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It is a real pleasure for me to be here and to take part in this inter-agency seminar.

As you all know too well from the work you do in your respective agencies, crime has been growing and is continuing to grow in our country. Very disturbing to me and a focus of a great deal of the attention of the Department of Justice is the rise in sophisticated and complex types of white collar and organized crime. What is needed to meet the demands of these enterprises is a national comprehensive and integrated enforcement strategy focusing on what can be done to improve our prevention, detection, investigation and prosecution of these crimes.

One of our best weapons to combat this growth is greater cooperation among the various law enforcement agencies on the federal, state and local levels. More than providing us with a good tool, this cooperation is essential if our efforts are to be put to best use and effectively directed.

While we must strive for this cooperation, we must also remember the legal restrictions. In exchanging information among law enforcement agencies, for example, the Privacy Act of 1974, the Tax Reform Act of 1976 and the Right to Financial Privacy Act of 1978 all contain prohibitions against complete sharing of data. But, despite these and other similar restrictions, the avenues for cooperation are countless.

On the state and local levels, a number of programs have been and are being implemented to ensure greater efficiency in law enforcement activities. Through one kind of program, federal funds are being used by state and local agencies to develop innovative ideas such as career criminal projects and prosecutorial management techniques. In addition, the establishment of Federal/State Law Enforcement Committees -- where U.S. Attorneys, state and local prosecutors meet to discuss the jurisdiction of certain cases and other problems -- has helped allocate our limited resources in the best possible way.

On the federal level, such cooperative efforts are also common. Strike forces, composed of officials from many different agencies, continue to play a very important role in our investigation and prosecution of sophisticated white collar and organized crime. Agencies working together have been responsible for better representing the needs of law enforcement in proposed legislation, executive branch initiatives and on long-range projects and studies. During the last session of Congress, for example, we have seen time and again that our ideas and opinions can be better expressed when we work on them together.

No better example of this joint effort exists than the type of inter-agency seminar you are participating in today. These study groups can bring tremendous resources to bear in examining common issues -- such as you are doing today with the polygraph technique -- and proposing sound programs and ideas.
Growing just as fast as the sophistication of law breakers has been our law enforcement techniques. Many of these modern law enforcement techniques and tools involve scientific methods and machinery ranging from the polygraph to automated information systems. Each of these advanced scientific achievements represents a significant development with enormous potential to aid our efforts, but each must be thoroughly studied so that their potential can be reached without intruding on or sacrificing equally important societal values.

We must establish standards for using scientific techniques just as we have done for the use of informants, wiretaps or other techniques. In fact, our efforts to establish guidelines often precede any actions taken by Congress or other oversight or regulatory officials. The Department of Justice, for example, has had regulations for using search warrants to obtain material from the press for many years. As you know, Congress is just now considering statutory restrictions on this procedure.

In the area of the polygraph, for example, great advances have occurred since experiments with its procedures began in 1895 and since the technique itself was first formulated some fifty years ago, various studies conducted since the early 1960's have indicated higher and higher degrees of validity and reliability in polygraph tests. These advances and the results of these tests necessitate the formulation of policies and guidelines to insure that the technique continues to be properly used.

Standards not only insure proper use and prevent abuse or misuse but they also serve to bring uniformity, consistency and equality to the use of the polygraph examination technique. Uniform precedents and practices among examiners and agencies prevent differences which are irregular and disparate treatment, which encourages unnecessary and detrimental criticism.

The polygraph, like so many of our procedures, can be highly reliable and valuable to our investigations if it is used in a competent and ethical manner. It is a technique which is most effective when used selectively, in the correct context and in a way which insures credibility. Credibility not only involves trustworthiness, but must also take into account skill, science and usefulness. There must be standards for the examiner, sophisticated training, a high degree of discipline and absolute integrity. Of these, integrity is the most important. In addition, our standards must address specific uses of the polygraph technique. As with all of our work, there is a need for restraint. Just because an individual consents to its use, there still should be a good reason to believe that the individual to be examined has information of the matter under investigation. Factors such as a person's age, capacity and physical and emotional condition must always be given proper weight.

And, it must always be remembered that the polygraph is just one in a number of procedures we have. Just as any other single part of an overall investigative effort, it should not be relied on to the exclusion of other evidence or as an excuse not to pursue other avenues of obtaining information. Use of the polygraph should never absolve agency officials of their responsibility to conduct as much of an investigation as possible by conventional means in order to verify the truthfulness and accuracy of information furnished.
The goals in this area are shared by all the agencies represented here today -- whether they are engaged in personal examinations, criminal investigations or intelligence activities. These goals are to find the proper use of the polygraph technique, to define and verify its validity and reliability, to protect against abuses and unnecessary intrusions into privacy, and to safeguard other competing interests. Through in-depth studies and discussions and our sharing of knowledge and experience, the guidelines necessary can be formulated and the goals I outlined can be reached. Should we be asked, we will be able to answer inquiries, whether by Congress, the press or the public, by showing them a technique which aids effective law enforcement and which does so in a restrained, balanced and lawful way.

There is no doubt that our work has become more complex and that the challenge of effective law enforcement is as hard to meet now as at any time in our history. Yet, we are beginning to find new ways to respond to the challenge. Technological advances are one very important part of our new abilities, but, in my opinion, the most important aspect and our best hope is continued cooperation among those of us sharing the same goal.

I congratulate you and wish you luck in your important work, and I thank you for letting me be part of your program.

* * * * *

Polygraph 1979, 08(2)
ADDRESS BY THE HONORABLE PAUL L. DOUGLAS,
ATTORNEY GENERAL OF THE STATE OF NEBRASKA

It is of some significance that your organization has chosen this year to meet in Nebraska. Currently the Nebraska Legislature is considering two bills dealing with polygraphy.

Both of them seek to alter the practice of the profession as it now exists. In one, LB 166, the Bill would make illegal use by employers or agents of polygraph examinations of employees or applicants to verify the truthfulness or to detect deception by mechanical or electronic means. Obviously, this constitutes a substantial portion of the private practice of polygraph services in the State of Nebraska.

The second Bill is a licensing statute under which operators would be required to secure a license. The act generally provides for the licensing of both public and private polygraph examiners. It sets out conditions under which such an examination may take place. It also prohibits an employer from requiring, as a condition of employment or continued employment, submission to a polygraph examination. However, an exception in this act allows such requirements where the employment involves public law enforcement, private security, private investigation or businesses related to the security of persons, firms, corporations, associations or copartnerships. It also allows an employer to ask an employee to voluntarily submit to such an examination and requires signed forms.

Of course, licensing polygraph examiners is nothing new. Several states have had polygraph examiner licensing statutes for some time. An example is the state of Illinois. However, the approach of this bill is to severely limit the use of polygraph examinations. It is interesting to note that there are a number of approaches around the country which are seeking to limit and define the areas in which polygraph examinations may be conducted, the method of conducting those examinations, and the persons who may conduct them. At the same time, there has been some movement across the country toward allowing for the introduction of polygraph examinations in evidence.

It seems at first blush that these two approaches are inconsistent. However, it may well be that both the approach of prohibiting the use of polygraph examinations in certain circumstances and allowing their evidentiary use may be threads of the same process. Perhaps it is becoming more generally recognized that polygraphy properly performed by trained operators and under controlled conditions has a substantial capacity for detecting truth and deception. Obviously, differing philosophical approaches would react in different manners to such a conclusion. One side reacts to such a conclusion by trying to restrict its use, seeking to protect individuals from such an examination. Thus, laws designed to limit and restrict the uses and applications to which these techniques can be applied.

The Address was given on April 26, 1979 at the Second Annual Seminar of the American Association of Police Polygraphists, in Omaha, Nebraska.
Other philosophical viewpoints would seek to expand the use of such an examination. Thus, recognition by some courts of the evidentiary values of the opinions of the examiner.

Given these conclusions, it is clear that each of you have a responsibility to become involved in the influencing direction of our law respecting the use of polygraph techniques.

I personally am convinced of the use and the value of the polygraph in all sorts of investigations. Obviously, the value is subjective to a certain extent. Tests, as I am sure all of you know, have not yet unequivocally established the scientific reliability of polygraph techniques. Just as certainly all of us know that the qualifications and training of the examiner are the most important aspects of a successful test. I think it is incumbent on all of us who utilize polygraphic services, who deliver those services, and who are involved in law enforcement generally, to do everything within our power to increase the ability, the expertise and the training of operators so that this valuable tool is not lost to us in the future.

We all know of individuals administering polygraph examinations who have not secured adequate training, or those who have had the training but have not had the experience necessary to temper that training and qualify them to make valid tests. It is not very difficult to learn how the machine operates or the theory behind the machine. It is not very difficult to ask some simple questions designed to elicit a response from an individual subject to a test. Each of us, however, is familiar, both in our own experience and generally, that the way the test is conducted, the way the interrogation is constructed, the precision with which the questions are drafted and asked, and the timing during the test are all critically important facts in validating the results of these tests. Yet, it has not been unusual in my experience to find polygraphists who have simply gone to school to learn the techniques and immediately commenced administering tests with little or no supervision. I believe it is essential that stricter guidelines on the qualifications of operators be established. That more thorough and thoughtful professional approaches be developed to ensure the ability of individual operators. That additional research and testing by the profession occur to give us guidance, especially in the area of improving on a continuing basis the abilities of the individuals administering these tests.

Certainly one important aspect of securing favorable legislation is to be well prepared before you appear before the legislative body, to have your arguments marshaled in favor of those desires you wish to see incorporated in legislation and to have the facts, the figures and the arguments ready for delivery to the legislative body.

I am suggesting to you that exactly this sort of approach will result in legislation that is not only such that you can live with it, but legislation that will enhance and improve your individual expertise and the profession in general. Go to the legislature and explain to it what in what areas are now deficient, what steps would most likely correct those areas, and what continuing steps should be incorporated within the legislation to ensure enhanced credibility of the process.
Legislators by and large are reacting to the needs of society in adopting particular legislation. If the anti-polygraph faction secures the legislative ear, you are going to be in a great deal of trouble. If you, the individuals who are most familiar with that process and that profession, secure their ear, you may not be completely pleased with what you get out of them but you will be much happier than if you are simply reacting to the proposals and arguments of the other side. As it now stands, the Nebraska Act that I have been discussing here will severely limit and restrict all non-police uses of the polygraph examination. It will also make the use by the police agencies more difficult than it presently is. It is necessary for you not only to have your profession interested in maintaining its ability to administer polygraph examinations, but you should marshal the individuals and groups that utilize your services in this matter.

I don't want to see the restriction on the use of the polygraph examination reach such a level that it is simply not available to us as an effective law enforcement tool. It may well be that some groups will seek to achieve exactly that end. Law enforcement would then be in a less favorable position. While we may generally operate on our assumptions and our beliefs as to what the facts may be in any given investigation, there is an enhanced reliability quotient when we have a polygraph examination properly conducted by properly trained individuals to support our beliefs.

I could give numerous examples to you of the value of polygraph examinations in solving all kinds of criminal cases, not only in finding the person who is guilty of the crime, but also exonerating persons who are not guilty of the crime. That latter aspect is one that is not sufficiently emphasized. For instance, those opposed to screening employees ignore the fact that such screening clears almost all of those screened.

I have been involved in several criminal investigations where a suspect seemed to be guilty. It was not an unusual event for such an individual to be cleared by passing a lie detector test. It would probably behoove all of you to try to get that message across more clearly to the general public.

It is interesting to note that the results of most polygraph examinations are not widely disseminated to the general public. Hundreds and hundreds of polygraph examinations are conducted by police agencies every year in all aspects of criminal investigation. Yet, one rarely ever sees the report in the newspaper of a polygraph examination having disclosed guilty, knowledge or exonerating the person subject to the polygraph examination. This probably enhances the mystique of these techniques. That is, what the public doesn't know, they fear. It may help to more widely acquaint society with the polygraph. We should inform the public generally as to what reactions are measured, how the test is administered, and the basis upon which the conclusions from the data secured are reached. Perhaps less secrecy and greater openness about the techniques utilized would enhance general acceptance of the polygraph.

If for no other reason, opposition has probably arisen to the use of the polygraph because it is an effective device. Society in general believes that if a person is subjected to a polygraph examination, the truth will come out. Many people equate refusal to take a polygraph examination with proof of guilt.
We know this may not be true but it certainly raises a substantial question in our mind. I have had people tell me that they wouldn’t take a polygraph examination because they didn’t want to get into their sex life when we were investigating an embezzlement. Apparently some people believe that once you are hooked up to a polygraph machine every secret, every lie, every falsehood that you ever engaged in is going to be brought out. Some of these fears could be eased if we simply more clearly explained to the society at large that a polygraph examination does not rummage through your entire life. While it may, its effectiveness is not greatly enhanced. Perhaps explaining to society the limited nature of most polygraph examinations would get rid of some of the problems we now have as far as anti-polygraph feelings are concerned. At a very minimum, we should attempt to educate those individuals who will be legislating on this subject as to the effective uses of a polygraph examination and the techniques that are going to be utilized in such an examination.

I believe some of the steps that I have outlined above are things that your organization ought to be considering very seriously in establishing groups and task forces to work on. In my view, the alternative will be for other agencies and other entities to step into the void which presently exists and to enact for you legislation that you will be very happy with.

In any event, it is clear that there are significant problems associated with the continued use of the polygraph in both police and private investigations. It seems clear that further restrictions are going to be imposed upon the operation of the polygraph and the applications to which it can be put. It is also rather clear from my standpoint as a member of the criminal justice system that it is important that such limitations and restrictions do not hamper our ability to utilize this investigative approach. As you all know, frequently in cases the time comes when no other investigative technique is going to result in any useful information. If we end up with a legal bar that won’t allow us to use this technique, our ability to discharge our duties is going to be impaired.

Therefore, I believe it is important that all legislative attempts to restrict, limit, or prohibit use of the polygraph technique be closely monitored by each of you individually and by your group to the end that those enactments which finally result from the legislative process are helpful in improving the quality of the profession and enhancing its effectiveness in the detection of criminal conduct. I’m not suggesting that you take a position that there should be no legislation on this subject at all, but that you become actively involved in any attempt legislatively to affect your profession. I strongly encourage that you support and back legislation designed to improve and enhance the profession and oppose that type of legislation which will impede the effective use of polygraph examinations.

* * * * *
VALIDITY AND RELIABILITY OF THE CARDIO ACTIVITY MONITOR

By

William A. Davidson

Background

The Cardio Activity Monitor (CAM) was originally designed for the Air Force in an attempt to develop a sensor capable of monitoring, for a relatively long period of time, the cardiovascular activity of a person. The output of the sensor was to be of the same form and information content as that of the conventional cardio recording units used on the current polygraph equipment, but without significantly disturbing the blood circulation of the subject. Prototype development and testing began in 1968 and was concluded in 1970. Initial reliability and validity studies utilizing a hypothetical crime situation, showed that:

- The CAM produced chart tracings that were equivalent in wave form to those produced by the conventional cuff.
- Chart sets in which the prototype was used to replace the conventional cuff were easily read by qualified examiners.
- GNT was less evident in charts where the cuff was replaced with the prototype CAM.
- Specific responses are often more dramatic and easier to read in the prototype tracing than in the conventional tracing.

In 1974 the Air Force received its' full complement of operational CAM units in the form of the Stoelting Model 22635 Stress Monitor. These units utilized the water actuated or "Wet" CAM. These units have since been converted to the present day "Dry" CAM. Since the CAM was introduced into actual operational testing there have been no studies of its reliability and validity in live cases.

Purpose

This pilot study was performed to determine the reliability and validity of the CAM in actual polygraph testing situations. Reliability was determined by measuring the extent of agreement or consistency between a panel of examiners.

Captain Davidson is Chief, USAF Polygraph Program, Air Force Office of Special Investigations. Captain Davidson has been a Special Agent with the Air Force since 1968 and has held his present position as Chief of the Polygraph Program for the past five years. He has a B.S. in Law Enforcement and Corrections and an M.A. in Criminal Justice. He completed the polygraph course at Fort Gordon, Ga. in 1970 and is a Member of the A.P.A. The author wishes to acknowledge the following USAF examiners as participants in this study: James A. Johnson, Kelly D. Harrison, Oscar G. Thomas, Donald H. Wilson, Wesley R. Pearce, Frances J. Kenney, and James E. Suter. The author also wishes to thank the following for technical assistance: Robert A. Brisentine, Jr., Director, Crime Records Directorate, USACID, Dr. Neil S. Hibler, Captain, USAF, Clinical Psychologist, and Frank Horvath, Ph.D., School of Criminal Justice, Michigan State University, East Lansing, Michigan. For copies of reprints of this article, write to Captain Davidson at Hq. AFOSI/CUPG, Washington, D.C. 20314.
based on a "blind" review of polygraph charts produced during actual examinations. Validity was determined through comparison of the decisions of the panel of examiners with established ground truth.

Method

Selection of Cases. Polygraph charts were drawn at random by computer from a pool of investigations of crimes against property conducted during the period 1975-1977. All cases selected were confirmed by confessions and in most instances by recovery of the property from the subject identified by the polygraph. Deceptive cases were confirmed by the subjects own confession and NDI cases were confirmed by the confession of another suspect in the same investigation. Thirty series of polygraph charts were originally selected, 15 deceptive, and 15 non-deceptive. Of this thirty, two were eliminated as they did not contain CAM tracings; six were eliminated as the CAM tracing overlapped the other recordings, which could influence the decision of the examiner panel; and one was eliminated after review of the investigative case file failed to reflect proper confirmation criteria. Of the 21 cases finally selected 10 were deceptive and eleven were non-deceptive. Six cases represented the Modified General Question Test and fifteen were Zone Comparison Tests.

Following selection, three sets of each series were reproduced. The CAM tracing was isolated in the first set leaving the CAM as the sole tracing available for review. In the second set the CAM was removed leaving double pneumo, GSR, and cardio tracing for review. The third set included both the CAM and all other component tracings.

