson, 438 Pa. 425, 264 A.2d 614 (1970).

[24]Metcalf v. Commonwealth, 338 Mass. 648, 156 N.E.2d 649 (1959). Commonwealth v. Johnson, 309 Mass. 476, 35 N.E.2d 801 (1941).

[25]Smith v. State, 44 S.W.2d 941 (1969).

[26]In re Walter, 172 N.W.2d 603 (1969).

[27]State v. Meyers, 74 N.D. 297, 22 N.W.2d, 199 (1946).

[28]See note 24, supra.

[29]The court places great reliance on probation officers' pre-sentence reports. Unfortunately, most of the country's juvenile courts employ persons who lack professional training to fill such positions. In President's Commission on Law Enforcement and Administration of Justice, Task Force Report: Corrections.

[30]M.G.L.A., c. 119 section 57.

[31]See Sanford J. Fox, Modern Juvenile Justice, West Publishing Co., St. Paul, Minn. 1972, p. 791 ff.

[32]M.G.L.A., c. 119 sections 55, 57, 69, 69A.

[33]See generally, In re Gault, 387 U.S. 1, 87 S.Ct. 1428, 18 L.Ed.2d 527 (1966).

[34]People v. Perry, 132 Ill. App. 2nd 326, 270 N.E.2d 272 (1971).

[35]The "general acceptance" test articulated more than forty years ago in Frye v. United States (54 U.S. App. D.C. 46, 293 F. 1013 (D.C. Cir. 1923)), has been the major reason stated by the courts for their rejection of polygraph evidence. See for example: State v. Bohner, 210 Wis. 651, 246 N.W. 314 (1933); Peterson v. State, 157 Tex.Cr. 255, 247 S.W.2d 120 (1952); Marks v. U.S. 260 F.2d 377 (10th Cir. 1958); Colbert v. Commonwealth of Kentucky, 306 S.W.2d 825, (Ky.Ct.App. 1957); Placker v. State, 171 Tex.Cr.R. 406, 350 S.W. 2d 546 (1961); State v. Foye, 254 N.C. 704, 120 S.E.2d 169 (1961).

The admissibility test utilized for polygraph results is unlike that used for other evidence, in which "(a)ny relevant conclusions which are supported by a qualified expert witness should be received unless there are other reasons for exclusion",

(McCormick on Evidence, 2d ed., Section 203 (1972)).

Courts have generally utilized a more severe test which must be fulfilled before taking judicial notice of any fact or circumstance, (McCormick on Evidence, supra). Until 1972, no appellate court approved polygraph evidence admissible at trial, absent a stipulation by the parties. Then, in United States v. Ridling:

> (T)he record in this case indicates that the theory of the polygraph is sound and that it is directly relevant to this case (perjury case), and that therefore the cases denying admissibility on these grounds are not controlling. 350 F.Supp. 90 (E.D.Mich. 1972).

Two other cases decided in 1972, United States v. Zeiger, 350 F.Supp. 685 (D.D.C., 1972); and United States V. DeBethem, 348 F.Supp. 1377 (S.D.Cal. 1972) indicate more extensive acceptance of the polygraph as evidence than do previous decisions, (see, for example: Altarescu, Problems Remaining for the "Generally Accepted" Polygraph, 53 Box.Univ.L.Rev. 375 (1973)).

> The polygraph is the collection of three standard recording components that have many other uses in the psychological field and the field of physiological research. And the three that are the primary components of the present day version of the polygraph involve the respiratory section that makes a running recording on chart paper of the breathing of an individual, the respiratory pattern and changes. Also there is a section that utilizes the blood pressure cuff assembly that is popularly used in the medical profession today, but this cuff assembly actually is attached through a connecting pneumatic tube to a tambour arrangement that makes a running recording of each pulse beat of the individual and relative changes in blood pressure during the polygraph examination. The third component is called the galvanic skin response and, in fact, this is widely used in psychology departments as an indicator or reflector of emotional changes within an individual. The popular explanation of the cycle galvanic reflex or galvanic skin response is that it records resistance changes within the individual being tested that relate to emotional changes, in Zimmerman, C., Polygraph in Court, Auburndale, Massachusetts: B.H.F. Printing, 1972, p. 4, from Transcript (expert testimony) in Courts Martial of Captain Ernest Medina regarding My Lai 4.

These components record the involuntary responses of certain internal organs responding to impulses of the sympathetic division of the autonomic nervous system, which automatically operate when confronted with an emergency or stressful situation, (See Ridling, supra at 92).

> The sympathetic division of the autonomic nervous system . . . is engaged in alerting and energizing the body for action. This division plays a major role in emotional behavior. It is primarily relevant to what Harvard physiologist Cannon called the "fight or flight" reaction: behavior caused by acute stress which refers to sudden or abrupt tension that may at times be very intense. This division assists in emergency situations by temporarily increasing or mobilizing our energy supply . . . Organs relevant to an emergency situation are . . . stimulated, energized, and prepared for action while those irrelevant are inhibited, (Swidler and Basilio, Ph.D., Psychology for Interrogation, in Zimmerman, supra, Addenda 1).

The chart recordsing of responses to a carefully arranged set of questions are interpreted by the examiners. The series contains relevant questions and control questions. Ideally, questions should be direct, clear, and with a factual basis; and answerable by a "yes" or "no"; (from Interview with Charles Zimmerman, Boston, Massachusetts, September, 1973). The questions are formulated in a pretest interview with the subject by the person who is later to be the examiner. This examination makes the subject familiar with the questions, (thus preventing surprise); it also gives the examiner the opportunity to observe the subject. This observation should enable the examiner to detect overt drug use by the subject that could negatively affect the test. This is important because depressants do cause a negative polygraph effect on the accuracy of the results. Inbau and Reid, writing in Truth and Deception, Baltimore, Maryland: The Williams & Wilkins Company (1966), clarify the aforementioned position:

> As to the influence of physiological and mental abnormalities, it may be stated as a general rule that if the abnormalities are sufficiently serious to materially affect the results of the test, they are usually recognizable as such, either in the type of recording they produce or else in the appearance or demeanor of the person being tested.

[36]The best interests of any society are the best interests of its children!

[37]The expertise of the examiner is indispensible to the accuracy of the polygraph results; and standards along the lines of those formulated by Inbau must be used to assure a high level of accuracy. Inbau would require:

(1) That the examiner possess a college degree.

(2) That he has received at least six months of internship training under an experienced, competent examiner or examiners with a sufficient volume of case work to afford supervised testing in actual case situations.

(3) That the (testifying expert) witness have at least five years experience as a specialist in the field of polygraph examination.

(4) That the examiner's testimony must be based upon polygraph records that he produces in court and which are available for cross examination purposes.

Supra, p. 257.

The accuracy (or inaccuracy) of the polygraph has been the subject of the greatest amount of interest in the technique. The technique provides for three possible answers to the series of questions directed at the examinee; (one question alone will not be the basis of a decision as to truth or deception). The subject may either be: (1) deliberately not telling the truth; (2) telling the truth as he believes it to be; or (3) the test may be inconclusive and no determonation of truth or deception can be based on the test results. Often, upon re-testing, a decision can be made. If the polygraph is used by a qualified examiner, "deception can now be detected with greater accuracy . . . than by any other method of investigation", Wicker, The Polygraph Truth Test and the Law of Evidence, 22 TENN.L.REV. 711, 715 (1953), crediting Inbau, Lie Detection and Criminal Interrogation, 2d ed., 1948, p. 73.

Inbau and Reid reported on the examination of over thirty-five thousand persons suspected or accused of criminal offenses or involved in personnel investigation initiated by their employer.

> On the basis of that (see above) we are confident that the technique, when properly applied by a trained, competent examiner, is very accurate in its indications. The percentage of known errors with the technique used in the laboratories of John E. Reid and Associates is less than 1%. Of the remainder, no diagnosis at all is attempted in about 5% of the cases, because of such

factors as physiological or psychological impairment of the subjects. Reid & Inbau, Truth and Deception, supra, p. 234.

Stanley Abrams, Ph.D., clinical psychologist at the Permanente Clinic in Portland, Oregon, has reported accuracy of 98% in discovering deception in actual criminal investigation, and 83% in laboratory studies, (Abrams, Polygraph Validity and Reliability: A Review, J.FORENSIC SCI. (Oct. 1973).

The laboratory results are less accurate, contrary to the usual application of the scientific method, because the fear of discovery is much greater when a real life situation is involved than an artifically-created situation; (from Abrams, The Polygraph: Laboratory vs. Field Research, 1 POLYGRAPH 145 (September 1972).

The percentage of error seems to range from less than 1% to a probable maximum of 5% (Wicker, supra at 713). Where there are errors, the great majority of them are in failure to detect deception, rather than failure to detect truth. In other words, where there is error, it is almost never against the innocent individual. The general nervousness of the innocent individual who is unjustly accused is distinguishable as being just that particular kind of reaction, just as the forced breathing of the subject trying to "beat the machine" is equally recognizable, (Interview with Zimmerman, supra).

[38]Miller et al, note 15 supra, at p. 1320.

[39]Most of the reported studies on the polygraph have dealt with adult subjects; whether in the laboratory, government, business, or criminal investigation settings, accuracy obtained seems to be beyond serious question. Studies reporting on results with children are less numerous, (see, for example, Reid & Inbau, supra, p. 197). Dr. Abrams reports that his

> preliminary work on the validity of the polygraph with children indicated that high accuracy can be attained at the age of twelve and higher. In younger children there is a much greater chance of error. (Personal letter to author: October 2, 1973.)

Reid and Inbau reach similar conclusions, (supra, p. 197). They found that in individual cases even children of ten or eleven can be tested with success, the determinative factors being the intelligence and maturity of the specific child. Some children over twelve will not be good subjects if they are emotionally immature or have markedly low intelligence.

The pre-test interview coupled with standard observatory techniques should enable the examiner to identify the obviously defective subject who simply cannot deal with the stress inherent in such a situation.

We would maintain that this is a relatively moot point however, since incarceration for any child under the age of twleve seems to be inherently refutative of all juvenile court philosophy.