Validation Procedure. Seven field examiners were selected to participate on the review panel. The experience level of those selected ranged from six months to 14 years. Each member of the panel was asked to make a "blind" analysis of each series utilizing standard numerical evaluation procedures taught by the U.S. Army Polygraph School, the only information available to examiners regarding the investigations were the charts. Criteria for evaluation of the CAM was +2 for non-deceptive and -2 for deceptive. Examiners were further instructed to evaluate the CAM set first, then the set without CAM, finally the set combining the CAM with other polygraph components. The panel was instructed to make one of three decisions based on their numerical analysis: deceptive, non-deceptive, or inconclusive. The inconclusive decision was used since this is a legitimate decision which under DOD standards would have required a re-test within thirty days of the original examination.

Results

The percentages of agreement between examiner panel and ground truth was 87.8% for CAM, 85.7% for polygraph without CAM and 89% for polygraph with CAM.

Tables 1, 2, and 3 reflect data regarding comparison of the polygraph examiner panel's decisions and ground truth for known DI and NDI charts. The percentage of agreement between examiners and ground truth in DI cases are 90% for CAM, 87% for polygraph without CAM, and 90% for polygraph with CAM. The percentage of agreement between examiners and ground truth in NDI cases are 85.7% for the CAM, 84% for the polygraph without the CAM, and 88% for the polygraph with CAM.
TABLE I
COMPARISON OF LEVELS OF AGREEMENT BETWEEN POLYGRAPH EXAMINER PANEL AND GROUND TRUTH (DI and NDI Cases)

CAM ONLY
Deceptive Charts (N = 10)

<table>
<thead>
<tr>
<th>EXAMINER PANEL</th>
<th>Agree W/GT</th>
<th>Disagree W/GT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unanimous</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Majority</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Total Cases</td>
<td>10</td>
<td>0</td>
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Unanimous Agree 70%
Majority Agree 100%
Majority Disagree 0%

Non Deceptive Charts (N = 11)

<table>
<thead>
<tr>
<th>EXAMINER PANEL</th>
<th>Agree W/GT</th>
<th>Disagree W/GT</th>
<th>TOTAL</th>
</tr>
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<tbody>
<tr>
<td>Unanimous</td>
<td>6</td>
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<td>6</td>
</tr>
<tr>
<td>Majority</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Total Cases</td>
<td>11</td>
<td>0</td>
<td>11</td>
</tr>
</tbody>
</table>

Unanimous Agree 55%
Majority Agree 100%
Majority Disagree 0%
<table>
<thead>
<tr>
<th>EXAMINER PANEL</th>
<th>Agree W/GT</th>
<th>Disagree W/GT</th>
<th>Inconclusive</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unanimous</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Majority</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Total Cases</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>10</td>
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</table>

Unanimous Agree 70%
Majority Agree 90%
Majority Disagree 10%
Majority Inconclusive 0%

<table>
<thead>
<tr>
<th>EXAMINER PANEL</th>
<th>Agree W/GT</th>
<th>Disagree W/GT</th>
<th>Inconclusive</th>
<th>TOTAL</th>
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</thead>
<tbody>
<tr>
<td>Unanimous</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Majority</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Total Cases</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>11</td>
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</tbody>
</table>

Unanimous Agree 45%
Majority Agree 90%
Majority Disagree 10%
Majority Inconclusive 0%
### TABLE 3
COMPARISON OF LEVELS OF AGREEMENT BETWEEN POLYGRAPH EXAMINER PANEL AND GROUND TRUTH (DI and NDI Cases)

**POLYGRAPH AND CAM**

#### Deceptive Charts

<table>
<thead>
<tr>
<th>EXAMINER PANEL</th>
<th>Agree W/GT</th>
<th>Disagree W/GT</th>
<th>Inconclusive</th>
<th>TOTAL</th>
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<tr>
<td>Unanimous</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Majority</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total Cases</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>10</td>
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Unanimous Agree 80%
Majority Agree 90%
Majority Disagree 10%
Majority Inconclusive 0%

#### Non Deceptive Charts

<table>
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<th>EXAMINER PANEL</th>
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<th>Disagree W/GT</th>
<th>Inconclusive</th>
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</thead>
<tbody>
<tr>
<td>Unanimous</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>7</td>
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<tr>
<td>Majority</td>
<td>3</td>
<td>0</td>
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<td>4</td>
</tr>
<tr>
<td>Total Cases</td>
<td>10</td>
<td>0</td>
<td>1</td>
<td>11</td>
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</tbody>
</table>

Unanimous Agree 62%
Majority Agree 91%
Majority Disagree 0%
Majority Inconclusive 9%
No attempt was made to compare the difference in decisions of examiners when reviewing ZCT examinations versus MGQT due to the unequal samples selected. Table 4 reflects a compilation of the data regarding comparison of the examiner panel and ground truth.

Table 5 reflects the percentage of correct decisions made by individual panel members for each set of charts reviewed. The average percentage and number of correct decisions are 18.5 or 88% for CAM, 18 or 86% for polygraph without CAM, and 18.7 or 89% for the polygraph with CAM.

Table 6 provides analysis of inconclusive and incorrect decisions. Of interest when reviewed this table is the fact that while the inconclusive rate rises by .8% when the CAM is incorporated with the normal polygraph components there is a 2.8 decrease in incorrect decisions. Presuming that re-examination of these inconclusive subjects (as required by DOD standards) would result in correct decisions, average correct decisions by the panel.
TABLE 5

PERCENTAGE OF CORRECT DECISIONS BY EXAMINER

<table>
<thead>
<tr>
<th>EXAMINER</th>
<th>CAM ONLY</th>
<th>POLYGRAPH WITHOUT CAM</th>
<th>POLYGRAPH WITH CAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>86%</td>
<td>81%</td>
<td>86%</td>
</tr>
<tr>
<td>2</td>
<td>81%</td>
<td>90%</td>
<td>95%</td>
</tr>
<tr>
<td>3</td>
<td>81%</td>
<td>81%</td>
<td>95%</td>
</tr>
<tr>
<td>4</td>
<td>100%</td>
<td>95%</td>
<td>95%</td>
</tr>
<tr>
<td>5</td>
<td>86%</td>
<td>81%</td>
<td>81%</td>
</tr>
<tr>
<td>6</td>
<td>90%</td>
<td>86%</td>
<td>86%</td>
</tr>
<tr>
<td>7</td>
<td>90%</td>
<td>90%</td>
<td>81%</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>88%</td>
<td>87%</td>
<td>89%</td>
</tr>
</tbody>
</table>

TABLE 6

COMPARATIVE ANALYSIS OF NON-CORRECT DECISIONS

<table>
<thead>
<tr>
<th>COMPONENTS(S)</th>
<th>PERCENT INCORRECT</th>
<th>PERCENT INCONCLUSIVE</th>
<th>PERCENT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAM</td>
<td>3.4%</td>
<td>8.8%</td>
<td>12.2%</td>
</tr>
<tr>
<td>POLYGRAPH WITHOUT CAM</td>
<td>7.5%</td>
<td>6.8%</td>
<td>14.3%</td>
</tr>
<tr>
<td>POLYGRAPH WITH CAM</td>
<td>3.4%</td>
<td>7.5%</td>
<td>10.9%</td>
</tr>
</tbody>
</table>

would then be 20 cases or 96.5% for CAM, 18 cases or 92.5% for the polygraph without CAM, and 20 cases or 96.5% for the polygraph with CAM.

Conclusions

While it is realized that the sample for this pilot study is small, it indicates that the polygraph examiners' judgement, based solely on a review of the tracings produced by the Cardio Activity Monitor, is predictive of truth or deception of subjects examined in criminal cases. When the CAM is combined with standard tracings, i.e., cardio sphygmograph, galvanic skin response, and pneumograph tracings, there is a slight increase, 2.8%, in the ability of the examiners to make correct decisions when reviewed polygraph charts.

Discussion

Review of the data collected during this study failed to reflect any
significant relationship between the experience level of the examiners selected for the panel and correct decisions. During the course of this study a majority of the examiner panel had one false positive and one false negative decision when reviewing the polygraph charts without the CAM. A review of the CAM data for those cases indicated the majority of the panel made correct decisions for both cases based on the CAM alone. When the CAM was combined with the standard components the majority decided that the false positive was inconclusive. There was no change in their decision regarding the false negative.

I do not recommend that we replace the standard cardio with the CAM based on the results of this study. Primarily, because that at the present time there is no way to determine what effect the absence of cuff pressure will have on the other components and CAM. Realizing that the sample for this pilot study is small, plans are to expand the number of cases in a future study and include a comparison of techniques in the data. In addition, a separate study is being planned to determine the reliability and validity of the CAM as well as other components when cuff pressure is absent.

* * * * *
A FIELD STUDY OF THE USEFULNESS OF THE CARDIO ACTIVITY MONITOR

By

James E. Suter

In 1974 the Air Force Office of Special Investigations purchased a number of Stoelting Model 22635 Emotional Stress Monitor Polygraph Instruments. All of the instruments were equipped with a Cardio Activity Monitor (CAM). The initial CAM transducers operated with a water system which required servicing by the examiner. These have been replaced with a dry transducer which requires no servicing by the examiner. This study was conducted with CAMS utilizing the dry transducer. After some use of the CAM it became obvious that while some examiners were obtaining good tracings with the CAM, others were not, and some were not using it at all. There was also considerable disagreement regarding the reliability of CAM tracings. This prompted the writer to initiate a study of the CAM under actual field conditions.

Purpose

In order to provide guidelines for the use of CAM as well as to examine its reliability, the main objectives of the study were:

To establish the best procedure for attaching the transducer and setting the sensitivity in order to produce the most legible tracings.

To establish criteria to be used in chart analysis.

To compare the CAM tracings against those of the Pneumo, GSR, and Cardio and on that basis to estimate the reliability of the CAM.

Method

In order to accomplish the above objectives, an evaluation sheet was devised which was to be completed on each chart subsequent to the examination. In the final analysis, information from the evaluation sheets was consolidated. All examinations were live cases of a specific nature consisting of criminal, counter-intelligence and espionage matters. Cases were selected in random fashion by four examiners while in pursuit of their normal operations. Examiners were instructed to use their own judgement in the evaluations while using ratings of:

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Excellent - A response which can be immediately recognized.

Good - A response which can be recognized without difficulty.

Fair - A response which can be recognized upon study.

Poor - Responses which are extremely difficult or impossible to recognize.

In all instances the cardio was operated in the mechanical pneumatic mode with the use of a standard arm cuff.

Physiological Aspects

The brachial artery extends down the arm and branches into the ulnar and radial arteries at the elbow. At the thumb the radial artery branches into smaller arterioles, and then to the capillaries. It is from these distal vessels that the CAM records cardiovascular responses. With the arm cuff of the cardiosphygmograph we are measuring responses from the brachial artery, one of the largest blood vessels. Since we know that activation of the sympathetic division of the autonomic nervous system during a period of emotional stress results in an increased blood supply to the larger skeletal muscles, we also know that the blood supply is less to the peripheral areas of the cardiovascular system. This is brought about by a combination of vasoconstruction at the extremities and dilation of the main arteries. Through this combined action the blood is drawn away from the peripheral extremity. Thus, when viewing the CAM tracing we will observe a quick descent, or what we might refer to as a "dive" in the tracing at the same time there is a rise in the tracing of the standard cardio pattern. While this is the typical response in the CAM, it does not occur with all persons or at all times.

Mechanics For Use of CAM

Which Hand? - The CAM transducer cannot be applied effectively on the hand of the arm to which the arm cuff for the cardio has been attached. The constrictive force of the cuff will considerably alter cardiovascular activity in the remaining portion of the extremity. The CAM used in this manner generally necessitates increased sensitivity adjustment, which can further result in erratic tracings. The CAM transducer should always be placed on the hand of the arm to which the arm cuff is not attached.

Placement - We found that the best CAM tracings are obtained by placing the transducer artery feeler (the small plastic button) about one-half to three-fourth inches from the extreme tip of the thumb - slightly on the palmar side. If the thumb skin is unusually thick or calloused the feeler can be placed at the joint of the thumb. If a good tracing is still not obtainable, the transducer can be placed on top of the thumb with the feeler against the thumb nail. This procedure was introduced and discussed by Richard Golden at the 1977 APA Seminar. As a last resort it is possible to attempt to obtain effective tracings by placement on the wrist, using an extended velco wrapping. However, when used at the wrist over the radial artery, the tracing will be that of an artery, and not from the capillaries. In every case, the transducer should not be touching anything other than the thumb or wrist, which should be in a relaxed position.
Application Pressure – Care should be taken in applying the proper pressure in attaching the transducer. Correct pressure has usually been obtained when the dicrotic notch is centered in the tracing. The notch is lowered with an increase in pressure of the wrapping and raised with a decrease in the wrapping pressure. If the wrap is too tight, a steadily descending tracing may be noted. If the wrap is too loose – an erratic tracing may be seen. A good rule of thumb is to make the wrapping snug.

Amplitude and Sensitivity – A tracing with an amplitude of about three-eighths to three-fourths of an inch is considered good. Our experience is that the lower the sensitivity at which a good amplitude is reached, the more legible the tracing will be. A good tracing can usually be obtained using a range of from 10 to 25 sensitivity units. As a general rule, the more the sensitivity is increased, the more erratic the tracing becomes. Before using excessive sensitivity, try applying a little more pressure on the velco wrapping. Also, check the plastic artery feeler; occasionally it will slip partially off the sensor of the transducer thus reducing the impulse received.

Criteria For Evaluation

The first criterion for evaluation has just been discussed; that is, to obtain clear tracings. Now look at what can be seen in those tracings. Shown in Figure 1 is a CAM tracing that fairly well parallels or mirrors the cardio tracing. While it adds nothing new, it does reinforce the value of cardio responses.

Figure 1
Figure 2 depicts the CAM tracing with peaking responses. The tracing has a tendency to ascent and descent back to the base line at the point of response. We consider this to be a legitimate response, the same as it would be in the cardio.

Figures 3 and 4 show what we think is the typical CAM response. That is a quick drop in the tracing at the point of deception. We refer to this as a "diving response." It should be noted that there is an increase in blood pressure in the cardio at the same time that there is a quick decrease in the CAM. Either one would stand alone as a deceptive response.

In the cardio pattern we tend to think of a general rise in pressure as indicative of an increase in tension, in the CAM a rise in the tracing is generally considered to be an indication of relief. Of course, a generally descending CAM pattern would suggest an increase in tension. (Figure 5).

There are times when we see a strong response in the CAM while there appears to be a quite limited response in the cardio, as depicted in Figure 6.
Results: Examiner Evaluation of Charts

In all, 329 charts of 105 subjects were evaluated; of these, 280 charts were recorded from males and 49 from females. Since there appeared to be no significant differences between the male and female charts, the findings were not separated by sex. There were 185 DI charts, 129 NDI charts and 15 inconclusive charts. Results of the examinations were not confirmed in many of the cases. A most significant factor was that the average CAM sensitivity was "17". Thus, it appears important for the sensitivity to be held down in order to get good tracings.

Tracing Legibility

- Excellent: 138 (42%)
- Good: 152 (46%)
- Poor: 39 (12%)

Acceptable: 88%

This percentage of acceptable tracings, that is, those judged "excellent" and "good," appears adequate, especially since during the survey constant efforts were made to correct and adjust to obtain better results. The percentage of legible charts currently being recorded would probably be higher.

Type of Specific Responses

- Peaking Responses: 212 (76%)
- Diving Responses: 204 (73%)
- Either or Both of Above: (92%)

Specific responses on 92% of the charts suggests that the CAM can be as useful as the other polygraph components.

Point of Response

- Upon Recognition of Question: 200 (61%)
- At Time of the Answer: 112 (34%)
- Subsequent to Answer: 17 (5%)

About 95% of the CAM responses occur at the time the examinee recognizes a test question or actually answers the question.

Comparison to Other Components

- Cardio: 294 (89%)
- Pneumo: 273 (83%)
- GSR: 241 (73%)

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The above figures reflect the number of times a specific response was seen in another component at the same time one appeared in the CAM. The greatest similarity appears to be with the cardio, then with the pneumo, and then with the GSR.

**Estimated Value of CAM Tracings**

- **Excellent:** 74 (23%)
- **Good:** 172 (52%)
- **Fair:** 66 (20%)
- **Poor:** 17 (5%)

These figures reflect the examiners' estimated rating of the value of CAM tracings compared to the Pneumo, Cardio, and GSR tracings on each chart. A rating of "Excellent" indicates a high degree of correspondence between the CAM and all other components; "Good" and "Fair" indicate favorable comparison of the CAM to one or two of the other components; "Poor" indicates the CAM tracing was not comparable to any of the other components.

**General Conclusions and Comments**

Based on the foregoing information, we believe the cardio activity monitor (CAM) is a valuable aid in detecting deception and is sufficiently reliable to be used as a component of the polygraph. We find also:

That the diving response in the CAM tracing is most indicative of deception.

That, in most cases, after it has been properly attached and sensitized, the CAM will produce a detailed tracing, with good amplitude and dicrotic notch wherein responses are easily recognized. We have noted several cases where cardio responses were not obtained at cuff pressures of 100mm and yet a clear CAM tracing was obtained. In one case this occurred where the examinee was taking a prescribed depressant medication.

That, although all examiners involved in the survey considered the CAM a valuable component, none of them would wish to replace the cardio with the CAM. In this regard, it may be that the CAM has a value similar to that of a second pneumo tracing; that is, that there are occasions when a response can be detected in one tracing and not in the other. In those instances where specific responses appear in both the CAM and cardio, one reinforces the other.