[40]There is a "plea-bargaining" aspect even to juvenile cases in jurisdictions which permit a juvenile court judge to dismiss the juvenile complaint and order the child bound over for trial as an adult, see note 3, supra. In such cases, it is not uncommon for the prosecution to "trade" a youth's "confession" for a promise not to request the dismissal of the juvenile complaint.

[41]Interview with Andrew Vachss, Superintendent of the Andros Intensive Treatment Unit, which is the maximum-security section of the Judge John J. Connelly Youth Center of the Department of Youth Services, State of Massachusetts, October 13, 1973 in regard to confessions:

> Most important, is the confession true? I have an example. There was a young man in this institution who was committed for first degree murder; in fact, he confessed to the crime. Because he confessed and because he was a juvenile and in juvenile court, no forensic evidence of any kind, no ballistics, no parafin tests were conducted . . . nothing at all . . . He had been here (in the prison) about six months and we were talking. He got to talking about the murder and I noticed some real gaps . . . To make a long story short, after about an hour and a half, the young man started crying and admitted he had not committed the murder . . . This young man has a two-fold motivation for confessing. One, there was a certain air of inevitability about him; he thought he was going to prison anyway as a natural consequence of his neighborhood, his peers, etc., and the reputation as a "killer" kept him out of trouble . . . and secondly, there had apparently been a cash payment involved . . . we see this a lot . . . If we had been able to know by some viable means whether this young man had been telling the truth, not so much that we could have apprehended a murderer, although that is part of it, the real thing is we had been treating this person . . . in psychiatry, group therapy, everything . . .

based on his being a killer. He is a sick young man alright, but murder is not the symptom of his sickness. The realsymptom was his confession to a murder he did not commit.

[42]See, Reid and Inbau, supra.

[43]Interview with Andrew Vachss, supra.

Let me give you another example from my experience. One young man in our institution had been committed by the juvenile court about seven times, on a variety of offenses from unarmed robbery to atrocious assault . . . while he was here (in prison) he got a writ on him, a mittimus. He was taken to juvenile court and he was confronted with a charge of shoplifting. The kid went absolutely berserk. He contested the whole thing, swore he was innocent and all that, but he was in fact found delinquent again, for about the eighth time. What was unusual was this young man who had been responding to treatment very well, all of a sudden just stopped (responding) . . . He stopped, because in spite of the fact that he was at war with society and himself, he had a basic, rock bottom belief that there was a certain element of fairness, of justice in past proceedings in that court . . . In fact, he had been found "guilty" of offenses he actually committed, at least in some fashion. But he wasn't guilty of this offense. He felt in a position of total deprivation. This made him five times more difficult to treat than before. The use of the polygraph as you suggest, I think would be excellent. If we could have established . . . proved . . . this young man was telling the truth, it wouldn't have made a damn bit of difference in his commitment, in his sentence, he still would have been locked up here . . . but it would have affected his feeling of essential fairness in society's representative, the court.

[44]McKeiver v. Pennsylvania, 403 U.S. 528, 91 S.Ct. 1976, 29 L.Ed.2d 647 (1973). We are also not proposing the use of the polygraph anyplace other than the dispositional stage; so even if there were a jury; it would never hear such evidence.

[45]Altarescu, supra, note 35.

[46]Zimmerman, supra, note 35.

[47]Id.

[48]Problems relating to prosecution comment on the refusal of a juvenile to take a polygraph test should follow

the rule applied in criminal trials relating to comment concerning defendant's decision not to take the stand in his own defense; see Griffin v. California, 380 U.S. 609 (1965).

[49]Kastigar v. U.S., 406 U.S. 441, 32 L.Ed.2d 212, 92 S.Ct. 1653 (1972).

[50]Wicker, supra, note 37.

[51]Dr. Peter Dorsett, a psychiatric consultant to the Massachusetts Department of Youth Services, described to a journalist the different types of boys who eventually "graduated" to adult prisons. After the expected background profiles, Dorsett concluded " . . . and there are other boys who have simply been victim to the environment, who are sent to an institution for some reason and subsequently learned to be delinquent." (Best, E. ANDROS: An Alternative for Dealing with Juvenile Problems, 2 PRISONER'S DIGEST/INTERNATIONAL 7, January 1973, p. 1 c. 1 This was also supported by the Vachss interview. See notes 41, 43, supra. Vachss claimed the contention that children learn to be criminals in juvenile institutions is too well known to require documentation.

[52]See, Reid and Inbau, Abrams, note 37, supra.

[53]Although "guilty" is not the word preferred by sociologists, we would maintain that it is emminently proper when such a finding is following by imprisonment.

[54]Vachss interview, notes 41, 43, supra.

> (From) my experience in several states, the overwhelming majority of juveniles receive inadequate treatment, especially in jurisdictions which consider imprisonment a form of treatment.

[55]An excellent example of the possible use of the polygraph in juvenile courts may be seen in the documentary film Juvenile Court, by Fredrick Wiseman. Wiseman is no stranger either to documentation of America's unique social conditions or to controversy as a result. Other films of Wiseman's have included a study of the U.S. Army (Basic Training), the Kansas City Police Force (Law and Order), and the now-infamous Titticut Follies, a study of the Massachusetts State Mental Hospital at Bridgewater. This latter film resulted in a lengthy series of court actions against the film's exhibition; Commonwealth v. Wiseman, 249 N.E.2d 610 (1969), cert. den. 398 U.S. 960, 90 S.Ct. 2165, 26 L.Ed.2d 546. In Juvenile Court, a fifteen year old male was accused of molesting an infant female of three while babysitting for the child's mother. Because the young man steadfastedly denied any culpability and the infant was an obviously unsuitable witness, the young man's attorney

was successful in obtaining the court's permission for a polygraph examination. The need for the examination was predicated on two basic points: (1) there was a definite question as to the truthfulness of the mother's accusations; (2) if the young man was indeed guilty, "treatment" would be out of the question unless there was, at some point, a self-admission, (see note 43, supra for an example of how a youth who feels unfairly convicted will not respond to treatment). Although the film does not depict the outcome of the examination, (hardly atypical for a Wiseman film), the reader should note this beginning of the erosion of the judicial prejudice against the use of the polygraph. See also notes 24-26, supra.

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THE VIDEOGRAPH, A NEW INSTRUMENT FOR RECORDING PICTURE, NARRATIVE AND PHYSIOLOGICAL DATA

L. A. Geddes, J. D. Bourland, W. A. Tacker, Jr. *

The Videograph is a new audio, video and graphic-record display instrument for teaching physiology. The instrument replays standard 3/4 inch color video tape cassettes on which a television program, narrative and three channels of physiological data are multiplexed.

Illustrated in the photograph is the instrument which shows the heart of a dog and a three channel record of the electroencephalogram, electrocardiogram and direct arterial pressure. The audio narrative is heard from the loudspeaker in the video monitor.

This system can easily be adapted to recording complete polygraphic examinations of the subject (and examiner if desired), the skin resistance, respiratory and cardiac recordings and the verbal questions and answers.

Note: The Videograph may be of exceptional value to the polygraph field because of its unique combination of playback features. In addition to the color TV taping of a live polygraph case, with the entire interview on sound, it is now possible to have an exact hard copy duplicate of the polygraph chart come out of the Videograph while the TV screen shows the polygraph instrument in operation. For training purposes, there may be instruction placed on the video sound track explaining the interview technique and discussing the chart interpretation. Thus the Videograph has two vital roles; reproduction of the interview and charts in their entirity for review or court presentation; and the development of training tapes for polygraph schools with staged and live examples of each technique. (Editor).

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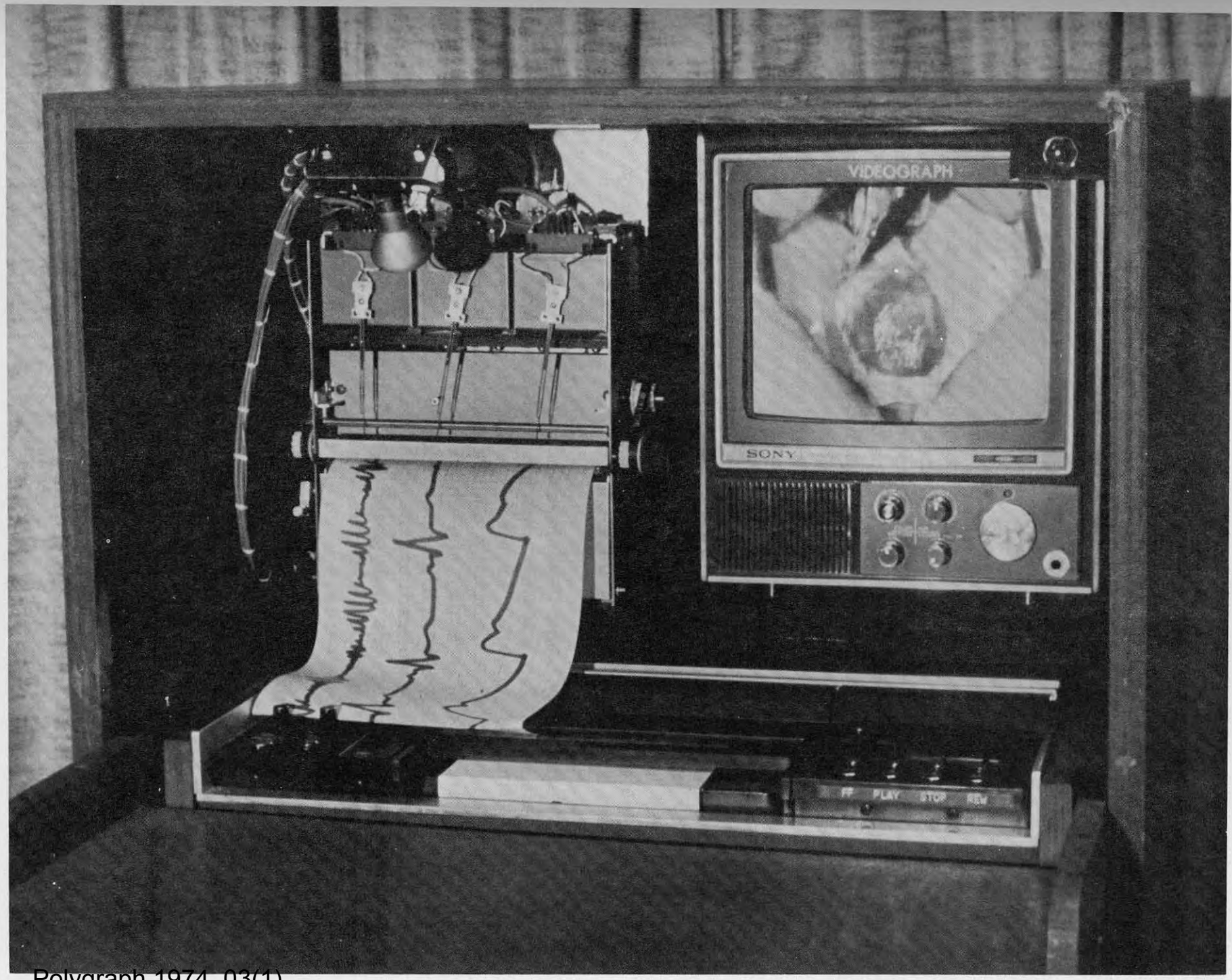

Figure 1 - The Videograph, a device which replays picture, narrative and three channels of physiological data, all recorded on video tape.

POLYGRAPH RESEARCH IN THE ARMY

BY

Robert A. Brisentine, Jr.

As all of you are aware, the Moss Committee more or less decreed that the polygraph examiner was his own worst enemy, as he had failed to keep statistics on his work and there had not been very much documented research to depict the reliability and validity of the Polygraph technique. Although every police detective having access to a competent polygraph firms and every properly trained and ethical polygraph examiner were aware that the polygraph technique was valid, all of the world had not been convinced that the polygraph was anything more than a trick or prop to assist a skilled interrogator to elicit a confession. This is not to say that all persons were really interested in the validity of the polygraph, as I would imagine that some did not care if the polygraph was the best thing since the wheel. This type did not care to prove or disprove its validity, but just desired to outlaw its use.

Consequently, the Department of Defense decided to establish an ad hoc committee to do research on the polygraph. The two general areas of research were (1) Study to Determine the Reliability and Validity of the Polygraph Examination and (2) Study the Instrumentation to determine if we can adopt better instrumentation. It was decided that the committee would conduct the validity and reliability study first and if the polygraph was found to have validity, research would be conducted to determine if present instrumentation was acceptable.

The research by the DoD Polygraph Committee has consisted of studies in seven different areas, which are as follows:

1. Field Test of the Polygraphs Used in DoD.

2. Evaluation of the Stoelting and Keeler Polygraphs.

3. Conversion of Polygraph Charts to Magnetic Tape.

4. Automatic Data Processing of Polygraph Responses.

5. Blind Analysis Polygraph Study.

6. External Criteria (Judge Advocate General) Study.

7. Descriptive Statistics Study.

I will attempt to give you a general idea as to the accomplishments of the DoD Polygraph Committee in each of the seven areas.

Field Inspection

The first area of research by the DoD Polygraph Committee was a Field Test or inspection of Polygraph instruments utilized within the DoD. This study was conducted during 1966, when there were two basic three channel instruments used in the DoD. I will refer to them as Brand A and Brand B. The purpose of the study was to determine whether polygraph instruments perform as specified under ordinary conditions of use. Calibration tests were performed on 17 Brand A and 40 Brand B instruments used by each of the three military services throughout the world. Twenty-four locations were visited and the instruments tested represented 14% of the polygraph instruments within the DoD. At that particular time, the military Departments of DoD owned 422 polygraph instruments, however, the number today is not as great.

The findings were -

1. The chart speed or kymograph performed according to specifications on all except two instruments. These were two polygraphs that had been used overseas on 220v.-50 cycle current and had been returned to the United States and had not been converted to 60 cycles.

2. 93% of the pneumographs in Brand A instruments and 41% of the pneumographs in Brand B instruments performed according to specifications. The balance of 23% or 13 polygraphs contained pneumographs that provided larger signals than required in response to large inputs.

3. 83% of the cardiograph units in Brand B instruments and 94% of the cardiographs in Brand A instruments performed according to specifications. Two of these polygraphs had cardio units that were non-operable, while six, or 10%, had

slow leaks. I should mention that the two polygraphs with non-operable cardio units were not being used to conduct examinations and were in the process of being repaired. This was pointed out to the researcher who conducted the study, but they were still included in the study results.

4. The GSR component operated according to specifications on 50% of Brand B instruments and on 17% of the Brand A instruments. It was interesting to note that the GSR unit on the Brand B polygraph responds linearly and almost instantaneously, while on the Brand A it lags about 20 seconds and shows a non-linear response.

I should mention that since 1966, the CID does not initiate a polygraph examination unless the instrument has an operable kymograph, GSR, cardio and pneumograph units. Within the next year or two, it is expected that examiners within the entire DoD will be required to calibrate their polygraph instruments before and after each examination.

National Bureau of Standards Tests

In line with the Field Evaluation Study, the DoD Polygraph Committee caused an evaluation of the polygraph instruments to be conducted by the Harry Diamond Laboratories of the National Bureau of Standards. During 1965, the Committee furnished the Bureau of Standards with two new polygraph instruments, which I will refer to as Brand A, and two new instruments, which I will refer to as Brand B. The three scientists who performed the study at the National Bureau of Standards were taught how to operate the instruments and the manner in which polygraphs are used in the DoD. In addition to presenting the polygraph research committee with test standards for polygraph instruments, the Bureau of Standards made observations as follows:

1. The pneumograph system of both types of polygraph instruments are a realistic measure of "breathing" rate and magnitude. The measure by the Brand A polygraph tends to increase greatly in amplitude from the base line of the chart with a small increase in pressure.

2. The Brand B polygraph cardiograph was "relatively unaffected" by variations in operating parameters. The Brand A polygraph cardiograph was "greatly affected" by

variations in operating parameters. Pen deflections, as a result of incremental pressure changes over the operating pressure range, show the Brand B polygraph to have less variation over its range than does the Brand A.

3. The ability of the GSR of the Brand A polygraph to measure subject resistance, or sensitivity, decreases as the subject resistance increases. The sensitivity is dependent upon subject resistance. The Brand B polygraph is "essentially" independent of subject resistance. In other words, Brand B pen deflection provides a realistic measure of this resistance range. It was observed that variations in operating parameters have a greater affect upon the Brand A polygraph than on the Brand B polygraph. With the exception of a constant drift from base line, the Brand B polygraph made better measurements or changes in subject resistance. In other words the Brand B polygraph produced more linear responses than the Brand A polygraph to the physical inputs used by the National Bureau of Standards for these tests. Both instruments are mechanically stable at all times and electronically stable after a warm up period of 30 minutes, during which time the Brand B instrument may drift. The drift can result in false readings in the GSR component.

The findings by the Bureau of Standards apply solely to the input-output characteristics of the two types of polygraphs and do not necessarily imply that these observed characteristics would or would not influence the interpretation of charts by polygraph examiners.

Magnetic Tape

Another rather interesting study was research to convert polygraph charts to magnetic tape. This was performed in conjunction with a study to determine the feasibility of interpreting polygraph charts with a computer. At this particular time I will only address the conversion of polygraph charts to magnetic tape. During the latter part of the year 1965, in conjunction with Southwest Research Incorporated, the DoD converted a model 22500 Stoelting polygraph to collect the polygraph tracings on a model 1300 Ampex recorder at the same time that polygraph charts are collected. To make a long story short, this instrument was put into use in April 1966, and since that time we have

several hundred sets of polygraph charts on magnetic tapes, which we intend to use to evaluate with a computer. I should mention that the reason we do not have more charts on magnetic tape is that we own only two of these instruments, with one at our School at Fort Gordon, Georgia, and one at my office.

The magnetic tape polygraph has another application in addition to feeding a computer. By collecting the charts on magnetic tape, they can be converted to paper tape and transmitted anywhere in the world over teletype machines. This would be of great assistance in our CID Quality control program, as theoretically we could be reviewing charts five minutes after they are collected in the polygraph rooms in Seoul, Korea, or Munich, Germany. This could be of immeasurable assistance, especially with the apprentice polygraph examiner who is not normally as secure in his findings as the experienced examiner. During the testing phase of the tape polygraph at Fort Gordon, Georgia we collected a polygraph chart and at the same time placed the charts on magnetic tape. After converting the tape back to a polygraph chart, we compared the chart collected in the polygraph room with the chart made from the magnetic tape. Naturally these charts should have mirrored each other. We found that the two charts were not identical. The Chief Engineer was of the opinion that he had an electronic malfunction and was proceeding to disassemble the polygraph tape instrument when I observed that ink in the polygraph playback unit was different in color to the ink in the actual polygraph. We cleaned out the ink wells and pens of both instruments, used ink from the same bottle and weighed all pens in both instruments and ran another set of charts. At this time the charts from the playback unit and charts from the polygraph were identical. This indicates the necessity of weighing pens and using the same ink in all pens of your polygraph instruments.

ADP Research

Research which has been programmed and is presently in process, but as yet incomplete, is in the area of Automatic Data Processing of Polygraph Responses. The research task is to extend and improve the output conversions of both the conventional and an advanced multichannel polygraph instrument from analog to digital coding and devise computer programs for on-line analysis and data display.

The computer programs have been written which will accept the on-line data, plus analog-to-digital conversion, for IBM 360 processing of four channels of EEG, GSR, inspiration and expiration, pause time, plethysmograph and electrocardiogram.

Pilot studies and analysis of the data comparing the two polygraph methods (conventional and the advanced system), indicate a significant enhancement of both the reliability and validity of identification procedures utilizing the computer system. Additionally, there appears to be an advantage to the examiner to have an immediate feedback, enabling him to select optimum areas of interrogation for further exploration, reducing the time required for eyeball interpretation and final decision.

This project is still in progress and work in the area is being pursued by Institute for Defense Analysis. I hope to give you more on this study at a later date.

Reliability

A "Blind Analysis Study" was performed to determine the reliability with which polygraph examiners interpret charts in the complete absence of information from other sources. Reliability measures the extent of agreement or consistency between examiners, but not whether the judgments are correct. Some scientists and laymen to the polygraph field will state that a polygraph examiner probably bases his judgment of "Deception Indicated" or "No Deception Indicated" on several sources of information, such as the case file, the investigator's verbal report, impressions gained during the pre-test interview, observations of the subject during the polygraph examination, and, of course, the tracings on the polygraph chart. The purpose of this study was to establish the reliability of the polygraph chart as the sole basis for judging deception, i.e., in the absence of all other clues. Reading charts in this fashion, which we called "blind," is not the way in which a polygraph examination is conducted.