* * * * *
BIOFEEDBACK CONDITIONED RESPONSES AND THE POLYGRAPH
A CASE REPORT

By
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Air Force Office of Special Investigations
District Office #10
Randolph Air Force Base, Texas 78148

Introduction

It has been demonstrated in laboratory settings that both hypnosis and biofeedback are able to substantially alter physiological processes used to measure deception (Corcoran, 1978, Weinstein, 1970). There has been reasonable scepticism, however, that this training would not be effective under field conditions. We recently have had experience with a case where a subject had had prior training in biofeedback and subsequently underwent polygraph examination in connection with an investigation of a crime.

With the increased use of biofeedback and hypnotherapy in clinics, many potential subjects of polygraph examinations may be able to exert volitional control over parameters which the polygraph measures. We are reporting this case even though the examinee (E) was not successful in deception because we believe the record to be typical of individuals who have had relaxation training, enhanced with biofeedback. It is our opinion that aspects of the prior medical history, which included biofeedback training, was instrumental in distorting the usual physiologic responses associated with deception. E was the dependent wife of the primary subject (S) of a criminal investigation involving theft and subsequent sale of USAF property. S refused polygraph examination, but E, despite being a potential co-subject agreed to examination.

Crime History

E alleged prior to examination that she was not aware that property sold by her husband had been stolen from the Air Force. She reported her husband had advised her that this property, valued in excess of $7,000.00, had been given to him by a lawyer who had requested S to sell the property for which S would receive a 25% finder's fee. Prior to the polygraph examination, E denied participation in the theft, denied knowledge that property had been stolen, and subsequently stored in their home, and denied assisting in the sale of the property.

For copies of reprints write to Dr. James F. T. Corcoran, USAF, MC, Chief, Adult Outpatient Mental Health Clinic, Wilford Hall USAF Medical Center (AFSC), Lackland Air Force Base, Texas 78236. The views expressed herein are those of the authors and do not reflect the views of the United States Air Force or The Department of Defense.
Medical History

E was a 23-year-old, Caucasian woman, a high-school graduate who had been afflicted with severe headaches for at least ten years. In the two years prior to polygraph examination, she had received multiple medical evaluations for her headaches. Over the preceding months, she had been prescribed at least twenty-four separate drugs, all of which required written prescriptions from a physician. Physicians who examined her described her in various ways, ranging from anxious, nervous, and depressed, to schizoid and lonely. Her complaint of severe, uncontrolled headaches persisted, despite attempts to control the discomfort with medication. An electroencephalogram and neurologic examination were both reported as being within normal limits. Her diagnosis on referral was migraine headaches which had proved intractable to medication. Psychological testing demonstrated no significant psychopathology.

Treatment with biofeedback consisted of 21 one-hour sessions over a seven-month period. There were frequent interruptions in training due to vacations and sickness, but E nonetheless attained excellent progress with electromyography obtaining low levels which suggested deep muscle relaxation. Temperature training was less successful. It was not unusual for her to start with hand temperatures in excess of 90°F., making it difficult for her to raise her hand temperature more than a maximum of 5 or 6 degrees F. Even when she started training with a headache, her temperature was frequently above 85°F. Usually she was able to raise or lower her hand temperature 1° to 2 degrees F. Often she seemed tired and poorly motivated. Her biofeedback technician felt she was a poor subject. Despite what appeared to be an uninspired effort by E, she reported significant improvement in the reduction frequency and severity of her headaches. At the end of treatment, she was able to go long periods of time without prescription medication, and enjoyed sustained periods of relief from all headache discomfort.

Examination

After two months of biofeedback training, E underwent polygraph examination. Prior to examination, E denied serious illness, injuries, head trauma, or episodes of unconsciousness. She reported having taken 100 mg of Elavil (an anti-depressant) over the preceding 24 hours, as well as Norinyl (an oral contraceptive). She also acknowledged participation in a biofeedback program aimed at controlling her migraine headaches. (Note: A review of her medical records failed to reveal any notation about biofeedback training because the biofeedback clinic she visited had maintained separate records.) At examination, she weighed 144 lbs., 5'4" tall, and of medium build. On the preceding night, she reported having slept for six hours and felt in "good health."

Her lawyer and a female witness were present for the entire examination. Upon reviewing details of the investigation, E and her lawyer agreed to the following relevant questions to which she answered "No."

3. Did you participate in that attempt to sell that property?

5. Did you know that the property stored in your house was stolen government property?
8. Did you know that the property was stolen government property?

9. Did you participate in the theft of the property?

During the pre-test interview, E appeared to be very nervous, but upon explaining the function of the polygraph and its components, E was observed to be calm and displayed no further general nervous tension (GNT).

Prior to E's arrival, a standard Calibration Chart of the Stoelting 22635 was completed (Figure #1). The instrument was aligned to record upper and lower pneumo, galvanic skin response (GSR 100,000 POT), cardio activity monitor (CAM) and standard cardio. A known number Peak of Tension/Stimulation Test (POT) was conducted first. Then, a Modified General Question Test (MGQT) was utilized and four polygrams were completed. These consisted of two standard series and two mixed series. Upon completion of the first relevant polygram, an attempt to use Electro Cardio Jell on E's fingers was unsuccessful. E stated, "I don't like that stuff..." Due to the need for her continued cooperation, the issue was not pursued.

Chart Interpretation

The four MGQT polygrams are reflected in Figures #2 through #5. Relevant questions are indicated by the capital letter "R" and control questions by the capital letter "C". All other questions are irrelevant. The Stimulation Test displayed acceptable though reduced responses (Figure #2), at 7.

In the four MGQT polygrams, the GSR response was subdued compared to the initial response seen in the Stimulation Test. Outside question #3 on Chart #1 (Figure #3) and question #5 on Chart #4 (Figure #6), GSR was of limited significance. After detailed analysis of the four MGQT polygrams, using the Department of Defense (DOD) numerical evaluation system, it was the opinion of the examiner that E was truthful in her answers to questions 8 and 9, deceptive to question 3, and inconclusive (on the deceptive side) to question 5.

In reviewing her charts, the examiner and two qualified control reviewers were impressed that E could effectively and volitionally suppress her blood pressure, resulting in little or minor changes in the cardio record. She was able to eliminate GSR activity completely.

The most effective component for interpretation of the record appeared to be the Cardio Activity Monitor (CAM), followed by the pneumograph. We speculate that part of the reason for this discrepancy could be related to E's lack of experience with these components compared to the Cardio and GSR units.

During the post-test interview, E stated that now that she could think about the incident in current perspective, she had indeed participated in attempting to sell the government property. Further, she had even talked another individual into helping her husband sell the property. She also identified another company that received a sample of the property from her husband after that company had shown an interest in buying a portion of the property. Lastly, E acknowledged her husband had stored several boxes of the
property in their home closet. E was able to accurately describe the containers and brand name of the government property. E terminated the interview by saying her husband had told her not to discuss the matter at all. She then departed with her lawyer.

Discussion

Biofeedback, a term first used in 1969 by the Biofeedback Research Society, refers to the process where a person is given immediate information concerning his or her own biological functions, such as cardiovascular activity, temperature, galvanic skin response, or any other measurable, physiologic process. This is usually done using either a meter, light, or auditory signal. Biofeedback training aims at helping that person through the use of this biological information to voluntarily control a specific physiologic process. In this specific instance, electromyographic (EMG) and temperature levels were used in an effort to control migraine headaches. In theory, it is possible to bring under volitional control any physiologic process that can be continuously monitored and reported back to the patient. The implication to polygraph examiners is important.

As early as 1973, clinicians had reported significant reduction in the frequency of vascular migraine headaches in 80% of patients who received thermal feedback (Sargent, 1973). Since biofeedback training is an enhancement of relaxation techniques, it is likely that other types of training will modify in varying degrees polygraph recordings. How well a subject can bring under control a physiologic parameter is subject to many variables. Stroebel and Glueck, who made a comparison analysis, noted that long-term compliance between a relaxation state of transcendental meditation and EMG-thermal biofeedback could vary by as much as 70%, but they also observed that compliance was very high for EMG-thermal biofeedback when applied to specific problems, such as headache pain, and much lower for "silent" conditions, such as hypertension (Stroebel, 1973).

Overall, polygraphers must take careful medical histories and attempt to elicit information about any relaxation biofeedback training. In many cases, notations reporting such training may not be present in a general medical record. While this particular polygraph chart was flat and controlled for some of the measured parameters, theoretically, physiologic responses could be varied at will.

References


THE PSYCHOLOGICAL STRESS EVALUATOR
TECHNICAL LIMITATIONS AFFECTING LIE DETECTION

By

Malcolm Brenner
University of Oregon
And
Harvie H. Branscomb
Massachusetts Institute of Technology

Our testimony concerns technical limitations in the Psychological Stress Evaluator (PSE), the original and most widespread of the recent lie detection devices which employ analysis of the human voice. Based on our research experience with this device, we believe that the PSE measure is not of sufficient technical quality to be used in lie detection and our testimony documents five technical shortcomings which affect the present instrument. This evidence on technical quality is especially relevant to lie detection in employment situations, since such lie detection evidence may be used as the sole basis for serious, uncontestable, and final decisions. Evidence on technical quality is also relevant to the issues of Constitutional rights which apply to voice lie detectors because of the possibility of testing subjects without their knowledge.

We do not believe that all aspects of PSE analysis are invalid. Several reports provide evidence that the PSE may be valid as a measure of psychological stress (1, 2). The rationale of PSE operation (involving stress-sensitive frequency modulation in the voice) is consistent with earlier acoustical evidence (3). However, there is a large difference between a preliminary measure of stress and a finished instrument which can be applied in an area as complex as lie detection. Detection of deception would be subject to controversy even if it employed an ideal measure of stress (4). Using a measure subject to serious technical limitations on reliability lie detection becomes extremely questionable. Our testimony concerns such limitations in the PSE.

The original research reported here was carried out at Harvard University as well as the universities of our affiliations. Specifically, it concerns five technical limitations.

1) **Subjectivity of Scoring**

PSE scoring is highly subjective and scores assigned to particular PSE patterns depend largely on the particular judge doing the scoring.

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This paper is reprinted, with updating and minor changes, from testimony presented at hearings on Senate Bill 1845, United States Senate, Subcommittee on the Constitution, Committee on Judiciary, September 19, 1978. For copies of reprints write to Dr. Malcolm Brenner, Ames Research Center LM 239–2, National Aeronautics and Space Administration, Moffet Field, California 94035.

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A mathematical estimate of scoring subjectivity is available in the interjudge reliability coefficient (r), which summarizes the degree of overlap present in the scores provided by two different judges who have scored the same material. This reliability coefficient ranges in value from $r = 0.00$ to $r = 1.00$, with the magnitude of the coefficient directly reflecting the degree of overlap present. Most psychologists would consider an interjudge reliability coefficient of $r = 0.80$ as the minimum requirement for any serious assessment instrument.

Interjudge reliability coefficients for PSE scoring, however, are typically lower than $r = 0.80$. Horvath (5) reports a coefficient value of $r = 0.38$, and Worth & Lewis (6) of $r = 0.56$, for material drawn from laboratory lie detection tasks, Older & Jenney (7) report a coefficient of $r = 0.39$, Lewis & Worth (8) of $r = 0.54$, and Rockwell, Hodgson, & Cook (9) of $r = 0.89$ for material drawn from tasks other than lie detection. These interjudge coefficients, the only values reported by independent investigators, suggest serious reliability problems. An example of these problems is provided by a hypothetical example of two judges scoring PSE patterns in two categories: High-stress and Low-stress. Given Worth & Lewis' coefficient value of $r = 0.56$ (the highest value reported for a lie detection task), these judges would be expected to disagree with each other at least 22% of the time (10).

2) Response Words

PSE scores vary systematically according to the exact words spoken by the subject, and, presumably, the exact linguistic properties of individual words.

Figure 1 demonstrates this effect, and summarizes data for sixteen subjects who performed a mental arithmetic experiment (3) (1034-1038 spoken responses are summarized in each graph). In the top graph ("repeat" responses) the subjects simply repeated out loud the digits from "0" to "9" in a random order as part of the baseline treatment ("6" was not included because it typically provides a PSE pattern of insufficient length to be scored, a severe example of response word difficulties). The digits "5" and "9" received characteristically high PSE scores, the digit "8" characteristically low scores, and the remaining digits intermediate scores. This robust pattern appeared in the data of every subject tested. This pattern also appears in the lower graph ("Mental Arithmetic Responses"), in a virtually identical order, despite the presence of a strong experimental manipulation based on the difficulty of mental arithmetic problems.* In both graphs, the PSE scoring difference between high response words and low response words is on the order of 2 to 1.

The response-word effect imposes serious problems for any PSE examinations which use unrestricted words or continuous speech. This problem also has direct implications for traditional examinations, especially if it turns out that "Yes" and "No" appear to have different levels of PSE-scored stress.

*Subjects were required to add either +4, +3, +1, or +0 to every digit in a string of digits and report out loud the converted series. The time allowance was held constant for each treatment.
"REPEAT" RESPONSES

MENTAL ARITHMETIC RESPONSES (COLLAPSING OVER TREATMENTS)
3) **Recording Quality**

PSE scores tend to vary according to the quality of the available tape recordings.

Evidence is provided by Older & Jenney(7). They prepared, under NASA contract, an analysis using PSE scores for stress changes in the voices of SkyLab Astronauts as a function of varying work load demands (2040 spoken utterances were included in the analysis). The available tape recordings varied considerably in quality, and were subjectively grouped into classifications of "good", "fair" or "poor". On a 1 - 5 point scale used to score PSE, Older & Jenney report a difference of about 12% in the final PSE scores as a direct function of available tape quality (pp. 37-39). "Good" recordings showed the highest average stress, and "poor" recordings the lowest.

An interesting sidelight of the Older & Jenney study is the fact that a large subsample of the data was scored by the Chief Instructor at Dektor, Inc., manufacturer of the PSE (the interjudge reliability coefficient, as noted above, was r = .39). Ironically, the Chief Instructor proved to be more influenced by the problem of tape quality than the routine judge. The difference in average PSE scores was 22%.

This tape-quality artifact has direct relevant to interrogation recordings made under field conditions. It is especially relevant to PSE samples transmitted over the telephone, a routine procedure which almost certainly lowers tape quality. A judge using telephone transmitted speech may score a pattern which shows less stress than the one made from the speech originally played into the phone.

4) **Transcription Speed**

PSE patterns vary according to the speed employed or transcribing material through the device.

To demonstrate this effect, we transcribed 217 vocal responses, drawn from two male and one female subject, at the two speeds most commonly used in PSE analysis: 1 7/3 IPS and 15/16 IPS. PSE scores derived from the two transcriptions proved to be extremely different. Correlation coefficients between the two scorings (computed the same way as correlation coefficients for interjudge reliability) ranged between r = .43 and r = .47 for each subject. In 8% of the cases (17 cases), a pattern which showed high PSE stress at one speed showed low PSE stress at a different speed.

Transcription speed differences appear to be caused both by the slow responsiveness of the transcribing pen and by changes in the filtering cutoffs employed. This effect is not treated in the company training program, which leaves the choice of transcription speed at the discretion of the interrogator(11).

5) **Conscious Control**

The vocal responses monitored by the PSE may be subject to conscious control.
Evidence for this possibility surfaced in an attempt to replicate Lykken's guilt knowledge task(3). Fifteen male and five female subjects underwent interrogations based on items of personal information (e.g., "What is your mother's first name?"). The subjects were offered a monetary reward to conceal their correct answers from an interrogator who would subsequently employ a PSE analysis of the subjects' vocal responses. The interrogator read out loud each item followed by six possible answers, and the subject repeated out loud all possible answers.

Lykken reports evidence for this task using Galvanic Skin Response(GSR). He reports that the GSR provided significant detection of guilty knowledge items for 20 subjects out of 20 tested, even though subjects had been offered a monetary reward and were given extensive prior information on the interrogation. The PSE results from our experiment were in direct contrast: 19 subjects out of 20 successfully concealed their correct responses (first-choice calls for these subjects, and distribution of calls, was within the levels expected by chance). Although several interpretations are possible for this difference, one clear possibility is that subjects are able to voluntarily influence their vocal responses in a way in which they are unable to influence Galvanic Skin Response.

The issue of conscious control is perhaps the most serious issue raised in this testimony, since it suggests a basic problem which applies to all voice lie detectors and argues for a burden of proof on all persons who wish to sell voice-related devices for these purposes. Incredibly, none of the opponents of voice lie-detectors have raised this possibility, although the strong conscious influence on voice articulation would seem to make this an obvious issue of concern.

There is now enough technical evidence to seriously question the PSE as a practical lie detection device. Problems of scoring subjectivity alone are sufficiently serious in the available literature to question any specific legal decisions, and in practice these scoring problems are compounded and multiplied by the remaining deleterious effects. These technical problems, it should be noted, may also apply to the more recent Mark II and Hagoth Lie Detectors which were not tested in these experiments.

The presence of problems in a new instrument is not surprising, and some of the problems described here for the PSE are typical for acoustical measures. What is surprising is the strength of these effects in a device sold for a process as delicate as lie detection. Detection of deception is an exacting application of stress analysis, and there are serious ethical and constitutional objections to the use of any form of detection of deception even if an instrument were available which was 100% accurate(12). The PSE, by contrast, fails to pass certain minimal standards required of any assessment measure, and is employed by users who are in an inappropriate position to recognize its limitations. It seems incredible that this instrument is presently applied in employment situations, where individuals do not have an opportunity to question the scientific quality of the decisions which may directly affect their employment.
References


* * * * *
AN EXPERIMENTAL COMPARISON OF THE PSYCHOLOGICAL STRESS EVALUATOR AND THE GALVANIC SKIN RESPONSE IN DETECTION OF DECEPTION

By
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The Psychological Stress Evaluator (PSE), which is asserted to be a voice-mediated lie detector, and the galvanic skin response (GSR), recorded with a standard field polygraph instrument, were used to detect nonrisk lies about numbered cards concealed by a sample of female (n = 30) and male (n = 30) college students. Evaluation of response data was subjectively carried out by two trained evaluators; their interrater agreement was .38 for PSE analysis and .92 for GSR evaluation. The hit rates obtained in PSE analysis were at chance levels and were not significantly affected by the sex of the subjects, simultaneous use of both PSE (tape recording) and polygraph apparatus, repeated trials of testing, or evaluator differences. Evaluations based on GSR analysis generally exceeded chance levels; however, hit rates was significantly (p < .05) higher in a first trial of testing than in a second trial. These findings were consistent with previous research and do not indicate that the PSE is effective in detecting deception.