A large number of charts were obtained from the three military services. From these, 90 sets were selected at random to comprise 30 for each type of polygraph examination: Zone Comparison (ZOC), General Question Test (GQT), and

Peak of Tension (POT). The sets were also selected so that half were judged by the original examiner as Deception Indicated and half No Deception Indicated, except the POT set, where this criterion does not apply. No charts judged Inconclusive by the original examiner were used. All information, including handwriting, was removed from the charts.

These charts were judged by 30 examiners, 10 from each military service, who worked independent of each other. There were seven steps to the study. The polygraph examiner analyst was first asked to evaluate the Peak of Tension charts for the peak or peaks. The second step consisted of reading the GQT charts for Deception Indicated, No Deception Indicated, or Inconclusive; and the third step required the reading of the ZOC charts for Deception Indicated, No Deception Indicated, or Inconclusive. The analyst was then informed that none of the polygraph charts had been considered Inconclusive by the original examiners, and a decision was requested for those GQT examinations which he had previously interpreted as Inconclusive. The same procedure was used for the ZOC. The last two steps consisted of evaluating each component and each question for truth or deception, for the ZOC and GQT charts. The collection effort alone required three days per examiner.

To summarize the results:

1. The reliability of the individual analyst is much better than chance but would be considered low. (It was 75 to 85%.)

2. The reliability of the group decision is fairly respectable (75 to 94%).

3. Zone of Comparison was much better than GQT for reliability.

4. Reliability for Deception was better than No Deception.

5. Reliability was lower when interpretation was on a question by question basis rather than reading entire chart for DI or NDI.

6. Agreement between individual analyst's decision and original examiner is much better than chance.

7. Agreement between group decision and the original examiner is excellent. (High 90 percent reliability.)

Although the study reflected that one polygraph examiner can interpret another examiner's charts, the study was contaminated by several factors; namely -

1. All military departments were not utilizing the same techniques and there was no interdepartmental standards for test construction.

2. All military departments were not training their examiners at the same facility, consequently, some examiners were attempting to interpret polygraph charts that were constructed in a manner which was completely foreign to them. Additionally, reliability was affected by the examiner being forced to interpret charts which he considered inconclusive, as these charts caused the reliability ratio to be lower.

Since this study, all polygraph examiners in the military departments are trained at the same facility and there is standardization within the military services.

If this study did nothing else for us in the DoD, it proved that as long as you have standardization, one examiner can interpret another examiner's charts, and we initiated this procedure in our quality control program. In other words, when an Army CID Examiner makes a final decision on a set of charts, this decision is substantiated by at least one other examiner.

Judge Advocate General Study - Validation

This was a validation study which consisted of comparing polygraph results with the investigative file. Specifically, the study consisted of comparing the judgments made by polygraph examiners in criminal cases against judgments of guilt or innocence made by a panel of lawyers who had access to the complete investigative file from which all references to the polygraph examination were removed. Guilt or innocence

as judged by a jury or court martial would not be a meaningful criterion since some judgments of innocence are based on legal technicalities. There are many criminal investigations files which included polygraph examinations conducted by the military services. Cases were selected at random from the 1963 to 1966 period so that there would be about an equal number of each type of polygraph examinations and, within each type, an equal number of judgments of Deception Indicated and No Deception Indicated by the original polygraph examiner. No cases judged Inconclusive or Indeterminate were employed. Only those cases were used where the investigative information was complete enough to permit a lawyer to judge guilt or innocence. This was accomplished by four U.S. Army Judge Advocate General attorneys who made a preliminary screening of 323 case files but did not otherwise participate in the study. The final number of cases in each category which met these criteria was 157 cases. 72 of these cases were interpreted by the examiner as DI, while 85 were considered by the examiner to be the charts of truthful individuals. 37 of the Deceptive and 52 of the No Deception charts were Zone of Comparison charts, while 35 of the deceptive and 33 of the No Deceptive charts were GQT charts.

In a preliminary experiment, it was found that unanimity of four (but not three), JAG attorneys also meant unanimity among nine JAG attorneys. Thus, in the main study, four JAG attorneys were used. Polygraph records were removed from the case files and all references to the polygraph test were removed from the case files and all references to the polygraph test were deleted. Then, each case file was reviewed independently by four JAG attorneys, each making a judgment of guilt or innocence of the subject. The attorneys were given explicit instructions to disregard all legal technicalities and to judge each case solely on the evidence contained in the file. The polygraph examiners and the JAG panel agreed on 92% of all cases. A breakdown on the statistics is -

Deception Indicated - 90% agreement

No Deception Indicated - 94% agreement

General Question Test - 93% agreement

Zone of Comparison - 91% agreement.

Descriptive Statistics Study

The Descriptive Statistics Study was conducted in 1968 for the purpose of determining if the three military departments (Army, Navy and Air Force), possessed any data, from a statistical standpoint, that would indicate the reliability or validity of the polygraph. As I have previously mentioned, the Moss Committee has stated that the government did not maintain any statistics that would prove or disprove that the procedure is reliable or valid. The first procedure in this study was to determine the number of polygraph examinations conducted by the three military departments, during the years 1963 through 1967. It should be mentioned that the only statistics gathered were those on Criminal matters and did not involve statistics on job placement, security or intelligence matters. In this respect the Moss Committee was correct, as the only data on the results of criminal polygraph examinations available in all services were the number of examinations conducted and the results of the examination. When I mention results I am speaking of the Polygraph Examiner's results and not the results of the investigation.

An interesting side light, although to me tragic, to this study was the fact that the number of polygraph examinations in criminal cases dropped in 1966 to about 25% of the number for 1965. This coincides with the occasion of the Moss Committee's inquiry concerning the use of the polygraph by government agencies. In 1967, the use of the polygraph by the Army exceeded its use in 1965, while its use by the Navy and Air Force continued to decline. To me the tragic aspect, and I address myself only to Army, is that we were failing to solve investigations during the period 1965 to 1967, because we were not making maximum use of the polygraph. I am certain that the Navy and Air Force were in the same position but I do not possess data to support this opinion.

The Army is no different than management in a large business firm, in respect to the use of the polygraph. The Army CID was not afraid to use the polygraph but Army commanders would not authorize its use. It was hard for the

CID to determine if the failure by Army Commanders to authorize use of the polygraph was due to caution because of the adverse comments presented by some individuals during the congressional hearings or the Commanders were actually of the opinion that the polygraph did not possess validity. So the Army CID had to initiate an education program for commanders.

In summary, the statistical study did not tell us anything that would lend itself to proving the validity of the polygraph technique, but it gave us three areas in which we had to work, if we planned to continue using this most valuable aid to criminal investigations: (1) Maintain statistics that would prove or disprove that polygraph examinations were useful during the conduct of investigations, (2) Educate commanders that the polygraph was essential, and (3) Educate CID commanders, and CID agents (known as detectives by you gentlemen in the civilian world), that the polygraph was not a guessing game used by a skilled interrogator, but was a valid scientific tool.

Research was just too slow for the criminal investigator, so we had to prove to the commander that the polygraph was necessary and valid by some other method. The "old" and experienced polygraph examiner knew that he could "sell" polygraph to the CID Agent and the CID Commander by solving crime through the use of the polygraph, but how do we get the Army Commander to approve its use?

We did this very simply. We rewrote our Department of the Army Polygraph Regulation, which presented Army commanders with the attitude of the Chief of Staff of the Army on use of the polygraph. The Chief of Staff of the Army was aware that the Army detective needed every scientific aid to assist in Criminal Investigations and the polygraph had proven in the past to be the most valuable aid during investigations. The next step was to prove to the CID Commander and CID Agent that through use of the polygraph he would solve his case with validity, and swifter than by other means. This was accomplished by giving the CID quality polygraph examiners. We did this by reviewing the records of all of the CID examiners. We had 198 school trained examiners but about one-half of these examiners were not using the polygraph sufficiently to maintain peak proficiency. We cut our examiner strength to 90, and within a two-year period retrained

these 90 examiners at a Polygraph Refresher Course. Additionally, we established a Quality Control Program at the U.S. Army CID Headquarters wherein all polygraph examination charts and documents are reviewed within 3 to 7 days after the conduct of the examination. The Quality Control Program is accomplished at Fort Holabird, Maryland.

The third area in which we needed to imporve was Statistical maintenance. During 1965, we designed areas to address in collecting statistics. They are:

1. Pre-Test Confessions

2. Deception Indicated or Specific Responses

3. No deception indicated or No Specific Responses

4. Inconclusive or Indeterminate

In the Deception Indicated area, we broke the statistics out to reflect the number of examinations that were confirmed by confessions, number confirmed with other evidence, number unconfirmed, number in which confirmation could not be established, and number in which the subject was later determined to be truthful (False positive). We expanded the No Deception Indicated area to depict the number of examinations that were confirmed by other evidence, number unconfirmed and number in which the subject was later proven to be untruthful (false negative).

The results of the statistical study by the DoD Committee may be reflected in the statistics collected on Army CID examinations during Calendar Year 1972. Of the world-wide examinations conducted, 62.6% reflected Deception Indicated, 31.6% indicated No Deception Indicated and on 1.3% were inconclusive. No opinion was 4.6%. 45.7% of the Deception examinations were confirmed by confessions or other evidence, 54.3% could not be confirmed, which is mostly due to unavailability of all records or because the examination was conducted for another Federal Agency. We were able to confirm 38.1% of those examinations that were determined to reflect no deception. This confirmation failed because the investigation was not solved or cleared. It is interesting to note that in all the examinations conducted by CID, world-wide, there were no examinations in which the examiner reached a finding of No Deception Indicated and

the subject was later determined to be guilty of the crime. Even more interesting, there was no instance in which a subject was found innocent by a court after the polygraph examiner reached a finding of Deception. We are proud of the low 1.25% inconclusive figure. These statistics are based only on examinations in which charts were collected.