The Psychological Stress Evaluator (PSE) is a device that is said to be useful in detecting emotional stress in the voice. According to its manufacturer, Dektor CI/S, Inc., the PSE detects inaudible and involuntary frequency modulations (FM) in the 8-12 Hz region. These frequency modulations, whose strength and pattern are inversely related to the degree of stress in a speaker, are believed to be a result of physiological tremor or microtremor (Lippold, 1971) that accompanies voluntary contraction of the striated muscles involved in vocalization. During nonstressful periods the modulations are under control of the central nervous system. As stress is imposed the autonomic nervous system gains dominance, resulting in a suppression of FM. This suppression, indicative of emotional stress, is displayed by the PSE as a characteristic blocked or rectangular wave form.

The PSE processes voice frequencies, preserved on a normal tape recording, using electronic filtering and frequency discrimination techniques. The stress-related FM patterns, displayed on a moving strip of heat sensitive paper, can

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be processed in four different modes of display (1-4) for either gross or more
detailed analysis. And, because the recovery of the FM indicator spontaneously
occurs with the removal of the stressing stimulus, stress in either narrative
or monosyllabic speech can be evaluated (Dektor, Note 1).

The PSE is primarily marketed as a voice-mediated lie detector, more ver-
satile but no less effective than the traditional polygraph instrument (Dektor,
Note 1). To date, that claim has been investigated in only two scientifically
acceptable studies. The most recent of these was a study carried out by Bar-
land (1975) to determine the validity of the polygraph and the PSE in detecting
deception in suspects involved in actual criminal investigations. In brief,
Barland found that the accuracy of each physiological measure recorded with the
polygraph instrument exceeded chance levels, whereas the accuracy of the PSE
did not.

Barland's (1975) findings were essentially similar to those reported by
Kubis (Note 2), who conducted an elaborate but laboratory-based study in-
volving mock crime situations. Kubis found that the hit rate for the PSE
was at chance levels, 33%; and the accuracy of judges who evaluated only the
behavior of the subjects undergoing testing surpassed that obtained with the
PSE. Kubis also reported, however, that the accuracy of PSE analysis on tape
recordings made without the simultaneous use of polygraphic apparatus was 53%,
whereas accuracy was 19% in analysis of recordings of polygraphically moni-
tored subjects. Kubis hypothesized that the physical discomfort produced by
the polygraph's blood pressure cuff, actually an occluding plethysmograph, and
the absence of stresses associated with the attachment of polygraph apparatus,
produced clearer voice records and thus more accurate PSE evaluations.

The purpose of the present study was to investigate the validity of the
PSE in a "guilty-information" paradigm (Gustafson & Orne, 1964), and specifi-
cally, within that context, to determine if, as Kubis (Note 2) hypothesized,
the simultaneous use of polygraph and tape recording apparatus reduces the
effectiveness of PSE analysis. Moreover, because the physical discomfort of
the polygraph's blood pressure cuff increases as a function of time (Yankee,
1965), it was expected that the validity of the PSE would decrease in a second
testing period immediately following a first. The galvanic skin response (GSR)
was used as the physiological measure against which the accuracy of the PSE
was compared.

**Method**

**Subjects**

Sixty college students, 30 female and 30 male, were recruited for an ex-
periment in lie detection from an introductory course in criminal justice.
Upon volunteering, each student completed an informed consent form that briefly
outlined the nature of the experiment and promised that each student would be
awarded extra credit toward his course grade for his participation, contingent
only upon maintaining a scheduled appointment and completing the task.

The age range for the female subjects was from 18 to 21 years, with a mean
age of 19.2 years; for the males the age range was from 18 to 31 years, with a
mean age of 19.9. None of the subjects had previously participated in a de-
tection of deception experiment.
**Procedure**

Twenty subjects, 10 female and 10 male, were randomly assigned to one of three conditions. Subjects assigned to the "tape only" condition were tested using tape recording apparatus only. A Uhrr 4000 Report-1C monophonic tape recorder, operating at 7.5 in. per sec (ips), fresh 1-mil polyester tape, and a Sony omnidirectional microphone, positioned in front of the subject, were used for recording. In the remaining two conditions, testing was carried out simultaneously using tape recording and polygraph apparatus. The polygraph was a standard "Stoelting field instrument, recording respiration, GSR, and cardiovascular activity. Respiration was recorded by a pneumatic tube positioned on the abdomen near the level of the diaphragm, adjusted to provide a pen excursion of 1-3 cm. GSR was recorded from two stainless-steel electrodes, attached without electrolyte to the volar surfaces of the index and fourth fingers of subjects' left hand; in all cases GSR was recorded in the automatic centering mode; that mode employs a short-time constant measurement technique that eliminates information concerning response recovery time. Cardiovascular activity was recorded by an occlusive blood pressure cuff located on the upper part of subjects' right arm. The cuff was inflated to a pressure of about 90-mm Hg to record cardiovascular activity in a manner consistent with standard field practice (Reid & Inbau, 1977).

In the "tape without cardio" condition, the polygraph's blood pressure cuff was attached to the subject but was not inflated; hence, for those subjects who were assigned to that condition no discomfort was produced by the cuff and no cardiovascular activity was recorded. Subjects who were assigned to the "tape and cardio" condition were tested with a fully operational polygraph, recording the three physiological measures as previously described.

Upon reporting for the experiment, each subject was met by an assistant who carried out the testing in a small, quiet, private office. The assistant initially conducted an interview lasting about 30 min during which he gathered brief background information, explained the nature of the testing apparatus, and the theory of detection of deception. To those subjects who were assigned to the two testing conditions in which the polygraph instrument was to be used, he gave a short demonstration of that apparatus. He then explained the testing procedure, and when assured that each subject understood the procedure, he operationalized the appropriate apparatus and carried out the testing.

The testing procedure, which was identical for all subjects except for the apparatus used, consisted of presenting to each subject a deck of five numbered cards face down. The subject chose one of the cards, looked at the number on it, and then, out of view of the assistant, wrote the number and his name on a small slip of paper; he then placed both the card and the paper slip face down in front of him. At no time prior to the completion of the testing was the assistant aware of the card number a subject had chosen.

The testing consisted of asking the basic question "Did you pick card number ___?" in two consecutive continuous trials. The subject was instructed to answer no to each card number during each trial and to sit motionless with his eyes closed throughout the testing. In the first trial the card numbers were called in ascending sequence, preceded and followed by a buffer number, that is, a number known not to be in the deck. Immediately following the
second buffer item the subject was asked a pivotal question, "Is your first name _____ ?", to which a yes response was required. A second trial was then conducted; in this trial the card numbers asked in the first trial were called in reverse order. During both trials, card numbers were called at about 20-sec intervals. All subjects had advance knowledge that in the first trial card numbers were to be called in ascending sequence; in the second, descending. The numbers, however, were not consecutive, and subjects were aware only of the number on their chosen card.

Upon completion of the testing, the assistant noted on the polygraph charts, when appropriate, and on the tape recording an identification code number for each subject. Then, the polygraph charts were prepared for evaluation by cutting each subject's charts into two halves, one half consisting of Trial 1, one half of Trial 2; each half was then coded in such a manner that the two halves could not be matched without knowledge of the coding scheme.

From the tape recordings, PSE charts were made by charting each subject's no responses to the card options separately for Trial 1 and Trial 2. The charts for each trial were then coded in a manner to prevent matching. All PSE charts were made on a PSE-101 in Mode 3 at a constant speed reduction of 4:1; that is, PSE charts were produced by playing back subjects' verbal responses at 1 7/8 ips.

Two trained and experienced field polygraph examiners, both also having been trained in the use of the PSE by the manufacturer, independently and subjectively evaluated the PSE and the polygraph charts in a blind manner. In the evaluation of the PSE charts, each of the five possible options in each trial was ranked from 1 to 5, 1 being assigned to the option believed to be the chosen card, that is, the response indicating the greatest stress (least FM) according to criteria taught by the manufacturer, and 5 being assigned to the option indicating the least stress. The polygraph charts were ranked in a manner identical to that carried out on the PSE charts, except that in this case each recorded physiological measure was separately ranked. Although only the GSR rankings were analyzed, it is necessary to point out that those rankings were not necessarily independent of other polygraphically recorded data. Because of such possible contamination, GSR responses were also objectively scored. An assistant, without any prior knowledge of the experiment, ranked each GSR response in each trial for each subject by assigning a rank of 1 to the response attaining the greatest millimeters of amplitude in the period starting with stimulus onset to 15 sec following stimulus offset. The response with the second greatest amplitude was assigned a rank of 2 and so forth; in the case of ties, mean ranks were assigned.

The rank assigned by each evaluator to the card option actually chosen by each subject was determined. If the chosen card was assigned a rank of 1, it was considered a correct detection, while if it was more than 1 it was considered as incorrect. Thus, each evaluator's rank on the card actually chosen by each subject was dichotomously scored, a 1 being assigned to a correct detection, a 0 to an incorrect detection. Unless specified otherwise, statistical analysis was carried out by subjected evaluators' dichotomous scores to a four-way analysis of variance with repeated measures. The four factors were testing condition (tape, tape without cardio, tape and cardio); sex (female, male); trials (1 and 2); and evaluators (A and B). The latter two factors were treated as repeated measures. All statistical testing employed a .05 rejection region.
Results

PSE Analysis

The major findings pertaining to the PSE analysis for each evaluator are shown in Table 1, which displays, by testing condition, the mean ranks to subjects' chosen cards (critical items) and the number of correct detections in each trial; smaller mean ranks indicate greater efficiency in detection.

Each evaluator made 60 calls in each of two trials, each trial being independently considered. Application of the decision rule previously specified and disregard for the sex of the subjects and the testing conditions showed that evaluators averaged 24.2% correct calls in Trial 1; in Trial 2 20.8% of the calls were correct. The difference between trials was not significant, F(1, 54) = 2.5, p > .10; nor were either of the evaluators' overall hit rates in either trial significantly greater than chance expectancy of 20% (using the chi-square technique). Interevaluator agreement, determined separately for each trial by calculating Pearson's r on the ranks assigned by evaluators to the subjects' chosen cards, was .31 and .45 for Trial one and Trial two, in order. The difference in the detection rates between conditions was not significant, F(2, 54) = 1.79, p > .10, and there were no significant effects associated with sex or evaluators. Moreover, as indicated in Table 1, a binomial test of each evaluator's detection rate within testing conditions showed that those rates were not generally above chance levels. Similarly, analysis of variance carried out on evaluators' ranks to critical items failed to disclose any significant effects for testing conditions, F(2, 54) = .35, p > .10; trials, F(1, 54) = .96, p > .10; or for any of the other factors.

GSR Analysis

Physiological data recorded by polygraph were available, of course, in only two testing conditions; only the findings pertaining to evaluation of GSR are reported here. To determine whether evaluators' subjective judgements of GSR responses were influenced by their inspection of other polygraphically recorded data, evaluators' ranks on subjects' chosen cards were correlated with those assigned by objective measurement. Pearson's r, averaged for the two evaluators, was .76 in Trial 1 and .65 in Trial 2. However, chi-square tests did not reveal any significant differences in the detection rates obtained by objective or subjective methods. Hence, because those two methods yielded similar results and because PSE responses were not objectively scored, only the results pertaining to subjective evaluation of GSR will be reported.

Each evaluator made 40 calls in each of two trials, each trial being independently considered. There was high interevaluator agreement in ranking responses to the chosen cards; Pearson's r being .92 for both Trial 1 and Trial 2. To facilitate comparison to the PSE findings, Table 2 shows each evaluator's mean rank to chosen cards and number of correct detections in each testing condition and in each trial. In all but the "tape and cardio" condition in the second trial, each evaluator's detection rate was significantly greater than chance expectation (binomial).
Table 1
Evaluators' Mean Ranks to Critical Items and Number of Correct Detections in Psychological Stress Evaluator Analysis

<table>
<thead>
<tr>
<th>Testing condition</th>
<th>Tape Only</th>
<th>Tape without cardio</th>
<th>Tape and cardio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean rank</td>
<td>No. correct detections</td>
<td>Mean rank</td>
</tr>
<tr>
<td>Evaluator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>2.55</td>
<td>8</td>
<td>3.00</td>
</tr>
<tr>
<td>B</td>
<td>2.85</td>
<td>6</td>
<td>2.75</td>
</tr>
</tbody>
</table>

Trial 1

<table>
<thead>
<tr>
<th>Evaluator</th>
<th>Mean rank</th>
<th>No. correct detections</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.60</td>
<td>7</td>
</tr>
<tr>
<td>B</td>
<td>3.50</td>
<td>3</td>
</tr>
</tbody>
</table>

Trial 2

<table>
<thead>
<tr>
<th>Evaluator</th>
<th>Mean rank</th>
<th>No. correct detections</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3.05</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>3.15</td>
<td>5</td>
</tr>
</tbody>
</table>

Note. Each evaluator made 20 calls in each testing condition, each trial being independently analyzed. Using the binomial distribution (n = 20, 1/5), a result of eight or more hits is significantly (p < .03) greater than chance expectancy.

Analysis of variance was carried out on evaluators' GSR detection rates; that analysis, which was identical to that previously specified except, of course, there were only two levels of testing conditions, did not reveal any significant effects associated with sex or evaluators. The effect for testing conditions was not significant, F(1, 36) = 3.19, p < .08, but the effect for trials was F(1, 36) = 6.10, p < .02, the average detection rates being 68.8% in Trial 1 and 42.5% in Trial 2. Each evaluator, however, did obtain an overall detection rate in each trial significantly greater than chance expectation (chi-square).

Analysis was also carried out on the raw GSR ranks assigned by evaluators to the critical items; smaller mean ranks indicated greater efficiency in detection. That analysis revealed that evaluators' mean rank in Trial 1, 1.60, was significantly lower than that in Trial 2, 2.21, F(1, 36) = 4.52, p < .04; and that the mean rank assigned to GSR responses recorded without an operational blood pressure cuff, 1.64, was significantly lower than the mean rank assigned when the cuff was inflated, 2.18, F(1, 36) = 4.28, p < .04.

Table 3 displays the distribution of evaluators' mean ranks, calculated by averaging ranks across each subject's two trials, to all critical items and all noncritical items in both PSE and GSR evaluation. Assuming any fixed cutoff point on the mean rank dimension shows the relatively greater detection efficiency of the GSR compared to that of the PSE. A cutoff of 2.25, for
example, yields a proportion of 17:60 hits (critical items ranked at or less than the cutoff) and a proportion of 66:240 false alarms (noncritical items ranked at or less than the cutoff) for the PSE. At the same cutoff point, the GSR yields a 26:40 hit rate and a 24:160 false-alarm rate.

Table 2
Evaluators' Mean Ranks to Critical Items and Number of Correct Detections in Galvanic Skin Response Analysis

<table>
<thead>
<tr>
<th>Testing condition</th>
<th>Tape without cardio</th>
<th>Tape and cardio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean rank</td>
<td>No. correct detections</td>
</tr>
<tr>
<td><strong>Evaluator</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1.40</td>
<td>15</td>
</tr>
<tr>
<td>B</td>
<td>1.35</td>
<td>16</td>
</tr>
</tbody>
</table>

Note. Each evaluator made 20 calls in each testing condition, each trial being independently analyzed. Using the binomial distribution (n = 20, 1/5), a result of eight or more hits is significantly (p < .03), greater than chance expectancy.

Table 3
Distribution of Evaluators' Rank of the Responses to All Critical Items and All Noncritical Items Averaged Across Subjects' Two Trials

<table>
<thead>
<tr>
<th>Mean rank</th>
<th>Critical Items</th>
<th>Non-Critical Items</th>
<th>Critical Items</th>
<th>Non-Critical Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>2</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.25</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>1.75</td>
<td>3</td>
<td>21</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2.00</td>
<td>7</td>
<td>10</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2.25</td>
<td>6</td>
<td>23</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>2.50</td>
<td>4</td>
<td>22</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>2.75</td>
<td>7</td>
<td>17</td>
<td>2</td>
<td>13</td>
</tr>
</tbody>
</table>
Table 3 (cont).

<table>
<thead>
<tr>
<th>Mean rank</th>
<th>PSE Critical Items</th>
<th>Non-Critical Items</th>
<th>GSR Critical Items</th>
<th>Non-Critical Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.00</td>
<td>6</td>
<td>22</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>3.25</td>
<td>8</td>
<td>24</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>3.50</td>
<td>4</td>
<td>17</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>3.75</td>
<td>5</td>
<td>29</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>4.00</td>
<td>4</td>
<td>17</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>4.25</td>
<td>1</td>
<td>14</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4.50</td>
<td>3</td>
<td>7</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>4.75</td>
<td>2</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.00</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. PSE = Psychological Stress Evaluator; GSR = Galvanic Skin Response.

Discussion

These results are remarkably consistent with those reported by Kubis (Note 2). On the one hand, PSE analysis yielded hit rates only at chance levels. On the other hand, the hit rates obtained in GSR analysis were far superior to those obtained in PSE analysis, and overall, well beyond chance levels.

The low detection efficiency in PSE analysis precluded the discovery of any significant effects for any of the independent variables examined. However, both the use of the polygraphs' blood pressure cuff and repeated trials did affect GSR analysis. Kugelmass and Lieblich (1966) have found that in low-risk situations the blood pressure cuff tends to reduce the contrast between responses to relevant and nonrelevant options, that is, it appears to lower the signal-to-noise ratio. Their findings are supported by the results in this research. But, it is important to point out that the interference effect of the blood pressure cuff on GSR responses appears to diminish with increasing levels of stress (Kugelmass, Lieblich, Ben-Ishai, Opatowski, & Kaplan, 1968), and there is a growing body of evidence showing that the detection efficiency of the GSR in real-life situations is not substantially affected by the blood pressure cuff (Barland, 1975; Barland & Raskin 1973).

Generally, hit rates observed in GSR analysis in this research were quite consistent with those reported in previous experimental research using the guilty-information paradigm (Gustafson & Orne, 1963; Gustafson & Orne, 1964; Kugelmass & Lieblich, 1966; Lieblich, Naftali, Shmueli, & Kugelmass, 1974). However, in the present study, unlike most prior research, hit rates were calculated separately for each of two consecutive trials; thus, it was possible to observe a systematic difference between those trials in regard to their detection efficiency. That difference obtained whether GSR responses were subjectively or objectively scored. For instance, analysis of variance carried out only on objectively assigned dichotomous scores (a rank of 1 being a correct detection, all other ranks incorrect) showed a significantly greater detection rate for Trial 1 than for Trial 2, 67.5% to 42.5%, F(1, 36) = 5.06, p < .03.
The standard procedure to minimize the confounding effects of repeated testing is to average responses across trials on an intrasubject basis. Such a procedure generally results in higher detection rates (Lieblich et al., 1974). Unfortunately, because PSE response data are not readily objectively scored, it was not feasible to carry out such a calculation on both PSE and GSR data in the present research; therefore, the difference between this and other research in the manner in which hit rates were calculated justifies some caution in directly comparing results. Nevertheless, the marked similarity between this and other experimental research regarding GSR analysis suggests, as Kugelmass et al. (1968) and Orne (1973) have also reported, that the difference between field and laboratory equipment probably does not explain the general disinclination of field examiners to rely on GSR data (Horvath, 1977; Reid & Inbau, 1977).

There are two limitations in this study pertaining to the results of PSE analysis that deserve brief mention. First, the full technical capability of the PSE was not evaluated. Subjects' vocal responses were monosyllabic in nature and were analyzed in only one of the four display modes of the PSE. Second, this study did not involve any overt manipulation of the subjects' motivational level. It has been demonstrated by Gustafson and Orne (1963) that the detection efficiency of the guilty-information paradigm, at least with respect to measures of electrodermal activity, depends to a considerable degree on subjects' motivation to deceive. It is not known if an increase in motivation increases detectability with the PSE or if a certain degree of psychological stress, not achieved in the present study, is necessary to maximize the effectiveness of the PSE. In spite of those possibilities Barland's (1975) findings in actual criminal suspects, who are presumed to be highly motivated to deceive, suggest that even in such circumstances the PSE is not effective in detecting deception.

The detection rates in PSE analysis in this study were not dissimilar to those reported by other investigators who made noninstrumental attempts to detect deception in the human voice (Fay & Middleton, 1941; Olechowski, 1967). Although electronic analysis of the speech spectrum would appear to be the more reliable of the two procedures, the acute inter- and intrasubject variability in the voice, and the lack of an adequate specification of the precise relationship between the components of the voice spectrum and emotional states (Williams & Stevens, 1972), present complex and formidable problems in using the voice to detect deception. In fact, contrary to the relationship claimed to exist between emotional stress and low frequency tremors in the voice, Shipp and McGlone (Note 3) found no electromyographic evidence of such tremors in the laryngeal muscles in vocalization of truthful or deceptive utterances. Similarly, McGlone and Hollien (Note 4), who spectrographically analyzed speech samples of subjects who read a passage in an unstressed condition and those of subjects who read a passage while receiving a series of electrical shocks, found no low-frequency energy in the speech samples of either group of subjects. Thus, neither the PSE nor its theoretical premise appear to be useful approaches to resolving the problems associated with detecting stress in the voice. More specifically, as a means of detecting deception, at least within the constraints of this experimental setting, the PSE was highly unreliable and was clearly much less useful than the traditional field measure of electrodermal activity.
Reference Notes


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* * * * *
ETHICS IN PRE-EMPLOYMENT POLYGRAPH EXAMINATIONS

By

Stanley M. Slowik

Of all the criticisms plaguing the polygraph profession today, none are more widespread than those concerning the pre-employment polygraph examination required by private and public agencies. Although many of these complaints are unfounded and based purely upon hypothetical assumptions, many have merit. It is, therefore, the ethical responsibility of all examiners to identify and correct those practices determined to be harmful to the individual examiner, his clients, the polygraph profession, and most importantly, those individuals being examined. (Lykken, 1975) Although the practices of a few should not be used as the foundation for condemning the majority, history is replete with examples of just such consequences, as was most certainly the case in the Supreme Court's Escobedo decision. (Escobedo v. Illinois, 1964) Failure to act can only lead to the type of restrictive legislation being debated in the U.S. Congress (S.B. 854) and already enacted in many States.

As an appropriate starting point, let us first review the relationship between the examiner and his client and the role of the polygraph examination in the applicant selection process.

Historically, American business has assumed the prerogative of hiring or not hiring, using as the bases for their decisions any method deemed appropriate by the employing agency. Although there have been significant legislative efforts to clarify any misconception of an inalienable "right" in the hiring decision, (P.L. 91-648) many employers remain woefully ignorant of the basic ethical issue that must be resolved long before the question of the polygraph as a selection device arises; i.e., the determinations of proper area of inquiry. Conflicts can arise between the examiner's responsibility to conduct the examinations in a manner compatible with the requirements of accepted polygraph technique to requests for information in areas that may be ethically improper or legally prohibited. (Horvath, 1975; Reid, 1979). Many times the examiner, indefensibly, is not cognizant of the impropriety of certain inquiries. Far more frequently, he mistakenly assumes that the client must have a valid and well-founded basis for requesting such information and makes a serious error in assuming that all ethical and legal responsibilities lie solely with the client and not himself. Too late, the examiner finds himself in civil jeopardy, without a client, suffering a serious loss of reputation and possibly forming the basis for negative impressions of the entire profession.

Three guidelines are suggested in determining the propriety of a given area of inquiry -- relevancy, non-discrimination, and suitability. These three areas should be discussed in detail with the client and all issues should be resolved before any examinations are conducted. It should also be noted that those guidelines apply to any means the examiner might utilize during his

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examination; i.e., written questionnaire, pre-test interview, test question, or post-test interrogation.

**Relevancy**

Relevancy dictates that all areas of inquiry be directed toward the applicant's behavior and performance relevant not only to the industry to which he is applying, but more specifically, to the particular position within that industry. Thus, while an applicant for the position of bank teller might ethically be requested to supply information regarding his integrity, inquiry into his driving history, if in fact the position entails no driving responsibilities, would be improper. Even if the employer requires the same information of all applicants, if the relevancy of the area of inquiry is unfounded, such inquiry is apt to be contested and overturned. Solicitation of irrelevant information may in fact jeopardize the entire pre-employment examination by enactment of prohibitive legislation. (Romig, 1977).

Many traditional questions regarding personal finances, military history, religious beliefs, sexual proclivities, union affiliation, or membership in certain fraternal organizations are without basis as to relevancy for most positions and rely solely upon historical assumption and precedent. This is not to say that under no circumstances can any inquiry into the above-mentioned areas be made for all possible occupations, but only that such inquiry must address specific relevant issues within the more encompassing topic area. (Title VII EEOC)

**Non-Discrimination**

All pre-employment areas of inquiry must be non-discriminatory with regard to race, sex, ethnic origin, and to some extent, age. Local ordinances and statutes should also be consulted to determine additional areas on inquiry prohibited by law. If any question contains or implies an innate bias regarding any of the aforementioned areas, it is impermissible to ask the question, regardless of the intent of the examiner or client. By way of example, job permanency is considered a relevant area of inquiry for most positions due to the recruiting and training costs absorbed by the firm. If, however, the examiner asks a female applicant if she is pregnant, that question is usually considered to be improper due to a presumed sexual bias. If job permanency is truly a concern, the alternatives of questioning the applicant with regard to moving out of the job area, seeking employment elsewhere, or becoming engaged in activities incompatible with the position under consideration could be explored.

**Suitability**

Question suitability refers to the area of inquiry's necessity or desirability to be presented by means of the polygraph as opposed to alternative means of investigation or examination.

Perhaps the most significant and redeeming element justifying the existence of pre-employment polygraph examinations is the ability to produce valid information where all other means of such evaluation are inaccurate, incomplete, or non-existent. Because the most reliable method of predicting future human
behavior appears to be consideration of recent, relevant past behavior, (Ginzberg, 1959) the polygraph is particularly valuable in evaluating such relevant and non-discriminatory areas as integrity, drug/alcohol abuse, and criminal activities. In addition, as all admissions of potentially disqualifying behavior come, by the very nature of the examination, voluntarily from the applicant himself, complaints of violation of Constitutional rights are seldom upheld. (Hepburn v. Alioto) Unfortunately, if the examiner ignores the issue of question suitability, one could find the examiner soliciting information in a myriad of areas best left to other selection devices. Oftentimes, the polygraph examination, for such pragmatic reasons as cost and expediency, becomes a substitute for motor vehicle checks, credit reports, physical and mental health information, and numerous other areas. This information obtained subsequently may become the basis of the applicant's disqualification.

Since the polygraph examination is frequently the only place in the selection process wherein this type of information is solicited and, in most cases, the examiner is encroaching into a field for which he cannot demonstrate expertise, most of the complaints regarding the solicitation of such material is therefore directed at the examiner and the polygraph profession when in fact it is the area of inquiry itself that is the actual source of the complaint. While convenience and cost may motivate a client into demanding the examiner solicit a wide variety of background data, such factors cannot justify the examiner's rationalization that they are suitable for the polygraph examination. Even if such inquiries are limited to the pre-test, they are still associated with the polygraph and should be relegated to some separate and distinct procedure or screening device.

In addition, several technical problems arise if too many areas of inquiry are included in a given examination. Regardless of the technique employed, subjects respond to a given set of questions/stimuli according to an emotional hierarchy of priority to deceive; i.e., in the case of truthful subjects, to the control questions and conversely for the untruthful, to the relevant questions. (Horvath, 1972) In pre-employment examinations, the relevant questions are of necessity somewhat broad. Thus, if too many relevant questions of a divergent nature are included in a single examination, some relevant questions could in effect take on many of the characteristics of control questions in their relationship to other relevant questions. The examiner should therefore limit the number of relevant pre-employment examination questions for a given series of tests to four or five. If more areas are determined to be necessary and appropriate, a separate series of tests could be incorporated, provided the total number of tests do not emotionally exhaust the subject.

Standards

Although the area of inquiry is probably the most critical element for which the examiner must accept cooperative responsibility with his client, no discussion of ethics in pre-employment testing would be complete without involving the standards of acceptable/unacceptable behavior by which the client makes his final determination. While it is entirely the prerogative of the client to establish his own standards, it is the examiner's responsibility to require specific foreknowledge of those standards in order to properly formulate the examination questions. It is a generally accepted principle of polygraph technique that the more specific a question, the more reliable the response, not necessarily in terms of actual examination validity, but more so in determining the meaningfulness of a given response. A response to the
question "Did you ever use any drugs illegally?" poses far more possibilities as to the actual activity of the applicant than does "In the last six months, did you use any marijuana on a job during working hours?" In the case of an applicant declining to make a clarifying admission, the applicant may in fact be denied a job for untruthfulness to an area of inquiry so overly broad as to incorporate misdeeds the client is willing to discount.

All standards should be limited in time, corresponding to the area of inquiry and should also be defined as to scope; i.e., degree, frequency, and circumstances surrounding the activity. It is central to all ethical considerations of human behavior that an individual guilty of misconduct at one point in his development, be forgiven and allowed to demonstrate a compliance to accepted norms within a reasonable period of time. Failure to limit the time and scope of an area of inquiry through pre-determined standards ignores the basic human ability to change. Failure to pre-establish standards makes the client and the examiner liable to subjective, arbitrary, and perhaps discriminating practices in the selection process.

Appellate Review

In that all sciences dealing with human behavior are by the very nature of their topic subject to error, so too must the polygraph profession accept this possibility and allow some measure to mitigate any harmful side effects resulting from any unforeseen but possible error. (Garrett, 1966) To this end, all examiners should consider permitting applicants to take a second examination when the slightest doubt exists concerning the possibility of misunderstanding or oversight. Such incidents appear to occur most frequently with regard to the applicant's statements of misconduct as opposed to objective interpretation of the polygraph charts, (Slowik, 1979) but all possibilities must be considered.

Consider the case of the firm that establishes a standard of not accepting applicants who have missed four or more days of work in the last twelve months because of consumption of alcoholic beverages. On the original examination, an applicant makes such an admission only to reflect afterwards and contend that in reality he had only missed two days, the other two having occurred outside the specified twelve-month time limit. The examiner, in such cases, has an ethical responsibility, upon consulting with the client, to consider a re-examination. Predicate with this concept is the examiner's ethical responsibility, upon request, to discuss the particulars of each applicant's examination with the applicant privately. (APA, 1978) It has been the experience of the author, that few things infuriate job applicants more than to be told of a decision affecting themselves personally without the consideration of an explanation as to how that decision was reached. Specters of an inanimate machine controlling human destiny flash before the frustrated individual as he seeks solace and counsel with the local chapter of the ACLU. Studies and experience both indicate strongly that the examiner's opinion of truth and deception, verified by post-test interrogation, result in voluntary admissions of wrongdoing that exceed the pre-established standards of the client. (Barland, 1977) Thus, in explaining to the applicant the deciding factors in being disqualified, the applicant's own admitted undesirable activities become the basis for the client's ultimate decision and the polygraph itself removed from the stigma of judge and jury. This is not to abdicate the importance of the effect of the examiner's decision, but only to place responsibility for the decision in its proper.
perspective, i.e., within the context of the applicant's own admitted behavior.

This, of course, applies only to those situations where the information obtained by the polygraph is primary to the client's decision as opposed to other factors at his disposal.

Finally, as appears to be necessary for any discussion of ethics, the practicality of the foregoing recommendations should be considered. Professions distinguish themselves from other occupations in many ways, foremost of which is the authority bestowed on them by society in acknowledgement of their particular expertise. (Greenwood) Such recognition is in effect a public trust involving the examiner, the polygraph subject and society as a whole. Failure to self-regulate results in which might be considered by the profession, an unwarranted intrusion by non-experts, and more seriously, a complete elimination of that profession. The client's wishes and desires cannot become so sacrosanct as to supersede the ethical principles mandated by the profession. State licensing laws are necessary and useful guides in establishing the minimum requirements for practice but fall far short of the ethical demands needed to stem attacks on a profession that may be approaching the crossroads of its very existence. No one should be so naive as to think that abolition of pre-employment examinations will allow other forms of polygraph testing to persevere unmolested. It is therefore the ethical responsibility of every examiner to adopt principles of practice that will correct prior wrongs and lead to the development of new concepts and growth. In the final analysis, good polygraph practices should always be good ethics.

Footnotes In Order of Appearance


2Escobedo v. Illinois 378 US 478 (1964). The actions of a few Chicago police officers in preventing the defendant from consulting with his lawyer who was actively seeking his whereabouts in police custody laid the foundation for the more sweeping Miranda decision two years later.

3SB 854 sponsored by Senator Birch Bayh and H.R. 3255 by Representative McKinney.

4Public Law 91-648, Title II, Section 208 (f)(5).


6John Reid reports incidents in which he has been requested by various employers to solicit information regarding applicants' intention to unionize the firm after employment. (Personal communication to the author, March 1979).

Title VII of the Equal Employment Opportunity Act of 1975, as amended, requires that all questions asked of applicants be supported by a clear "business necessity." The burden is on the employer to clearly demonstrate that necessity.


In a recent unpublished study by the author, of 2227 applicants reviewed, 71 were re-examined (3.1%). Of these, 38 (54%) repeated or enlarged upon their initial disqualifying admissions, 15 (21%) were determined to be untruthful by chart analysis, and 18 (25%) or 0.8% of the initial study group had their initial determination changed from Unacceptable to Qualifiedly Acceptable. All of these applicants, however, had originally been determined to be Unacceptable by chart analysis alone, and all, upon re-examination, made statements verifying the original opinion of untruthfulness but admitted activities within the time and scope of the client's standards of acceptability.


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THE RIGHTS OF THE EXAMINEE POLYGRAPHED BY A LAW ENFORCEMENT AGENCY

By

James Allan Matte

Recently a person knowledgeable about polygraphy was requested to submit to a polygraph examination by a law enforcement agency pursuant to an investigation. That person consented to the test providing that the polygraphist was a member of the American Polygraph Association or possessed similar qualifications and used an objective technique employing control questions and a numerical scoring system of chart analysis as recommended by the Utah Study (Raskin, 1976). His request was denied and the qualifications of the polygraphist were not furnished to him. As an alternative he requested that the test be recorded and the recording and polygraph charts be made available to his attorney upon request, or else his attorney and/or a certified private polygraphist of his choice be permitted to view the entire examination either through the facilities of a two-way mirror or closed circuit television in order to critique the examination for the protection of the examinee in the event of erroneous polygraph results because of incompetency and/or poor technique by the polygraphist. This request was also denied with the statement that it was generally accepted amongst polygraphists queried by that department their neither copies of the charts nor any other related data are ever released to the counsel representing the examinee; nor is anyone representing the examinee permitted to view the examination. The examinee and his counsel were also denied a request for a list of the prospective relevant questions, understandably in draft form, to be used in the examination (Annot. 1). Obviously both parties were exercising self-protective measures and an analysis of the motives behind these measures raises questions regarding the rights of the examinee, innocent or guilty, to adopt protective measures against possible error, and the need and even the desirability of denying these protective measures to the examinee by law enforcement agencies.