The quantity of examinations in 1972 were more than three times the number conducted during the year 1966. Needless to say, CID Agents, CID Commanders and Army Commanders are now aware of the value of the polygraph.

Anxiety and Sex

I would like to mention one more study. This was a study that was conducted by my office during the years 1969 and 1970. During the winter of 1969, an Army Major named Robert B. Machen came to my office and stated that he was contemplating writing his doctoral dissertation on the subject of "The Effect of Ten Hours of Instruction in Sex Education on Anxiety Related to Sex Concepts." His reason for contacting me was to determine if it was feasible to use the polygraph to determine reductions in anxiety. I explained that each time a polygraph examiner conducts a polygraph examination he is measuring increases and decreases in anxiety, and that the polygraph would probably be the best and swiftest technique to measure anxiety reduction. This appeared to be a good study to use in validating the polygraph and at the same time assist the Major. Upon obtaining approval from the Department of the Army to conduct the study, I assisted Major Machen in formulating ten relevant questions and I recorded a 20-minute pre-test. The next item was to volunteer some of the other Army Polygraph Examiners to assist in the study. Major Machen's hypothesis was that 10 hours of instruction in sex education would reduce significantly the anxiety level of the sample of young male adults with regard to selected sex concepts, so my job was to use the polygraph to determine if this was a correct hypothesis.

The procedures used in the study were to select 100 individuals and divide them into two groups of 50 each. One group was designated the experimental group and the other the control group. The subjects in each group were matched as to sex, chronological age, marital status, educational level and religious background. The experimental

group and the control group were given an individually administered polygraph examination to determine each subject's anxiety level with regard to selected sex concepts. The experimental group was then given a written sex knowledge test followed by 10 hours of instruction in sex education. Each subject in the experimental group and control group was then administered a second polygraph examination to determine sex concepts anxiety. A comparison was made between the experimental group and the control group to determine whether or not a significant reduction in the sex concepts anxiety level was evident.

The scoring data for the second polygraph test revealed that the anxiety level of the experimental group had a mean of 19.06 and a standard deviation of 5.65. A significant anxiety decrease at the .01 level of significance was found to exist between the mean scoring data recorded for Polygraph Test 1 and the mean scoring data recorded for Polygraph Test 2 in the experimental group. The anxiety level of the control group had a mean of 32.84 and a standard deviation of 8.32. In other words, the anxiety level of those individuals who received the 10 hour block of instructions decreased significantly, while the anxiety level of the control group increased.

On the polygraph validity side, the polygraph examiners were not aware at anytime as to whether a subject had received sex education. Further, at no time was a subject asked during the test if he was "in fact lying about any question." The charts were interpreted in the "blind," that is all answer markings were removed from the charts by the researcher prior to being interpreted by the polygraph examiner. The end result as to validity was 99%; that is, we missed one subject out of 100. This individual received training but the training caused his anxiety level to increase, and the researcher was of the opinion that the individual was severely neurotic.

Summary

Basically, this research has pointed out that our instruments are basically reliable when properly calibrated, that a possibility exists wherein polygraph charts can be interpreted by a computer, that polygraph charts can be transmitted over telephone lines, that the polygraph is valid for determining anxiety release, and the polygraph is

reliable and is a valid tool for determining truth or deception when used by properly trained examiners.

Finally, our research has reflected that to obtain complete professionalism in the polygraph field, it is essential that the scientific world be convinced that the polygraph is valid. To prove validity we need standardization. Regardless of the technique, one examiner should be able to read another examiner's charts. The Army is proving this theory, as we have reduced our yearly Inconclusive rate from 5% to 1.8%.

WANTED - DEAD OR ALIVE!

The Archives of the American Polygraph Association is now receiving material on research, law, instruments, cases, examiners' biographies, books, articles, polygraph organizations and polygraph history.

APA members are requested to submit or loan material for the development of this official archive. Anne Arundel Community College has provided a special room for the collection and will handle the filing and correspondence. If material cannot be donated, loaned material will be accepted, copied by Xerox or microfilm, and returned. An acquisition list will be published in the Journal.

Send material to: **The Andrew G. Truxal Library**
Anne Arundel Community College
101 College Parkway
Arnold, Maryland 21012

PERSONALITY AND VASOMOTOR BEHAVIOR

By

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ABSTRACT

The relationship between the performance of undergraduates on the MAS, the TAS and the N and E scales of the MPI and their vasomotor behavior during: (1) adaptation to the laboratory setting, (2) habituation to neutral stimuli, and (3) semantic conditioning and extinction, was investigated. A photo-electric cell attached to a Physiograph 6 was used to measure vasomotor change. Although the vasomotor behavior of subjects was moderately consistent throughout, the personality test scores did not reliably predict that vasomotor consistency. (Author).

Vasomotor activity is of particular interest to examiners using photo-electric plethysmographs and cardioactivity monitors. The association with personality test scores has wider implications. (Ed.)

During the 1950's and early 1960's, numerous studies investigated the relationship between subjects' scores on the Manifest Anxiety Scale (Taylor, 1951), the Test Anxiety Scale (Sarason & Mandler, 1952), and the Neuroticism (N) Scale and the Extroversion (E) Scale of the Maudsley Personality Inventory (Eysenck, 1955) and various physiological criterion measures.

Spence, et al. (1951, 1953, 1965a, & 1965b), Hilgard, et al. (1951), Prokasy & Truax (1959) and Franks (1956 & 1961) found an equivocal relationship to obtain between eyeblink conditioning and scores on the MAS, the N Scale and the E Scale.

Holtzman, et al. (1952), Berry & Martin (1957), Mednick (1957), Belloni (1964), Nies (1964), and Maltzman and Raskin (1965) found the relationship between MAS, TAS, N and E scale scores and GSR conditioning to be equally equivocal.

Lacey, et al. (1955) obtained a moderate but not statistically significant relationship between MAS scores and heart rate change.

Less has been reported of the relationship obtaining between MAS, TAS, and the N and E scales of the Maudsley and the various measures of vasomotor behavior.

This study was designed to investigate the relationship between subjects' scores on the MAS, TAS, and the N and E scale of the Maudsley and 49 derived measures of vasomotor behavior during the three phases of the study: (1) adaptation to laboratory setting, (2) habituation to neutral stimuli, and (3) conditioning/extinction of the vasomotor component of an instrumental act.

The interactive effect of the four scales as predictors was also investigated. Thirteen simple and eleven interaction hypotheses were formulated and tested.

METHOD

Subjects -

Eighty-eight (60 female and 28 male) undergraduates, ranging in age from 19 to 25 years, served as subjects.

Procedures -

The Manifest Anxiety Scale (Taylor, 1951), the Test Anxiety Scale (Sarason & Mandler, 1952), and the N and E scales of the Maudsley Personality Inventory (Eysenck, 1955) were administered to two sections of introductory educational psychology. During the same class session, the purpose and operation of the study was explained. Volunteers were then recruited.

An E & M Physiograph 6 with a photo-electric cell attachment was used to study the vasomotor behavior of each

volunteer individually, under these three conditions: (1) Adaptation phase, the subjects were told to remain relaxed for five minutes. No stimuli were presented; (2) Habituation phase - the subjects were presented a list of 30 unrelated, unreinforced words, and (3) Conditioning/Extinction phase - the subjects were presented another list of 135 words, of which 45 were the key word "violin." The subjects were instructed to press the button at their right hand whenever the word "violin" was heard, but to respond to no other word. The remaining 90 words had previously been found to be unrelated to the word "violin." (Darr, 1967; Luria & Vinogradova 1959; Mednick, 1957 & Schvarts, 1956). The key word was interspersed throughout the 135 word list. In order to assess the consistency of vasomotor behavior during the Conditioning/Extinction phase, that period's data was divided into three subphases for analysis: C/E I, II and III.

Subjects were studied in a sound-controlled room. A 50 db white noise background was present throughout. Both integrated and unintegrated vasomotor outpoint were recorded. Only reduction in amplitude of 1/3 or more over previous baseline amplitude were considered as vasoconstructions (Darr, 1973). High inter-rater reliability was obtained (Darr, 1967).

Four response categories were studied: (1) spontaneous vasomotor reactions (SVR) - observable changes in pulse volume apparently unrelated to environmental stimulations, (2) anticipatory vasomotor reactions (AVR) - vasoconstrictions occurring shortly before stimulus onset during the Habituation and Conditioning/Extinction phases, (3) unconditional vasomotor reactions (UCR) - vasoconstructions occurring within 6 seconds after presentation of an unreinforced word, and (4) conditioned vasomotor reaction (CVR) - vasoconstriction occurring within 6 seconds after presentation of the key word - "violin."

Using the above categories 49 vasomotor criterion measures were derived. Pearson product coefficients were computed to assess the relationship between performance on each of the four personality measures and the 49 derived criterion measures. Multiple regression analysis, (Bottenberg & Ward, 1963) was used to test for significance of predictor sets of personality variables.

RESULTS

Only three of the 64 Pearson product coefficients computed were significant at the .05 level. In all three, a negative relationship was found to obtain between measures of chronic anxiety and number of spontaneous vasoconstrictions (SVR).

MAS * SVR (Conditioning/Extinction, Phase III), $r = -.2142$, $n = 88$, $p < .05$.

N * SVR (Adaptation Phase), $r = -.2191$, $n = 88$, $p < .05$.

N * SVR (Conditioning/Extinction, Phase III), $r = -.2171$, $n = 88$, $p < .05$.

Only two of the 147 F ratios computed to test for significance of the predictor sets of personality variables were significant at the .05 level: MAS * E interaction predicting (a) "Subjects who did not experimentally condition" and (b) "General amplitude level." The two significant interactions accounted for so little variance as to render them useless for prediction purposes.

DISCUSSION and CONCLUSION

Because of the reported correlation between reduced peripheral pulse volume (PV) and clinically observed anxiety (Gamberg, 1958; Stanishevskaya, 1955; Ackner, 1956; Lynn, 1963 and Rogov, et al., 1965), it was predicted that subjects with high MAS scores would demonstrate significantly smaller experimental PV than subjects with low MAS scores.

The pulse volumes of four subjects were of such low amplitude that no baseline could be discerned on their recordings, indicating that certain subjects maintain constricted PVs in conditions where no environmental bases for constriction can be found.