Because of several court decisions upholding the right of a police department to order a policeman to submit to a polygraph examination or else face department charges or lose his job, the right of the policeman as an examinee to protect himself against an unfair or erroneous polygraph test becomes even more meaningful (See Citations, Annot. 2).

Without regard to whether or not an accused person has a right to demand the opportunity to take a polygraph examination, unreasonably restrictive procedures violate an individual's right to due process of law and equal protection under the law. Once a governmental body extends to individuals a right or privilege, it must administer that right or privilege fairly and even handedly and cannot arbitrarily hamstring the exercise of that right or privilege with unreasonable limitations and conditions.

Special acknowledgement is made to Charles J. Scibetta of the law firm of Sargent, Scibetta and Repka, P.C., for his contribution to the legal aspects of this article. For copies of reprints of this article write to the author at Suite 321, Statler Hilton Hotel, Buffalo, New York 14202.
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Furthermore, the privilege against self-incrimination and right to counsel assure an individual of at least minimal safeguards once he becomes the subject of a criminal investigation.

The necessity to preserve an adequate record to review the fairness and accuracy of the testing procedures, and the individual's right to counsel during the investigatory process should be balanced against whatever legitimate fears may exist by police polygraphists that interruptions and disruptions might render adequate testing procedures impossible.

An analogy may be made with line-up procedures where such a balancing test had been applied. There the courts have determined that a limited right to counsel exists enabling the defendant's attorney to view the line-up and preserve objections to and evidence of the procedures used for subsequent judicial review without enabling the defendant or his attorney to disrupt the line-up itself (See Annot. 3, citations). Similar procedures could easily be adopted in polygraph examinations. In fact they must be adopted if an individual is to be protected from inadequate or improper polygraph examinations.

The lack of polygraph licensing laws in half the states in this country is but one element indicative of the lack of control over those who practice polygraphy, and law enforcement agencies while generally more selective nevertheless have their share of polygraphists who are still using obsolete techniques and fail to meet American Polygraph Association standards of practice. Astute criminal attorneys are well aware of the great advances made in the polygraph technique towards standardization and objective chart analysis by quantification. However they also realize that a great number of polygraphists both public and private, still cling to older, less sophisticated techniques possessing many weaknesses. Publications of the Utah Study and such books as A Polygraph Handbook for Attorneys have furnished invaluable information in evaluating the expertise of a polygraphist and the polygraph technique used.

Therefore it can be expected that the aforementioned requests will be made with more frequency by attorneys who wish to insure the expertise of the polygraphist and the quality and accuracy of the technique used on their client.

It has been well established that no accusatory or interrogative approach should be used during the pre-test interview of a polygraph examination, otherwise erroneous charts may result. Furthermore, the actual examination should be conducted without emphasis on a particular question. It becomes obvious even to the layman that without a recording or live viewing of the pre-test interview and examination by a knowledgeable representative of the examinee, the right of the examinee to a scientifically prepared, impartial and objectively administered polygraph examination cannot be assured him.

The examinee is not capable of evaluating the examination, and his protests when erroneously found deceptive appear to be self-serving. Furthermore, he has no record to document or support his criticism of the test.

I fail to see any reason, scientific or otherwise, for denying an examinee the right to have a representative such as his attorney or a polygraphist of his choice witness the polygraph examination either through a two-way mirror or closed circuit television. Nor do I see any valid reason for denying his representative an opportunity to review the polygraph charts, or furnish him
For too many years the polygraph technique has been cloaked in secrecy for fear that knowledge of its substance would defeat it. Yet all polygraph techniques accepted by the scientific community and recognized by the American Polygraph Association have been written about in detail in books, and scientific journals. Objectives to full disclosure will no doubt be heard from polygraphists who use the polygraph as an extension of their interrogation technique rendering the polygraph as nothing more than a psychological lever to obtain confessions; from those polygraphists who rely on factors other than the polygraph charts, such as observation of gestures, to reach a conclusion; from those polygraphists who have neglected to change their procedure to conform to the latest advances and developments in polygraphy; and from some of the polygraphist who have been enjoying complete autonomy and immunity from critique because of their status as the sole polygraphist in their department.

The expert polygraphist, public or private, who uses a scientifically accepted technique and conducts a proper pre-test interview and examination such as recommended by the Utah Study where exclusive control questions are used for comparison against the relevant questions and the polygraph charts are numerically scored, should welcome an opportunity to show those who question the results of his polygraph examination the objectivity of his pre-test procedure and chart analysis. This author videotapes the entire polygraph examination which is made available with the charts to anyone having a need to know, approved by the examinee and his attorney.

Police polygraphists who fear that a defense attorney viewing the examination live might interrupt the examination when the client starts to confess can enter into a prior agreement with the attorney promising no interference (Annot. 4), or use close-circuit television in a room removed from the examination room, or better still, videotape the entire examination for subsequent showing to the attorney which will allow the attorney and his expert polygraphist an opportunity to critique the examination and the charts, safeguarding the examinee's right to a fair, impartial and scientifically accurate polygraph examination. Objections to the review of the polygraph examination, the questions used and the polygraph charts by the defense attorney or his expert polygraphist are weak and without scientific substance.

The U.S. Army C.I.D. Command whose polygraph school trains most federal polygraphists has had for a number of years a quality control team centrally located in the United States which reviews and critiques the entire polygraph examination data and charts of all polygraph examinations conducted world-wide by the C.I.D., and has enjoyed an extremely high accuracy rate as a result of it. Indeed, most federal agencies have centralized quality control operations.

The Utah Study recommends that "the results of control-question examinations should always be determined by numerical evaluation of the polygraph charts. When important investigative or judicial decisions may be influenced by the results of such tests, an additional numerical evaluation of the polygraph charts by an independent examiner is recommended."

It seems logical that if cardiology charts obtained from a patient can be reviewed by other cardiologists, developed latent fingerprints examined
by opposing fingerprint experts, photographs of ballistic comparison and iden-
tification examined by opposing experts, then polygraph charts and related data
that generated the charts should also become available for examination by the
opposition.

The right of the examinee to protect himself against error that might
cause him the loss of liberty or life supersedes the right that any law en-
forcement agency may have that would deny him that right. If we expect the
courts to ever afford polygraph judicial notice of acceptance as a scientific
means of truth-verification and lie-detection, we must forever remove this un-
necessary cloak of secrecy and present it in all its glory as a fair, impartial,
scientifically structured examination, recorded by a scientifically accurate
and reliable instrument, resulting in polygraph charts that are objectively an-
alyzed through the use of a numerical scoring system that permits its objec-
tive and accurate review by any other expert polygraphist trained in the same
technique.

Annot. 1. While it is understood that final formulation of the relevant questions
are normally done during the pre-test interview portion of the polygraph ex-
amination, the general area that the relevant questions will cover and a
draft of the proposed relevant questions should be available to the defense
attorney upon request.

New Orleans Police Department, 236 So.2d 548, 1970. Dolan v. Kelly, Su-
preme Court of Suffolk County, 348 N.Y. Supp.2d 478 (1973). Seattle

406 U.S. 682, 92 S.Ct. 1877, 32 L.Ed.2d 411. These cases hold that a
defendant is entitled to counsel in a line-up once adversary proceedings
have been initiated. In the case of a polygraph examination, the privi-
lege against self-incrimination and other considerations would make the
right to counsel apply at an earlier stage in the investigatory process.

Stanley Abrams, A Polygraph Handbook for Attorneys, Lexington Books,

Annot. 4. If a confession is obtained by means considered illegal, the viewing
attorney can make note of it for later submission to the court to have
the confession excluded.

Note: The Utah Study is a final report entitled "Validity and Reliability of
Detection of Deception" by David C. Raskin, Ph.D., Gordon H. Barland, Ph.D.,
and John A. Podlesny, M.A., Department of Psychology, University of Utah,
dated 30 August 1976, under contract 75-NI-99-0001, National Institute of
Law Enforcement and Criminal Justice, Law Enforcement Assistance Admin-
istration, U.S. Department of Justice.
ANALYSIS OF ZONE CHARTS BY VARIOUS PAIRINGS
OF CONTROL AND RELEVANT QUESTIONS

By
Michael Koll

Purpose

The purpose of this paper is to compare and evaluate the effects of CQ/RQ pairings within a questioning sequence used to obtain a standard zone ten-question chart. This paper is intended to provoke thought regarding how we use Control Questions.

Design

This study took a random sampling to develop 20 polygraph tests (60 charts) which had been conducted by students at the U.S. Army Polygraph School, Fort McClellan, Alabama. These tests utilized a mock crime lab paradigm, with a variety of "criminal" issues to resolve - theft, false statements, property destruction, simulated assaults, etc. There were about an equal number of men and women, all from 18-26 years of age, and in apparent good health.

A Modified Zone Comparison Test (as taught by the Army School) was utilized. The question sequence was:

1) Neutral Question
2) Sacrifice Relevant Question (Regarding that , do you intend to answer truthfully each question about that?)
3) Symptomatic Question (Are you completely convinced that I will not ask you a question on this test that has not already been reviewed?)

Pairing \[\{4\} \text{Control (CQ)} \Rightarrow \{5\} \text{Relevant (RQ)}\] Greater of \#4 or \#6 to \#5

Pairing \[\{6\} \text{Control (CQ)} \Rightarrow \{7\} \text{Relevant (RQ)}\]

3) Symptomatic Question (Is there something else you are afraid I will ask you a question about even though I told you I would not?)

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No S.K.Y. series was considered in this study. Each test had three complete charts plus a short stimulation chart administered between the first and second relevant-issue chart.

A standard numerical scoring system was used to score every CQ/RQ pair by each component (cardiosphygmograph, pneumograph and galvanograph):

-3 (Very significant RQ reactions over CQ reactions)
-2
-1 (Minimal differentiation between CQ/RQ reactions)
0
+1 (Very significant CQ over RQ reactions)
+2
+3

Each CQ/RQ pair or "spot" has a total score based on all three component comparisons. Conceivably, any single "spot" could have a +3 score each for the pneumograph, GSR, and cardio components, for a possible total "spot" of +9.

In this Modified Zone Comparison Test there are three "spots" (tri-zones) which require a total aggregate score for all zones (spots) of -6 for a definitive determination of the polygraph examination. The inconclusive range is a total score for all "tri-zones" of -5 inclusive (based on evaluation of three charts).

Policies

Using the standard ten-question test as outlined earlier, we find several possibilities and policies concerning CQ/RQ evaluative pairings. The U.S. Army Polygraph School teaches the following:

Compare the greater of CQ #4 or #6 against RQ #5; compare CQ #6 to RQ #7; compare CQ #9 to RQ #10.

The U.S. Army CIDC has a similar policy:

Compare the greater of CQ #4 or #6 against RQ #5; compare CQ #6 to RQ #7 - but only if Symptomatic #8 is less than CQ #6 and RQ #7 in reaction - otherwise no evaluation is made at this "spot"; compare CQ #9 to RQ #10.

The U.S. Air Force OSI policy follows the Army Polygraph School method, but transposes whichever CQ appears strongest after the first chart to the CQ #6 position. Army CID also does this at the present time to insure the "best" CQ effectiveness in the #6 position (allowing comparison against both RQ #5 and #7 for maximum benefit to the examinee).

The Naval Investigative Service policy is the following:

Compare the greater of CQ #4 or #6 to RQ #5; compare greater of CQ #6 or Symptomatic #8 against RQ #7 if by over all chart review Symptomatic #8 is of such response that you can eliminate the outside issue - (use of Symptomatic #8 as a CQ if "psychological set" is not at #8 so as to over-power all other CQ's or RQ's.)
CQ/RQ Design Structure

In this study 60 charts from 20 tests were scored in the blind, 30 charts had been obtained from files of truthful (NDI-No Deception Indicated) subjects and 30 charts from files of deceptive (DI-Deception Indicated) subjects. Ground or known truth had been established at the time the mock-crimes were conducted. Additionally, 36 charts out of the 60 charts evaluated had previously been scored by one of the Army Polygraph School Instructors, thus allowing for some correlations regarding numerical scoring reliability - student to instructor; student to re-scorer; instructor to re-scorer.

The 60 charts in this study were scored in three ways:

1) **Straight paired** comparisons of CQ's to RQ's -
   - CQ #4 to RQ #5
   - CQ #6 to RQ #7
   - CQ #9 to RQ #10

2) **Greater CQ** comparison - greater of CQ's #4 or #6 to each of RQ's #5 and #7. Straight CQ #9 to RQ #10 comparison.

3) **Greatest CQ** on the entire chart compared to each RQ.

All comparisons were done on a component - to - component basis, pneumograph/GSR/cardio, rather than on a "spot" basis.

**Table 1**

Table 1 is a compilation of the total scores obtained for each of the 20 subjects grouped by involvement (DI) or non-involvement (NDI), and by method of CQ/RQ comparison. (Table 1 is in cumulative scores.)

<table>
<thead>
<tr>
<th>Subject #</th>
<th>1</th>
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<th>7</th>
<th>8</th>
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<th>10</th>
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<tr>
<td><strong>TRUTHFUL (NDI) SUBJECT</strong></td>
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<tr>
<td>Straight Pairs</td>
<td>+7</td>
<td>+19</td>
<td>+17</td>
<td>+13</td>
<td>+6</td>
<td>+13</td>
<td>+25</td>
<td>+6</td>
<td>+5</td>
<td>+7</td>
</tr>
<tr>
<td>Greater CQ</td>
<td>+13</td>
<td>+22</td>
<td>+24</td>
<td>+20</td>
<td>+17</td>
<td>+25</td>
<td>+17</td>
<td>+8</td>
<td>+17</td>
<td>+8</td>
</tr>
<tr>
<td>Greatest CQ</td>
<td>+19</td>
<td>+31</td>
<td>+33</td>
<td>+26</td>
<td>+29</td>
<td>+27</td>
<td>+14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UNTRUTHFUL (DI) SUBJECT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight Pairs</td>
<td>-7</td>
<td>-21</td>
<td>-16</td>
<td>-12</td>
<td>-17</td>
<td>-16</td>
<td>-9</td>
<td>-6</td>
<td>-4</td>
<td>-6</td>
</tr>
<tr>
<td>Greater CQ</td>
<td>-1</td>
<td>-16</td>
<td>-15</td>
<td>-10</td>
<td>-10</td>
<td>-12</td>
<td>-5</td>
<td>-2</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Greatest CQ</td>
<td>+5</td>
<td>-18</td>
<td>-11</td>
<td>-5</td>
<td>-7</td>
<td>-10</td>
<td>-2</td>
<td>+4</td>
<td>+1</td>
<td>+12</td>
</tr>
</tbody>
</table>

**Results - Truthful Subjects**

A review of Table 1 illustrates that for truthful subjects (NDI charts), the scores became "stronger" and more dramatic as the comparisons went from straight-pair CQ/RQ to the greater CQ to the greatest CQ comparisons. Note subject #9 as an example:
Straight Pair  
Greater CQ  
Greatest CQ  

+5 (inconclusive)  
+17 (correct)  
+27 (correct - "stronger" score)  

Note also that in the case of truthful subjects (NDI), the average score from straight pairs was less than that for the greater CQ, and the average of both was less than that for the greatest CQ.

Table 2

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight pairs</td>
<td>+11.8</td>
</tr>
<tr>
<td>Greater CQ</td>
<td>+16.7</td>
</tr>
<tr>
<td>Greatest CQ</td>
<td>+23.0</td>
</tr>
</tbody>
</table>

However, the rank order does not follow in the case of untruthful subjects (DI). In fact, it is the reverse.

Table 3

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight pairs</td>
<td>-11.4</td>
</tr>
<tr>
<td>Greater CQ</td>
<td>-7.8</td>
</tr>
<tr>
<td>Greatest CQ</td>
<td>-3.1</td>
</tr>
</tbody>
</table>

Note also that the greatest CQ produces some anomalies in the scoring of subjects #1, #8, #9, and #10. While the scores of the first three of this group would have been in the inconclusive range, that of #10 was +12, a truthful conclusion.

Straight Pairs - Truthful Subjects

Employing the standard ± 6 for a decision, the straight-pair evaluations of two subjects (out of ten) were called inconclusive when they were actually truthful. No wrong calls were made.

Greater CQ - Truthful Subjects

In the greater CQ evaluations there were no inconclusive results and no wrong calls.

Greatest CQ - Truthful Subjects

Using the greatest CQ evaluation brought very strong truthful (NDI) scores, again with no inconclusives or wrong decision. Obviously, the "stronger" the CQ used, the greater the propensity will be to "call" a subject truthful (NDI), especially when they are in fact truthful.

Results - Untruthful Subjects

Straight Pairs - Untruthful Subjects

Review of Table 1 for untruthful subjects (DI) illustrates that one subject (out of ten) was inconclusive when the straight pair evaluation was used. Three additional scores were not strong (-7, -6, and -6), but they did not fall within the inconclusive range. No wrong calls were made.
Greater CQ - Untruthful Subjects

When the greater CQ evaluation was used five subjects (out of ten) or 50%, were inconclusive. No wrong calls were made.

Greatest CQ - Untruthful Subjects

When the greatest CQ evaluation was used, five subjects were inconclusive, with one wrong decision, a false negative. Note untruthful subject #10.

Table 4

In regard to Subject #10, the analysis by pairing was:

<table>
<thead>
<tr>
<th>Pairing</th>
<th>Correct</th>
<th>False Positives</th>
<th>False Negatives</th>
<th>Inconclusives</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Greater CQ</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Greatest CQ</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>

Employing the greatest CQ pairing, only four tests, or 40%, were correctly called for these ten known untruthful (DI) subjects.