A significant MAS * E interaction was obtained when General Amplitude was used as a criterion measure ($F = 5.1743$, 1/88df, p .0258). However, the significant interaction accounted for less than three percent of the variance. Thus, the predictors in this interaction model actually accounted for little of the variation in PV.

Sarason's findings (1957a & b) relating to the effect of situational anxiety or stress upon the performance of human laboratory subjects led to the prediction that subjects with high TAS scores would tend to emit a wider range of PV than subjects with lower scores. Furthermore, subjects with high TAS scores would tend toward general constrictiveness when environmental factors were manipulated.

Some subjects demonstrated large fluctuations in PV during the study in the manner suggested by Sarason's work; however, TAS scores were not significant predictors of these fluctuations. Furthermore, while some subjects did increase amplitude over time, others tended to reduce amplitude. Ackner and Pampiglione (1955) attributed such PV decreases to early phases of sleep or complete relaxation.

The work of Eysenck (1955, 1957, & 1961) and Franks (1956 & 1961) suggested that the scores on the Extroversion (E) scale are a more reliable predictor of speed of conditioning and extinction than are MAS, Neuroticism (N) scale, and the TAS scores. Eysenck (1955) hypothesized that introverts tend to condition more rapidly than extroverts and to remain conditioned longer because they are more responsive to their environment. Conversely, extroverts tend to condition more slowly but extinguish more rapidly because they are less influenced by environment.

The patterns of vasomotor behavior found in this study follow closely the excitation-inhibition theory (Pavlov, 1928 & Eysenck, 1961). Subjects, who were responsive during Adaptation - i.e., emitted reliably more vasomotor reactions to nonreinforced stimuli - conditioned sooner and remained conditioned longer than subjects who emitted fewer UCVRs during Adaptation; however, the E scale scores were not reliable predictors of either subjects who were responsive during Adaptation, who conditioned rapidly, or who extinguished rapidly.

Although the physiological findings of the study agree with Eysenck's formulation, the E scale accounted for very little of the observed variance in behavior-less than 10 percent. Thus, E scale scores contributed little to prediction of vasomotor behavior.

Franks and Mantell (1966) suggested that the physiological variables under study in the classical conditioning paradigm are beyond the scope of paper and pencil tests. Rather they suggest that pre-treatment experimental measures be used to make experimental predictions.

The results of this study support the notion of Franks and Mantell (1966). During the study most subjects' vasomotor behavior remained consistent throughout the three phases; however, there appeared to be little relationship between subjects scores on the four personality measures and their vasomotor behavior.

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ESSENTIAL CONSIDERATIONS TOWARD JUDICIAL ACCEPTANCE

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Until recently, debates over the legitimate scope of polygraph testing went on essentially outside the courts, simply because courts have ruled polygraph evidence inadmissible for any purpose. The only other formal legal response was a flurry of legislative activity in about twelve states banning or limiting use of the polygraph in employment situations. Today, however, more courts are showing a willingness to reconsider the matter of admissibility of polygraph evidence that it should motivate polygraph examiners to marshall their forces so that this class of evidence can be dealt with by courts and administrative agencies on a secure basis. There are three aspects of this: (1) developing the admissibility of polygraph evidence in the courts; (2) establishing the legitimate boundaries of use of the polygraph as an investigative tool in both public and private law enforcement and crime prevention; and (3) establishing institutional reliability in the field of polygraphy. These three aspects are important enough and so interrelated that the failure to treat any one of them adequately may well imperil the legal and social status of polygraph testing.

DEVELOPING ADMISSIBILITY IN THE COURTS

In a sense, polygraph evidence has been treated by the courts much more severely than other categories of scientific evidence. Generally speaking, when an appreciable number of specialists make use of a new test, device, or procedure in their occupational or professional activities, and then set up controls and standards on the observations made or results reached, the courts begin to permit them to testify on the basis of their tests or observations whenever their opinions are of help to court and jury in resolving one or more of the issues being litigated. The evidence at least is ruled admissible; it then is up to the opposing party to attack the probabilities on which the expert opinion evidence rests. In other words, once

the admissibility hurdle is passed, the fight turns on weight and credibility.

That the number of experts may be small is illustrated by so-called voiceprint evidence. As long as only one person, Dr. Lawrence Kersta, maintained the reliability of voiceprinting, it was difficult to persuade courts to admit the evidence. Today, however, the roster of experts, although yet small, embraces people like Dr. O. Tosi of Michigan State University and Lt. E. Nash of the Michigan State Police. Also, the body of test data has expanded rapidly. Consequently, several courts have admitted voiceprint evidence at least for purposes of corroboration.

Polygraphy continues to function under an inherited burden of adverse judicial rulings based on claimed statistical unreliability. Therefore, from the standpoint of polygraph experts, a vital need is to bolster proof of the validity of the scientific basis on which polygraphy rests. There appears to be a great lack of publicity concerning empiric, basic research into the validity of the premise on which the polygraph examination rests: lying produces a physiological response to a state of psychic stress, a response which can be objectively measured and interpreted. Perhaps there are scientific studies not generally disseminated; if so, they should be widely circulated. If such studies have not been made, then they should be promptly commissioned. We must note that the acceptance of voiceprinting flowed directly from scientific testing by qualified experts, financed by federal LEAA grants. Rote reliance on the statements of totem figures like Inbau and Reid is not enough.

Moreover, greater attention must be given to the matter of statistical probabilities underlying polygraphy, since statistics appear to weigh heavily with courts. True, there are studies that claim a 95% or better reliability for polygraph chart interpretation [e.g., Horvath & Reid, The Reliability of Polygraph Examiner Diagnosis of Truth and Deception, 62 J.Cr.L., C. & P.S. 276 (1971)]. That high a percentage, if uncontradicted, will persuade most courts. A sophisticated opponent of polygraphy, however, will rely on the phenomenon of "conditional probability" [e.g., Skolnick, Scientific Theory and Scientific Evidence: An Analysis of Lie Detection, 70 Yale L.J. 694, 714-21 (1961); J. Shattuck, P. Brown & S. Carlson, The Lie Detector

as a Surveillance Device, 24-26 (ACLU 1973; press mimeo ed.)]. This means that if a test has less than 100% accuracy, "the probability of its accuracy in any single case is dependent upon the prevalence of the condition in the population group to which the test is being given" (ACLU Report at 24).

Using an illustration in the ACLU Report, suppose there are 25 embezzlers among 1,000 bank employees. If a reliability factor of 95% is assumed, then 50 of the 1,000 employees will be incorrectly diagnosed. This means that 24 of the 25 embezzlers will be discovered, which sounds excellent. However, it also means that 49 people (5% of 975 innocent people) will also be incorrectly diagnosed, in this instance as guilty. Therefore, of the 73 people diagnosed as criminal (the 24 actually-guilty and 49 wrongly-accused innocent persons), only 24 are in fact guilty. Thus, the probability ratio is actually 24/73, or almost 33 per cent. If there are only five embezzlers out of the 1,000, then the five will probably be discovered (95% of 5 = 5), but 50 innocent persons will also be classed by the polygraph examiners as guilty. The reliability factor is then based on 5/55, or 9%.

Devastating attacks on polygraph evidence can be foreseen unless polygraph experts are equipped to counter persuasively the claim that conditional probability, correctly applied, leaves more than the 50% probability required by statisticians for scientific reliability.

A second caveat for proponents of polygraph evidence is that only admissibility for limited purposes should be sought. Judge Joiner's memorandum opinion in United States v. Ridling is an excellent precedent. The issue of criminal intent was critical in that perjury case, and polygraph evidence would help indicate circumstantially the presence or absence of the intent to lie under oath. If intent appears to be well established through other circumstantial evidence, then probably it is unwise to offer polygraph evidence other than for purposes of impeachment or rehabilitation, as the case may be, after the person who underwent polygraph examination has testified under oath. In short, only in carefully controlled cases should polygraph evidence be offered.

A third factor to be considered is that selection of the polygraph examiner or examiners should be made under

court order. There is probably inherent power in a court to enter such an order for cause shown [cf. United States v. Ridling, supra], and the Supreme Court appears to accept the constitutionality of such orders for the production of what is demonstrative evidence and not "testimonial utterances" [see United States v. Dionisio, 12 Cr.L. 3083 (1/22/1973); United States v. Mara, 12 CR.L. 3089 (1/22/1973), involving grand jury subpoenas to provide voiceprint samples and handwriting exemplars]. A court predisposed to enter such an order should exercise care in the selection of polygraph examiners, control over the foundation laid for admission of the test results, and caution in preservation of the record. At the same time this should minimize the likelihood of a "battle of experts" encountered when each side offers its own examiner.

A fourth element important in establishing judicial acceptance of polygraph evidence is use of carefully drafted stipulations enforced by the courts [cf. Note, Lie Detector Tests: Possible Admissibility Upon Stipulation, 4 John Marshall J. of Practice & Proc. 244 (1971)]. Attention should be paid to developing a standard form with prescribed procedures to be followed in obtaining consent from parties and counsel and in offering the stipulation in court. Perhaps an analogy worth considering is plea negotiation, including judicial procedures for accepting guilty pleas, and pleas of nolo contendere. Once a valid stipulation is accepted and a polygraph examination conducted, then courts should require the parties to conform to it. In criminal cases, this means that evidence adverse to the defendant will be admissible within whatever limits are set by the court, as discussed above. But it should also mean dismissal of the charges if that is what the prosecution stipulates to [see Butler v. State, 228 So. 2d 421, 16 N. Y. L. Forum 646 (1969)]. Certainly the stipulation will continue to be critical to the admission of polygraph evidence in most cases, so that greater attention should be paid to it than has generally been done thus far.

ESTABLISHING LIMITS ON THE POLYGRAPH AS AN INVESTIGATIVE TOOL

Public Law Enforcement Use

Whatever the ultimate decision may be as to the in-court use of polygraph evidence, there is no appreciable legal

problem if law enforcement agencies continue to use it to screen suspects out of the system. There is ample analogy for this conclusion in other areas of law enforcement. For example, even if Miranda requirements are not met in a particular case, no legal consequences flow if the suspect either gives inconclusive responses to questioning or reveals information that exculpates him. A stop-and-frisk situation, even if questionable under Adams v. Williams [407 U.S. 143 (1972)], beings no adverse legal consequences if the person stopped identifies himself adequately to the officer and is permitted to go his way, or if the frisk reveals no weapon or incriminating evidence (assuming no gross excess of force or abuse of authority that might support a civil rights act civil proceeding). Polygraph examinations that result in the non-arrest or release of suspects or arrested persons do not translate into legal disputes over evidence. Moreover, the concept of conditional probability, mentioned earlier, operates only to indicate that a few guilty suspects may be erroneously screened out of the criminal justice system as innocent, and this renders most unlikely any class actions or civil rights injunctive measures against the police use of polygraph testing.

Dionisio and Mara, mentioned earlier, when coupled with the lineup decisions, seem to establish the premise that the polygraph does not fall with the concept of self-incrimination as long as the answers, as opposed to physiological responses, are not used in evidence against the person examined. The controlling constitutional doctrine seems to be Fourth Amendment search and seizure. The two grand jury cases, Dionisio and Mara do not directly govern orders for the conduct of polygraph examinations during preliminary proceedings. Dictum in Davis v. Mississippi suggests that practice rules for brief, limited detention of suspects for fingerprinting would not violate the Fourth Amendment if a probable cause basis were established for the order. A few courts appear to find inherent power to order voiceprinting and lineup identification at pre-trial stages of prosecutions. The police may wish to keep in mind that in the long range, special procedures for the acquisition of evidence should be established in revised criminal procedure rules or statutes.

If the privilege against self-incrimination does not apply to polygraph evidence, then logically the Miranda

doctrine, which rests squarely on self-incrimination, should have no application either. Nevertheless, officers administering polygraph tests may be well advised to use Miranda warnings whenever the suspect is in police custody, simply to forestall any attack on otherwise admissible polygraph evidence, which a magistrate or trial judge hostile to such evidence might seize upon as a legal basis for excluding it.

Private Law Enforcement Use

This is part of a developing problem area of the law, namely, the extent to which society can make use of private para-police agencies in law enforcement without having the evidence-acquiring actions of those agencies subjected to exactly the same rules that apply to regular law enforcement officers. Thus, for example, it is being asserted with increasing frequency, and sometimes successfully, that if plant security guards or private police agencies question suspected thieves (employees or customers) detained against their will, and obtain incriminating admissions in the absence of Miranda warnings, then the statements should be inadmissible. As another example, if school officials search student desks and lockers to obtain evidence to turn over to police, then the seizure should be invalidated under the Fourth Amendment. It may be a reasonable legal forecast that if private agencies use the polygraph to uncover crime, then their testing procedures will be subjected to whatever constitutional, statutory and evidence law controls are imposed on evidence derived from law enforcement polygraph testing. Accordingly, polygraph examiners affiliated with law enforcement agencies should be as concerned over the standards and techniques used by private polygraph firms and consultants as they are over their own.

The use of the polygraph for purposes of employee discipline or discharge probably presents no constitutional problem under existing precedent. For example, even public school officials are allowed to question pupils and examine lockers if their good faith motivation is to enforce school regulations necessary to student safety and welfare during school hours on school premises. Private and parochial schools are entirely outside the Fourth Amendment-Fourteenth Amendment, whatever the motives of their staff in inquiring into student conduct.

In twelve states, however, statutes enacted at the behest of labor organizations prohibit or restrict use of the polygraph in connection with retention of employment. Although in these jurisdictions the statutes seem not to be invoked formally by prosecutors, they appear to restrict significantly the private use of the polygraph. Ironically, they seem to necessitate early summoning of the police to conduct polygraph examinations, since in most of these statutes, law enforcement use of the polygraph is not within the statutory prohibition.[1]

In the remainder of the states, use of the polygraph for plant protection and the like is dealt with through labor contracts. Most labor organizations oppose all polygraph examinations, usually on the basis that the polygraph invades personal privacy. Negotiators for employers in businesses and industries in which theft or embezzlement is a significant economic problem should probably seek a limited type of authorization clause that limits use of the polygraph to instances of clearly apparent criminal acquisition of company property, and to those who have direct control over or unsupervised access to the property in question. Few responsible union representatives would seek to outlaw, under a union contract, a requirement that employee lunch boxes be inspected on departure, or perhaps that a metal detector be used; to the extent that such an assumption is valid, then clauses relating to polygraph examination should be as narrowly drawn.

A more sensitive area is use of the polygraph to screen employment applicants. The professional body of polygraph examiners risk very substantial opposition from influential sectors of public opinion if indiscriminate use of the polygraph for profit is widely carried on. There is enough restiveness over fingerprinting of applicants, access to computer bank data, investigations into family and mental condition, and other probings of the soul, that heedless use of the polygraph may accelerate the demand for highly restrictive legislation in every state. It may become highly prudent for polygraph examiners to insist on use of the instrument only on applicants for limited and highly

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[1]See Romig, Clarence H.A. "State Legislation Concerning the Polygraph in June 1973," Polygraph, 2:2, p. 85.

sensitive positions, covering narrow categories of subject matter, under substantial safeguards for confidentiality, and subject to requirements of corroboration before action is taken by the employer. Moreover, only clearly qualified examiners should be used.

ESTABLISHING INSTITUTIONAL RELIABILITY FOR POLYGRAPHY

The last comment poses what is probably the most critical elements to the establishment of the polygraph as acceptable scientific evidence: the qualifications and standards of those who conduct polygraph examinations. Even the strongest proponents of the polygraph recognize that perhaps a strong majority of those who in the past have held themselves out as polygraph examiners were unqualified. Action is needed on three fronts:

Standardization of Training

It is essential that a sound accrediting agency be created to establish standards for the educational prerequisites and training of polygraph examiners. Only graduates of approved schools should be able to call themselves certified polygraph examiners. Only provisional certification should be offered initially; final certification should be withheld until substantial experience has been gained under the direct supervision of senior examiners. Beyond this, a continuing education and recertification examination requirement should be imposed as a condition to biennial recertification. Without objectively defensible education and certification requirements, it is frivolous to speak of a polygraph "profession."

Discipline

A concomitant to standardization of training and certification is creation of a neutral, impartial disciplinary body which includes non-examiners (and non-law enforcement personnel) in its membership. Such a body must have the legal authority to enjoin unqualified practitioners and those whose certification has been revoked on adequate grounds. It must also be empowered to maintain lists of qualified polygraph examiners, from among whom judicial

appointments may be made in cases in which polygraph evidence is relevant. Mere membership in an organization which anyone can join on the unsubstantiated assertion that he is an examiner, and the payment of annual dues, is not any guarantee at all of professional qualifications. If courts are unwittingly led to admit testimony by unqualified or marginally qualified examiners, all examiners are thereby discredited. Self-preservation dictates adequate occupational standards rigorously enforced.

Constructive Law Revision

All this requires law change at the state level. Responsible polygraph examiners should urge licensing and regulatory legislation in every state, without grandfather clauses. There may be latent constitutional problems in legislation without such clauses, but one can find regulatory acts without such coverage that have been sustained as valid. There is probably no way absolutely to escape allegations of personal preference on the part of those who set the standards and form the initial accrediting body, but the process of establishing a formal machinery of a new profession or occupational group has occurred often enough in the past that it should be successful in this context as well.

AN URGENCY FOR THE CHANGES

A high order of priority should be given to empirical studies to establish the validity of the scientific premises underlying polygraph examination, and the statistical reliability of the technique, so that a valid foundation may be laid for this class of evidence in all jurisdictions in the country. So important a matter should not be left to haphazard development, particularly with a background of so many adverse rulings to admissibility of polygraph evidence based specifically on its unreliability.

The organized body of polygraph examiners should also be most careful in selecting suitable test cases and in providing qualified experts to make a record establishing the scientific validity of polygraph evidence. In Michigan, for example, evidence based on the Harger Drunkometer was rendered inadmissible because of a bungled presentation of

evidence based on its use in the prosecution out of which the test case arose. It took the adoption of a different device, the breathalyzer, and a carefully prepared test case, before law enforcement could rely on a generally accepted test for alcohol/blood ratio and the physical and mental impairment resulting. A failure to select suitable test cases may perpetuate the general inadmissibility of polygraph evidence.

Finally, attention should be paid to realistic public education about the proper limits of polygraph examination. Popular mythology about the "lie detector", "black box" makes juror over-reliance on polygraph evidence all too possible, which in turn affects the willingness of courts to admit it. Moreover, to the extent that proponents of the polygraph indicate that belief in its infallibility is a prerequisite of its successful use, they invite judicial decisions that cite this as proof of the polygraph's scientific unreliability. The polygraph has very real limits, which should be openly acknowledged to the public and the courts.

The polygraph has a role to play in both investigation and litigation. It suffers under a legacy of adverse, often hostile precedent which must be overturned before polygraph evidence becomes generally admissible. Proponents of the polygraph must agree among themselves about how far courtroom use of the polygraph can properly extend, and the degree to which it can be a legitimate personnel management tool. Rigorous certification requirements must be created and enforced, and only clearly qualified examiners permitted to appear in court. If these strictures are followed, polygraph evidence may become generally accepted by courts and administrative agencies. If they are not, there is risk not only that the rule of evidence exclusion will continue, but that prohibiting legislation will become ever more widespread.

TEXAS COURTS UPHOLD DISMISSAL OF POLICEMAN FOR REFUSING TO TAKE A POLYGRAPH EXAMINATION

By

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A suit was instituted in a Texas Court of Appeals to set aside an order of the Civil Service Commission of the city of Pasadena indefinitely suspending and permanently dismissing E. D. Richardson from the classified service of the Police Department of the City of Pasadena for his insubordination in refusing to submit to a polygraph examination. At a trial the district court had upheld the indefinite suspension and permanent dismissal, and the appellant made a further appeal to set aside that judgment.

The first issue in the appeal trial was whether the indefinite suspension and permanent dismissal of a police officer based solely upon his insubordination in refusing to submit to a polygraph examination was lawful. The second issue was whether the reception of affidavits by the Civil Service Commission after the close of testimony and without notice to the appellant deprived him of fundamental due process.