Table 5

Combined Results

<table>
<thead>
<tr>
<th>Pairing</th>
<th>Correct</th>
<th>False Positives</th>
<th>False Negatives</th>
<th>Inconclusives</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight pairs</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Greater CQ</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Greatest CQ</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 6

Validity and Utility

<table>
<thead>
<tr>
<th>Pairing</th>
<th>Validity (no inconclusives)</th>
<th>Utility (including inconclusives)</th>
<th>Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight pairs</td>
<td>100%</td>
<td>85%</td>
<td>0</td>
</tr>
<tr>
<td>Greater CQ</td>
<td>100%</td>
<td>75%</td>
<td>0</td>
</tr>
<tr>
<td>Greatest CQ</td>
<td>93%</td>
<td>70%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 6 illustrates combined results from all 20 subjects in the sampling by the type of CQ/RQ pairing. It should be noted that of our sixty (60) scorings (20 polygraph tests scored three different ways), there was only one wrong decision, a false negative, while 13 decisions were inconclusive (22%), and 46 (out of 60) correct decisions for an overall utility rate of 77%. If the thirteen (13) inconclusive scorings are excluded, there were 46 correct decisions out of 47 scorings, for an overall validity rate of 98%.

Chart Analysis Correlations

All of the charts were scored by the original examiner (student). All were also rescored by an examiner who conducted this study (rescorer). Thirty-six of the forty sets selected at random for this study contained scoring by
instructors at the Polygraph School. Using those thirty-six cases, the following correlations on chart analysis were obtained:

Table 7

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>student - instructor</td>
<td>.93</td>
</tr>
<tr>
<td>student - rescorer</td>
<td>.94</td>
</tr>
<tr>
<td>rescorer - instructor</td>
<td>.99</td>
</tr>
</tbody>
</table>

These figures indicate that the scoring system has a high degree of reliability.

Discussion

In terms of overall accuracy, with fewest inconclusives, the greater CQ evaluation was most effective for truthful (NDI) subjects, while the straight pairing was most effective for untruthful (DI) subjects. Of course in a real-life situation the Examiner does not know the extent of involvement or non-involvement of the examinee. If the CQ/RQ straight-pairing evaluation was used exclusively, it appears that although there would not be any loss in terms of accuracy of decision, there might be a tendency to report examinees who were in fact truthful as inconclusive. On the other hand, exclusively using the greater CQ/RQ pairing would cause more of the polygraph charts of untruthful (deceptive) examinees to fall within the inconclusive range. However, in practice this method allows for some degree of flexibility in the second and subsequent charts by placing the greater CQ before that first primary RQ which an examinee will hear in the standard ZCT question sequence. Thus, some of that initial shock can be absorbed, allowing a more accurate analysis.

The use of the greatest CQ/RQ pairing seems to lack the consistency that is necessary for a low rate of unresolved cases and a high rate of validity. It does not appear to be a useful form of analysis.

If we refer back to the explanation of many of the United States Department of Defense policies, we find that there is a combining of the straight pairing and greater CQ pairing evaluative comparisons.

Compare the greater of CQ #4 or CQ #6 against RQ #5; Compare CQ #6 against RQ #7; Compare CQ #9 against RQ #10; Transpose strongest CQ after first chart to the CQ #6 position to allow comparison against both RQ #5 and RQ #6.

Conclusions

The results of this study support the position that the greatest degree of accuracy with the lowest inconclusive rate for subjects in a mock crime can be attained in the Modified Zone Comparison Test with the Straight pairing CQ/RQ comparative evaluations:

- CQ #4 to RQ #5
- CQ #6 to RQ #7
- CQ #9 to RQ #10
This study supports the position that there is an extremely high degree of reliability between different polygraph examiners when numerical scoring criteria are employed to evaluate and analyze polygraph charts. The study also demonstrates that the ACT polygraph examination in a mock-crime paradigm has a high degree of validity.

This study has many limitations—sample size, population type, use of a lab mock-crime paradigm, and other shortcomings. However, the methodology should now be applied to ACT polygraph charts from real cases in which ground truth has been established by confessions and investigations. The analysis of these charts would be useful in reviewing scoring policies and teaching methods.

* * * * *


EFFECTS OF LEVEL OF SOCIALIZATION ON ELECTRODERMAL DETECTION OF DECEPTION

By

William M. Waid, Martin T. Orne, and Stuart K. Wilson
Institute of Pennsylvania Hospital and University of Pennsylvania

Abstract

Fifteen college students attempted to deceive a professional polygraph examiner, while 15 others who had nothing to hide also submitted to the examination. The examiner was blind as to whether each subject was deceptive or truthful. Using the skin conductance response (SCR), significant discrimination was made between deceptive and truthful subjects with both "guilty person" and "guilty knowledge" polygraph tests. On both types of test, however, subjects who were not detected were significantly less socialized (Socilization Scale of the California Psychological Inventory) than those who were detected. This reduced susceptibility to detection was mediated by a reduced SCR to deception among low-socialization subjects. Among innocent subjects the highly socialized were more responsive electrodynamically throughout the test, leading some of them to be misclassified as deceptive on at least one test. Implications of the results for both detection of deception and the construct of socialization are discussed.

The psychophysiological detection of deception depends upon the subject giving larger autonomic responses to questions associated with his deception than to appropriate control questions. Research over the past two decades has led to a better understanding of the factors which produce such differential responsivity among deceptive subjects. For example, the attempt to deceive (Gustafson & Orne, 1963; Kugelmass, Lieblich, & Bergman, 1967) and mere exposure

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We wish to thank Joseph Brophy for lending his professional expertise to the role of polygraph examiner and several colleagues for their substantive comments during the preparation of the manuscript: Frederick J. Evans, A. Gordon Hammer, Pamela A. Markowsky, Emily Carota Orne, Helen M. Pettinati, Betsy E. Lawrence, and R. Lynn Horne.

Special appreciation is due to Jeremy P. DeLong and Anna M. Waid for their scoring of the present data.

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to questions associated with the subject's deception (Gustafson & Orne, 1965b; Kugelmass et al., 1967) have been shown to be sufficient to produce differential responsivity, and the more thoroughly a subject processes the test items, as indexed by later memory, the more often he is detected (Waid, Orne, Cook, & Orne, 1978). Such research has been important in revealing the components which are responsible for the differential responsivity which lead to detection.

Another class of variables which is also likely to influence differential responsivity -- attributes of the subject such as personality -- has been less thoroughly investigated (Barland & Raskin, 1973; Orne, Thackray, & Paskewitz, 1972). One personality construct of particular interest, both on the basis of face validity and because of relevant prior work, is socialization. Poorly socialized individuals are characterized by tendencies toward impulsivity, lack of restraint, superficial interpersonal relationships, and a history of interpersonal conflict despite normal intelligence, good superficial social skills, and an absence of neuroticism and social anxiety (Gough, 1960). The behavior patterns of poorly socialized individuals suggest that deception is not unusual for them and they might be less aroused while attempting deception and consequently less easily detected.

From an empirical perspective, the potential importance of individual differences in socialization is underlined by the finding of Waid (1976) that college students scoring low on the socialization scale (Gough, 1964) of the California Psychological Inventory (CPI) gave smaller skin conductance responses (SCRs) to noxious noise bursts than did subjects scoring high on socialization. The high and low groups did not differ, however, in the amplitude of the SCR to innocuous 68 dB tones, indicating that the low-socialization subjects were characterized by a reduced SCR specifically for noxious stimuli rather than by a generalized reduction of electrodermal responsivity. Similar findings have been reported for the related construct of psychopathy. Hare (1978) has recently reviewed the many studies finding prison inmates diagnosed as psychopathic to give smaller SCRs than nonpsychopathic prisoners or nonprisoner control subjects in anticipation and in response to noxious stimuli.

The reduced differential electrodermal responsivity of low socialization subjects strongly suggests the relevant of socialization to the detection of deception since the latter depends precisely upon a differentially large response to relevant as opposed to control questions. The present paper examines the susceptibility to electrodermal detection of deception of subjects differing on the CPI index of socialization. The results have implications for an understanding of socialization as well as for the detection of deception. If the reduced SCR to noxious, disturbing stimuli shown by low-socialization subjects (Waid, 1976; Hare, 1978) plays a functional role in their social behavior, than it should be observed in response to social stimuli or behavior such as deception which might be conceptualized as noxious or disturbing.

Since the comparative utility of laboratory models reflecting two basic approaches to the detection of deception is a matter of some controversy (Lykken, 1974; Podlesny & Raskin, 1977), tests representative of both approaches were administered. The "Guilty Person Test" simulates the "control-question" field lie detector test (Reid & Inbau, 1977). For example, if the theft of

1Although this type of test is referred to in the field as the "control question test," the term "guilty person test" better reflects its nature and how it differs from other tests since every type of polygraph test has control questions, though their nature may differ.
$600 were the subject of the test, the subject might be asked, "Did you take the $600?" The subject would be considered deceptive if he responded more to this question than to a control question about other possible thefts in his life. In the "Guilty Knowledge Test," in contrast, the subject is asked about several items of information which a guilty but not an innocent person would know. Using the same example, but assuming that the amount of money stolen had not been made public, one critical item could be tested by asking the subject, "Was the amount stolen $100 ... $400 ... $500 ... $600 ... $700 ... or $800?" The guilty individual would be expected to respond more to $600 than to the control amounts, whereas for innocent individuals there should be no difference among the amounts. (This procedure is referred to as "peak-of-tension" in the field literature.) Lykken (1974) has urged the wider use of this approach, but with multiple critical items, in the field, and Reid and Inbau (1977) describe its increased, apparently successful, use in the field. Unfortunately, the necessary conditions for the guilty knowledge test are frequently difficult to attain in field situations. Nonetheless, the present purpose was not to compare these approaches but to permit the best possible test of the effect of level of socialization. Socialization might affect detection on one type of test but not on the other. Since we were not seeking to compare the two types of test and since, when used in the field, the guilty knowledge procedure is usually given after at least two guilty person tests, we administered the guilty person tests first to each subject followed by the guilty knowledge tests. A peak-of-tension test, i.e., a guilty-knowledge-type test with only a single item, was also administered.

METHOD

Subjects

Subjects were 30 male college students, aged 18 to 28, who volunteered to participate in a polygraph test study. Age was uncorrelated with socialization ($r = -.004$) and was not considered further.

Apparatus

Skin conductance recordings were obtained using a constant .75-V source (Beckman Skin Conductance Coupler) applied to a pair of .64 cm² Beckman bio-potential electrodes attached to the palmar surfaces of the first phalanx of the third and fourth fingers of the left hand. Johnson & Johnson K-Y Jelly was used as the electrode medium (Edelberg, 1967). The skin was cleaned with acetone prior to electrode placement, and adhesive rings were used to maintain a uniform area of contact with the skin.

Procedures

Each subject served as either a "guilty" person carrying a memorized list of "code words" (N=15) or an "innocent" person suspected of carrying "code" words (N=15). Experimenter 1 explained the subject's task and supervised guilty subjects' "overlearning" of 6 code words. To learn the 6 code words, they were required to associate them, reproduce them in the original, reverse and alphabetical order, and perform a number of interpolated tasks prior to again reproducing them. Subjects were told that failure to reproduce all 6 words correctly would disqualify them from the experiment. The procedure took approximately 1 hr and was designed to ensure overlearning as well as increase the
subject's ego involvement in the task. "Innocent" subjects were informed that the polygraph examiner would suspect them and that it was often very difficult to prove one's innocence in a "lie detection" test. As a test of their "ability to perform under stress," the innocent subjects completed the same timed, interpolated tasks as did their guilty counterparts, but they, of course, learned no words. Since in a life situation the innocent suspect is often as concerned as the guilty, it is crucial in a laboratory model to involve the control subjects in the procedure lest one detect the latter on the basis of their lack of concern and relatively low arousal. Therefore, care was taken to have innocent subjects view their role as the experimental group by emphasizing our interest in determining the likelihood of false positives.

At the completion of the hour, subjects were informed that they would now be examined. Innocent subjects were reminded that they had to prove their innocence by not responding physiologically. Guilty subjects were told that the polygrapher would do his best to obtain a confession, that it would be difficult to deceive him, but that it was possible to "beat the polygraph"; highly intelligent, mature individuals would be able to control their emotions well enough to succeed.

Polygraph Test. The subject was then turned over to Experimenter 2, a professional polygraph examiner, who had no prior knowledge of whether he was innocent or guilty nor of the six code words. He attached several transducers, including those connected to a Stoelting field polygraph situated in the room. Two electrodes unobtrusively terminated in an adjoining room, where Experimenter 3 simultaneously recorded the SCR on a Beckman laboratory polygraph. Experimenter 2 first conducted a pretest interview which included biographical and basic medical-history questions followed by a review of the matter under investigation and a review of the relevant questions which would be asked on the first test. The control questions were not reviewed at this time to permit comparison of a test with unreviewed control questions with a subsequent test with reviewed control questions. Experimenter 2 administered several distinct tests to each subject. Between tests the experimenter left the room for 3 min. Upon returning he told the subject there was still suspicion about possible deception and that another series of questions would be asked. The interval between questions within a test was 12 to 14 sec. Every question could be answered yes or no. The tests were as follows:

2 To prevent a bias from developing in Experimenter 2, the precise words assigned to guilty subjects as code words varied. For scoring detections of code words among innocent subjects, the word in each category which was most frequently detected among guilty subjects was arbitrarily designated as the word to be detected in that category. Although there were no significant differences in these frequencies, this procedure nonetheless makes the most conservative test of whether innocents do appear innocent since it uses the most arousing word in each category as the word to be detected. The 24 words used in the tests, and from which the code words were selected were carefully matched for frequency of usage (100 or more times/million, Thorndike & Lorge, 1944).

3 The Stoelting field polygraph served primarily as part of the stimulus context in the present study since its presence enhances the subject's awareness of the monitoring of his "involuntary" responses. The data presented here, however, are from the Beckman skin conductance recordings.
a) Guilty Person Test. The subject was asked 3 questions directly bearing on his guilt or innocence (e.g., "Are you a courier carrying critical code words?"), interpolated with 2 control questions (e.g., "In your entire life did you ever steal even one thing?") and several irrelevant questions (e.g., "Are you in the United States?"). Following the test the examiner questioned the subject briefly about his answers, particularly to the control questions. Then a "Card test" was presented as a demonstration of the accuracy of the polygraph, as in field polygraphy. Since some subjects report purposely increasing their response on the card test in order to give a false impression of their response to deception, the results are not comparable to the other tests and are not presented. A second guilty person test was then conducted. The first guilty person test involved unreviewed control questions, whereas on the second test the subject did know the wording of the control questions.

b) Peak-of-Tension Test. The subject was asked, "Are there 2 critical code words?" and subsequently, 3, 4, 5, 6, or 7 critical code words. The same sequence was then asked again, but in the reverse order. Since couriers were concealing 6 code words, they were lying about information incidental to their role when they responded "no" to the number 6, whereas innocent subjects had no knowledge of the number of code words. The questions were reviewed prior to the test so the subject knew when the critical item would occur.

c) Guilty Knowledge Test. Subjects were asked if any of 24 words had special meaning to them as code words. Six of the words were the subject's code words. The list of words was repeated 4 times, so the number of detections per subject could range from 0 to 24.

Startle Stimulus. Ten to 15 sec following the last question on the final test, Experimenter 2 instructed the subject to remain still with eyes closed. Five to 10 sec later Experimenter 2 clapped his hands loudly. (This procedure was added only for the last 26 subjects.) Perfect standardization of this stimulus through tape recording was sacrificed in order to keep equipment in the room at a minimum and to preclude subject suspicion of physiological recording or other activity in the adjacent room. Nonetheless, Experimenter 2 was reasonably consistent. Measure of 10 hand claps gave a mean sound pressure level of 91.3 dB (re .0002 dynes/cm²) at the location of the subject's ears with a standard deviation of 1.8.

Conclusion. Experimenter 2 then informed the subject that the testing was at an end, and, without communicating anything concerning his decision, conducted the subject to the reception room. The subject then completed the Socialization Scale (which was identified to the subject only as California Psychological Inventory: Scale VII) and several other questionnaires assessing his reactions to the experiment. Finally, Experimenter 4 conducted a post-experimental interview with each subject. During that time, all questions concerning the experiment were answered.

The use of the control-question test in laboratory research represents a semantic problem which appears irreconcilable within the limits of current laboratory approaches. According to field polygraphers the control question should deal with a subject similar to that of the relevant questions, as described in the example above concerning theft. In the laboratory "mock crime" or "courier" context, however, the subject has not actually stolen anything or committed any other transgression. Thus, the control question concerning the possible thefts in his life does not deal with the same subject matter as the relevant question. The control question deals with actual transgressions whereas the "mock crime" or "courier" questions obviously do not. Despite the inconsistency, the data
Data Quantification

Amplitude of the SCR. Amplitude of the SCR was scored as the change in µmhos from onset to peak of the phasic change in conductance beginning in a period 1.5 sec following stimulus onset. The criterion for a scorable response was change of at least 0.025 µmhos conductance. If no scorable response occurred, a value of 0 was given that response. On the Guilty Person Tests this period extended 9 sec following stimulus onset since the questions were relatively long. On the remaining tests the period extended to only 5 sec following stimulus onset since each "question" was merely a single word or number. The scoring was done twice, independently, by two assistants who were blind as to subjects' "guilt" or "innocence," code words, and level of socialization. Discrepancies greater than 0.5 mm were resolved by Experimenter 3.

Detection. Since each test had a different format, a different criterion for detection was required for each. On both guilty person tests subjects were classified as "deception indicated" if they gave a larger SCR to any of the 3 critical questions than the largest SCR to any of the control questions. This is similar to some field polygraph procedures (Reid & Inbau, 1977). In some scoring systems (Podlesny & Raskin, 1977) subjects who are rated as responding equally to control and relevant questions are classified as "inconclusive." For research purposes we view it more desirable to use the actual, objective, amplitude values, rather than a rating scheme (Podlesny & Raskin, 1977), and classify subjects as "no deception indicated" if their responses are not larger to the relevant than to the control questions. Further, to permit a sensitive test of the effect of socialization we report results separately for each test rather than a global final decision reflecting a combination of all the tests as typically would be done in the field.