The appellant had complained through police department channels of his "Report of Performance Rating" for the six-month period which ended December 31, 1971. Chief Ellis R. Means ordered an investigation which produced allegations of unsatisfactory performance by Officer Richardson. To determine whether the alleged improper activities had continued into the performance rating period in question and further to determine whether such activities had continued to the time of the investigation, Chief Means ordered the appellant to submit to a polygraph examination. The appellant refused the order to take the polygraph examination. Thereafter Chief Means issued a written order indefinitely suspending Officer Richardson for insubordination. Officer Richardson appealed the order of indefinite suspension to the Civil Service Commission of the City of Pasadena.

At the Civil Service Commission hearing the appellant maintained that Chief Means had merely requested that he

take a polygraph examination. The Chief of Police, the only other witness, stated he had given a direct order. Six days after the open hearing the Commission accepted affidavits of three police officers who were present at the conference in question, and who corroborated the version of Chief Means. The Commission found insubordination in the refusal of the polygraph examination, upheld the indefinite suspension, and ordered the permanent dismissal of Officer Richardson.

Richardson then sued to be returned to his position. The district court heard the testimony of Chief Means, the appellant, the three civil service commissioners, two of the three police officers who gave the aforementioned affidavits. The trial court affirmed the indefinite suspension and permanent dismissal of Officer Richardson.

If the order to submit to a polygraph examination were unreasonable or unconstitutional, the appellant's refusal would not have been the insubordination required for dismissal by Rule 13, Section 6 (e) of the Policemen's Civil Service Rules of Pasadena. The appellant urged that his constitutional rights to privacy, freedom of association, and due process were violated by the special order and by his dismissal pursuant to his refusal. The question of whether a dismissal for refusal to submit to a polygraph examination is constitutional was addressed in the case of Talent v. City of Abilene, Docket No. 4619, Tex. Civ. App. - Eastland, June 8, 1973. There a fireman refused to take a polygraph examination concerning a criminal investigation. The Eastland Court of Civil Appeals rejected the constitutional argument, citing several precedents of other jurisdictions. These cases are pertinent, although they basically involve the right against self-incrimination in a criminal investigation rather than the right of privacy in an efficiency investigation. (See also Seattle Police Officers' Guild v. City of Seattle, 80 Wash. 2d 307, 494 P.2d 485 (1972).)

The court stated that a private citizen has "the right of privacy" as enunciated by the Texas Supreme Court in the case of Billings v. Atkinson, 489 S.W.2d 858 (Tex. Sup. 1973). A private citizen has a right to refuse a polygraph examination. The appellant, however, was a police officer and a public employee. By accepting public employment as a police officer he subordinated his right of privacy as a private citizen to the superior right of the public to

an efficient and credible police department. A police officer is guilty of insubordination in refusing a direct order of a superior officer to submit to a polygraph examination during a departmental investigation of a matter relating to efficiency and credibility when reasonable cause exists to believe that the police officer so ordered can supply relevant knowledge or information. Insubordination in refusing a reasonable and constitutional command cannot be upheld without jeopardizing the system of police administration which is premised on discipline.

Chief of Police Means was confronted with allegations that Officer Richardson had engaged in improper conduct. Officer Richardson denied the allegations. The polygraph is a scientific instrument used by police departments as an aid in the search for truth. The order of the Chief of Police to the appellant to take a polygraph examination was not unreasonable under the circumstances nor was the order less reasonable, because the investigation did not involve a charge of criminal conduct. (See also Coursey v. Board of Fire and Police Commissioners, 90 Ill. App. 2d 31, 234 N.E. 2d 339 (1967).)

The court held that the indefinite suspension and permanent dismissal of Officer Richardson, based upon his insubordination in refusing to submit to the polygraph examination, was lawful.

The second issue to be decided by the appeals court was whether the receipt of affidavits after the hearing without notice to, or the presence of, the appellant violated the requirements of due process. The Firemen's and Policemen's Civil Service Act provides:

> The members of the Civil Service Boards are hereby directed . . . when sitting as a board of appeals for a suspended or agrieved employee . . . to conduct such hearing fairly and impartially . . . considering only the evidence presented before them in such hearing. TEX. REV. CIV. STAT. ANN. art. 1269m, sec. 16(a) (1963).

The records revealed that after the hearing the Civil Service Commission did receive and read three pertinent

affidavits before its decision. The three affidavits were by police officers who were present at the conference between Chief Means and Officer Richardson, and they corroborated the statement of Chief Means to the effect that he had ordered Officer Richardson to take a polygraph examination. Richardson was deprived of the right to object to the admission of the affidavits and he was further deprived of the right to cross-examine the three witnesses.

The Firemen's and Policemen's Civil Service Act also provided for a trial in the district court in the event the policeman is dissatisfied with the decision of the Commission. (TEX. REV. CIV. STAT. ANN. art. 1269m, sec. 18 (1963).) Any such appeal is governed by the substantial evidence rule. The review is limited to an ascertainment of whether there was substantial evidence reasonably sufficient to support the challenged order. (Firemen's and Policemen's Civil Serv. Com'n v. Hamman, 404 S.W.2d 308 (Tex.Sup. 1966).)

In the case at appeal, the trial court in the trial heard the testimony of many witnesses including but not limited to Chief Means, the appellant, the three civil service commissioners, two of the three affiants, and it reviewed a full statement of facts prepared by the court reporter who attended the hearing before the Civil Service Commission, and review the three affidavits. The appellant was present at the trial. He was represented by an attorney of his own choice who cross-examined the witnesses against the appellant. At the trial the appellant was afforded the opportunity to subpoena witnesses. After the trial the court upheld the indefinite suspension and permanent dismissal of the appellant as being reasonably supported by substantial evidence. The court made findings of fact and conclusions of law.

Inasmuch as the Civil Service Commission, in granting the challenged order, acted upon substantial evidence reasonably sufficient to support said order, which supporting evidence was properly submitted at the hearing before the Civil Service Commission, the improper receipt by the Civil Service Commission after the closing of the hearing of the three affidavits in question did not violate fundamental due process in Richardson's case. (Firemen's and Policemen's Civil Serv. Com'n. v. Hamman, supra; Fire Department of City v. City of Fort Worth, 217 S.W. 2d 664 (Texas.Sup. 1949).)

The Appeals Court considered all of appellant's points of error and found no merit in them. They were overruled and the judgment of the trial court was affirmed on September 26, 1973.

ABSTRACTS

"Stimulus Repetition, Change, and Assessments of Sensitivities of and Relationships Among an Electrodermal and Two Plethysmographic Components of the Orienting Reaction." Stanley Ginsberg and John J. Furedy. Psychophysiolcgy 11:1 (Jan 74) 35-43.

Twenty subjects presented with 15 300-msec tones (for half the subjects) or lights (for remaining subjects) followed by a change trial to the other modality. There was highly reliable havituation in the electrodermal skin resistance response (SRR) and the plethysmographic pulse volume (PV), but no clear habituation in the plethysmographic blood volume (BV). Change produced reliable increases in all three orienting-reaction (OR) components. Application of signal-detection methods showed skin resistance response to be a more sensitive index of both initial orienting reaction and orienting reaction to change than either pulse volume or blood volume, which were not different. Neither pulse volume nor blood volume were correlated with skin resistance response, but the blood volume-pulse volume correlations were significant, and, when corrected for attenuation, approximated +.75. The problem of why the plethysmographic orienting response components sometimes habituate to stimulus repetition, and sometimes do not, was discussed, but it was concluded that while some possible explanations have been eliminated by the present results, the problem itself still awaits solution and poses a challenge to psychophysiologists. [Author abstract].

"Ear Lobe Photoplethysmography." By Robert M. Stern, Psychophysiology 11:1 (Jan 74), 73-75.

Evidence is provided showing that there is very little change in pulse volume in the ear lobe as a function of the usual types of psychological stimuli. On the one hand, this makes ear lobe plethysmography an excellent source of a signal to trigger a cardiotachometer for investigators interested in pulse rate who do not want to, or cannot, use EKG recording. On the other hand, this makes the ear lobe an inappropriate place from which to record vasomotor reactivity. [Author abstract].

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SOME FURTHER OBSERVATIONS ON THE DEBETHAM CASE - CORRECTION*

In Vol. 2 # 3 of Polygraph there appeared an article entitled "Some Further Observations on the DeBetham Case" by Kenneth L. Haney. One pages 249 and 250 of that article, the author made reference to testimony by a college professor who was identified as an expert in polygraph. It is obvious to all who know that case that the passage referred to my testimony. In describing testimony I gave regarding a manuscript written by Gordon H. Barland and myself, the author wrote "A review of his manuscript turned up a line he had written regarding his thoughts on validity. 'We will never know the validity of the polygraph.' Asked about this by the prosecutor, he admitted he had written this, then said, 'Well, I guess I'll just have to change that, won't I?'"

The above quotation from Mr. Haney's article represents a very serious error in fact. The actual passage referring to my testimony is found on page 140 of the transcript from the DeBetham hearing. The question posed by the prosecutor included an exact quote from our manuscript which said "The question of validity of the lie detection technique in field situations is an extremely complex issue which may never be fully answerable." My answer to that was "By 'Answerable' what we mean is there, that we are never going to be able to have independent verification on every case that is run or we will never - because of the social situation - or we may never have one hundred per cent accuracy. Perhaps that is poor wording. As I said, this is a rough draft. We haven't finished polishing it off. I think you have given me a good suggestion on how to revise some of the wording."

Because of the misleading nature of Mr. Haney's comments about my testimony, I have found it necessary to write this brief and accurate description of what my testimony actually was. If that description were to go unchallenged, there might be some who feel that I am not a person of high ethics, and that I am given to changing my testimony about matters of fact in order to suit the particular situation at hand. Obviously, such conclusions cannot be drawn from the actual fact, and I am confident that the above correct account will

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*The statement above has been verified from the Official Court Transcript (N. Ansley, Editor.)

dispel any doubts about my testimony or my scientific integrity.

(signed) David C. Raskin, Ph.D.

I have reviewed the official court transcript on the professor's testimony and compared it with notes I took while testimony was given.

There can be no doubt that the professor is exactly right and I was wrong.

I regret that my hastily taken hand-written trial notes did not properly reflect at a later date that testimony which I thought the professor gave. For the rest of the article I referred to the transcripts as I was not present during the testimony.

(signed Kenneth L. Haney
January 9, 1974.

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