On the Peak-of-Tension Test subjects were classified as deception indicated if they gave a larger SCR to the critical number than the largest SCR to any of the remaining numbers (except the first number in each series) on either or both presentations of the two series. On the Guilty Knowledge Test a code word was considered detected if it evoked a larger response than the largest response to any of the 3 control words in that category. Subjects who had code words detected 7 or more times (6 = chance rate of detection) were classified as deception indicated. Subjects who had code words detected 6 or fewer times were classified as "no deception indicated."

Results

Accuracy of Detection

Each type of test except the Peak-of-Tension Test significantly discriminated between guilty and innocent subjects (Table 1). On all tests, a much larger percentage of guilty than of innocent subjects were detected as deceptive. That is, guilty subjects produced larger SCRs to critical than to control stimuli, whereas innocent subjects did not. The present results are not intended as a comparison of the guilty person, peak-of-tension, and guilty knowledge 4 cont. presented below indicate that such control questions permit significant discrimination of truthful and deceptive laboratory subjects.

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techniques. Detection was depressed on the peak-of-tension and guilty knowledge tests because they always occurred after guilty person tests, as would be done in most current field procedures. There was no difference between Guilty Person Test 1, in which the control questions were unreviewed, and Guilty Person Test 2 in which these questions had been reviewed.

Socialization and Detection

Guilty Subjects. On each type of test except the second guilty person test, deceptive subjects who escaped detection scored significantly lower on the Socialization Scale than subjects who were detected. That is, subjects who intended to respond electrodermally more when deceiving than when answering control questions were significantly more socialized than those who did not. These results are presented in Table 2.5

<table>
<thead>
<tr>
<th>Groups</th>
<th>Guilty Person</th>
<th>Peak of Tension</th>
<th>Guilty Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Guilty</td>
<td>12</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Innocent</td>
<td>3</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>$X^2$</td>
<td>8.53</td>
<td>8.53</td>
<td>1.35</td>
</tr>
<tr>
<td>$p$</td>
<td>&lt;.01</td>
<td>&lt;.01</td>
<td>NS</td>
</tr>
</tbody>
</table>

It might be hypothesized that either the demonstration of the polygraph's effectiveness which preceded the second guilty person test or the use of reviewed control questions on this test may have counteracted the effects of socialization. The present study was not designed to test this hypothesis. However, since the effects of socialization were present on later tests, in which both critical and control items were reviewed, any such effects were only transient.

5Since there were generally fewer guilty subjects in the "no deception indicated" than in the "deception indicated" categories, it is important to note that the standard deviations of the two categories are very similar. Thus the data meet the assumption of homogeneity of variance and are appropriate for t-tests despite the unequal Ns (Senter, 1969).
TABLE 2

Socialization score of deceptive subjects as a function of detection classification on four tests

<table>
<thead>
<tr>
<th>Tests</th>
<th>Deception Indicated</th>
<th>No Deception Indicated</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>N</td>
<td>M</td>
</tr>
<tr>
<td>Guilty Person 1</td>
<td>38.0</td>
<td>5.0</td>
<td>12</td>
<td>30.3</td>
</tr>
<tr>
<td>Guilty Person 2</td>
<td>36.1</td>
<td>5.1</td>
<td>12</td>
<td>38.0</td>
</tr>
<tr>
<td>Peak-of-Tension</td>
<td>40.3</td>
<td>4.5</td>
<td>7</td>
<td>33.1</td>
</tr>
<tr>
<td>Guilty Knowledge</td>
<td>39.4</td>
<td>4.9</td>
<td>8</td>
<td>33.0</td>
</tr>
</tbody>
</table>

Innocent Subjects. As can be seen in Table 1, on each separate test few innocent subjects were misclassified as deceptive. However, 6 of 15 subjects were misclassified as deceptive on one guilty person test, 3 on the first guilty person test, and 3 different subjects on the second guilty person test. The mean socialization score of these 6 subjects (M = 38.8, SD = 4.1) was significantly higher than that of those correctly classified as innocent on both tests (M = 32.8, SD = 7.1, t(14) = 2.06, P < .05). One other was misclassified on the peak-of-tension and 1 on the guilty knowledge test. (Two of the 3 subjects misclassified on the guilty person tests.) When all 8 misclassified subjects (M = 38.5, SD = 4.6) were compared with the 7 remaining subjects (M = 31.6, SD = 6.9), the results were also significant (t(14) = 2.26, p < .025).

Comparative with Normative Data. The mean socialization scale score reported by Gough (1964) for 1,745 male college students was 37.41 (SD = 5.28). This is similar to the mean socialization scale scores (36.1 to 40.3) of "guilty" subjects classified as "deception indicated," in Table 2. Excluding guilty person test 2, the means of deceptive subjects classified as no deception indicated (30.3-33.1) are close to or more than one standard deviation below the normative mean for college males and approximately the normative score for "high school disciplinary problems" (M = 31.25, SD = 5.4).

Socialization and Amplitude of the Skin Conductance Response

The mean SCR of each guilty subject to critical questions and the mean SCR of each innocent subject to all questions on the four tests was computed and expressed as the square root of the mean SCR.

As anticipated, the reduced susceptibility to detection of low-socialization subjects was mediated by a reduced SCR accompanying deception. Among guilty subjects the correlation between socialization and the mean SCR accompanying deception across the four tests was r(13) = .45, p < .05. The correlation between Socialization and the mean SCR to neutral questions (i.e., the irrelevant question on the guilty person tests, and the control items on the remaining tests)
was not significant, however, $r(13) = .31$. These results are analogous to those of Waid (1976) who found low socialization subjects to give significantly smaller SCRs to noxious noise bursts than high socialization subjects, but found no significant difference between groups in response to innocuous tones.

The tendency of high-socialization, innocent subjects to be misclassified as deceptive was mediated by their larger SCRs to the test questions. The correlation of socialization, with the mean SCR to all test questions across the four tests was $r(13) = .56$, $p < .025$.

Socialization and Response to a Startle Stimulus

Low-socialization subjects showed a significantly smaller SCR to an unexpected, loud stimulus - a hand clap - than did high-socialization subjects. The correlation between socialization and the SCR for the 26 subjects for whom the latter measure was available was $r(24) = .46$, $p < .01$. This result replicates related findings by Waid (1976) and Hare (1978).

Socialization and Skin Conductance Levels

The amplitude of the SCR is typically independent of skin conductance level (SCL) (Edelberg, 1967; Venables & Christie, 1973). Nonetheless, SCL just prior to the initial question of each test was measured and correlated with socialization score to test for any adventitious effect of base level of conductance. For guilty subjects these four correlations were $-.02$, $-.03$, $-.03$, and $-.02$. For innocents the correlations were $+.48$, $+.54$, $+.49$, and $+.56$, none of which were significant (two-tailed). None of the correlations are negative, confirming that the relationship between socialization and detection is not an artifact of the law of initial values.

Discussion

From the present data, it appears that the relatively poor socialized individual is less likely to be detected by his differential SCR while deceiving than his highly socialized counterpart. A highly socialized, innocent subject, on the other hand, may, due to his greater overall electrodermal responsivity in this situation, be more likely to be misjudged as deceptive than his less socialized counterpart. Although the effect of socialization might not be the same with cardiovascular or respiratory measures, it should be noted that the skin conductance response has been found to be the most accurate indicator of deception both in the laboratory (Barland & Raskin, 1975; Cutrow, Parks, Lucas, & Thomas, 1972; Thackray & Orne, 1968) and in one field study which focused on this issue (Barland, 1975). Whether the relationship between socialization and detection would manifest itself in most field settings, however, can be determined only by further research.

Raskin & Hare (1978) recently reported finding no effect of socialization on the detection of deception among prison inmates. The apparent conflict between their results and the present ones may be due to the large number of methodological differences between the two studies. Lykken (1978) has described some of the potential confounding factors involved in having prison inmates attempt to deceive a polygraph examiner in order to win prize money, as was the case in Raskin and Hare (1978). Further, since the focus of that study was the clinical syndrome of psychopathy, all of the subjects were preselected as high
or low on clinical ratings of psychopathy. High and low socialization subjects within each of these categories were then compared. In contrast, after separating prison inmates solely on the basis of socialization, Schalling, Lidberg, Levan­der, and Dahlin (1973) found, as predicted, less skin conductance activity between presentations of a noxious stimulus among low-socialization prisoners. These results suggest that the negative results of Raskin and Hare (1978) probably relate to either the selection problems mentioned above or to procedures used in the detection of deception rather than to an ineffectiveness of the Socialization Scale in prison samples. Clinical diagnosis of psychopathy was also unrelated to detection. This results does not necessarily conflict with the present results since the correlation between socialization and Raskin and Hare's clinical diagnosis was only -.31. Furthermore, as Lykken emphasized (1978) in a discussion of these data, psychopathy might have had an effect in the absence of monetary inducements (Lykken, 1978).

Podlesny and Raskin (1977) have asserted that the setting used in the present experiment is not an adequately motivating context for the detection of deception. From this view, it might be argued that socialization had its present effects only because of relatively unmotivating conditions. Such an interpretation, however, is difficult to reconcile with the accuracy of classification of both "guilty," and "innocent" subjects. The present accuracy of 80% of both innocents and guilties on each guilty person test falls in the range of those of other studies using the guilty person test in a "mock crime" context (Barland & Raskin, 1975; Podlesny & Raskin, 1978; Raskin & Hare, 1978).

The present findings appear particularly stable in light of the fact that they held true under three quite different types of tests. Low-socialization, deceptive subjects were less susceptible to detection regardless of whether the type of test was guilty person, peak-of-tension, or guilty knowledge. Further support for the reliability of these findings comes from the fact that low-socialization subjects in the present sample were less responsive to a loud, unexpected noise than were high-socialization subjects, replicating findings by Waid (1976) and Hare (1978).

Nonetheless, socialization score did not predict a deceptive subject's detection on each test. Only 3 deceptive subjects, each scoring relatively low on socialization, escaped detection on the first guilty person test, and the 3 subjects who escaped detection on the second guilty person test were no less socialized than subjects who were detected on that test. Thus, despite the significant tendency for low-socialization subjects to escape detection, some low-socialization subjects were detected on some tests.

Although there was a tendency for innocent, high-socialization subjects to appear deceptive on individual tests, the results also suggest that present detection of deception procedures may minimize this tendency. Thus, it is noteworthy that no innocent subject was misclassified as deceptive on both guilty person tests, and none of the innocent subjects were misclassified on three or more tests. Consequently, basing final decisions on several tests reduces the effects of socialization on false positive decisions.

Some light is shed on this issue by a dissertation which appeared after the present paper had been submitted for publication. Ingersoll (1977) found that deceptive subjects scoring high on the MMPI Psychopathic Deviate (Pd) Scale were detected significantly less than were low Pd subjects.
Several other technical issues concerning polygraph tests must be commented upon viz a viz the present results. First, the peak-of-tension test did not discriminate significantly between deceptive and truthful subjects. Undoubtedly, this was partially due to the fact that it was always administered relatively late in the session. It is also likely, however, that the incidental information under consideration was simply not very salient to the deceptive subjects. Secondly, although the guilty knowledge test discriminated between truthful and deceptive subjects, there was a high number of false negatives. The present study, however, was not designed as a comparison of guilty knowledge and guilty person tests. The guilty knowledge test was always administered last, resulting in reduced detection rates.

The present results also have broader implications regarding the construct of socialization and the role of electrodermal arousal in social behavior. If a person is less aroused electrodermally by lying, and related behaviors, it may be that such actions are easier for him and consequently he may be more likely to engage in them. The results of such reduced arousal to antinormative behavior patterns characterized as under-socialized. The present findings that less socialized subjects give smaller SCRs when deceiving than do more socialized subjects, is consistent with this view. Only further research, however, can determine whether the reduced physiological component should be conceptualized as an index of an arousal-dampening process which facilitates such behavior or whether it should be conceptualized as a result of the facility with which the less-socialized person deceives.

In summary, the predicted effect of level of socialization on the electrodermal detection of deception was confirmed in a normal population: on individual tests, deceptive subjects who escaped detection were significantly less socialized than those who were detected. In addition, among innocent subjects there was a tendency for highly socialized subjects to be more responsive electrodermally throughout the test, leading some of them to be misclassified as deceptive on individual tests.

References


A DEVICE FOR REVEALING LIES DURING QUESTIONING

By

Von Heindl*

The following notice appeared recently in the German press: "Dr. Bernard and Prof. Gelma, two famous French psychiatrists, have been busy during the war building devices which enable them to measure emotions and brain waves (Gehirnbewegungen) under experimental conditions. They constructed a 'psychoelectric meter,' which is attached to the scalp. When the subject is questioned about things which he must immediately react to intellectually, an opinion is received in the form of a pen deflection. As soon as the relevant thought flashes through the mind, an electric wave of very low frequency is allegedly elicited and the needle of the thought-registration device deflects. If the answer contains a discrepancy or perhaps an open falsehood, there is a deflection of 10 to 15 divisions from zero. Prof. Gelma has gone still farther. He allegedly determined the degree to which an adolescent liked a girl. In one case he made a murderer confess; cross examination proved him guilty, although he denied the crime. For the forensic psychologist a significant advance would be achieved with this technical novelty."

This "technical novelty" is an old story. About 35 years ago (Translator's Note: about 1909) I conducted the same experiments and pursued the same idea in Munich when I was in the physics laboratory of Prof. Roentgen. When I explained my plan of conducting experiments on the measurement of electrical currents during criminal interrogations to him, the great Roentgen lent me an old electroscope from the supplies at his institute. The master harnessmaker Marstaller in Munich made two leather belts according to my specifications. They contained copper wires, and were strapped on to the wrists of the person subjected to the interrogation. The wires were then connected to the electroscope and to a Leclanche element which I had bought for a few cents, whereupon the apparatus was complete. It indicated the innermost excitement of the suspect by a swinging of the pointer of the electroscope a few divisions of the scale at every insidious question, and particularly at every dishonest answer. Since an interrogation of real criminal suspects was not permitted because of judicial misgivings, we conducted experiments on friends who had some kind of embarrassing black mark against them, which they wanted to keep concealed. They always betrayed themselves when they wore the leather strap and were thus connected to the circuit. A physics student who worked in the laboratory and whom we knew to have had some love affairs that he was desperate to keep quiet, produced enormous sweeps of the pointer under questioning. One of the participants of my experiments was a young Dutchman, who was being trained by Roentgen at that time -- the later president of the Kaiser-Wilhelm Institute and nobel prize winner Peter Debye, who today is one of the most famous physicists in the world.

*Published in Archiv für Kriminologie, 1944, 11, 100-101. Translated by Gordon H. Barland, Ph.D., who wishes to thank Kristin Barland and Dr. Heidi Herbold-Wooten for their advice and encouragement.
Footnotes:

1 The exact nature of the psychoelectrometer is unknown. The word does not have a precise definition. Electroencephalographic techniques were well known but not in common practice before World War II. The statement that the instrument was attached to the scalp suggests EEG rather than EMG; which seems unlikely in terms of the results. [Ed.]

2 Wilhelm Konrad Roentgen, German physicist, born Lennup, Rhenish Prussia, March 27, 1845, died in Munich, February 10, 1923. It was his work with cathode rays at the University of Wurzburg in Bavaria in 1895 that brought him fame. He discovered the penetrating power of radiation. Because he did not know the nature of the radiation he used the usual mathematical symbol for the unknown, the letter x for the ray. He received the first Nobel Prize.

3 Although an electroscope is an apparatus depending for its action on the electrostatic repulsion between charged bodies, the text suggests that the instrument was a galvanometer, a common instrument in physics and psychological laboratories at that time. [Ed.]

4 A Leclanche element was a battery consisting of a carbon cathode covered with manganese dioxide and a zinc anode dipping into ammonium chloride solution, the manganese dioxide being retained in a porous pot.

5 Peter Joseph Wilhelm Debye, born Maastricht, Netherlands, March 24, 1884. A physicist, he taught at the University of Zurich as a professor of theoretical physics, succeeding Einstein in that post. His fields included the theoretical treatment of dipole moments, which measure the effect of an electrical field on the orientation of those molecules that carry a positive electric charge on one portion of their structure and a negative one on the other. A unit of dipole moment is called a debye. He also contributed significantly in the development and use of the x-ray. He received the Nobel Prize in chemistry for his work on dipolar moments in 1936. In 1940 he came to the United States and became a professor of Chemistry at Cornell where he remained until his retirement in 1950. He became a U.S. citizen in 1946.

*** * *** * *
Introduction

Several features present in the Stoelting Executive model polygraph instrument, along with a minor modification to the carrying case, facilitates calibration of the cardiosphygmograph and pneumograph components.

Calibrating the Cardiosphygmograph

The storage compartment, located in the cover of the carrying case, is modified by drilling a single 3/8" hole in the side (figure 1). The blood
pressure cuff is folded into a pad and placed in the compartment with the tube assembly running through the hole to the instrument (figure 2). The compartment lid is closed and the cuff inflated. Once the lid is locked in the closed position, the cuff is held securely enough to permit calibration (figure 3). Creating the pressure change to produce the desired deflection of the recording pen can be accomplished by either; drilling a hole in the lid and applying finger pressure directly to the cuff or by merely applying finger pressure against the closed lid.

Captain R. G. Smith is a Member of the APA. For copies of reprints write to him at 31 Rigel Road, Ottowa, Ontario, Canada KLK QAl.
Calibrating the Pneumograph

Two built-in features of the carrying case can be used to calibrate the pneumograph. The slot in the open end of the convoluted tube, when it lies upside down, fits neatly over the edge of the carrying case cover (figure 4).
Applying it to the corner of the cover prevents slippage when expanded. The expanded tube is held securely when the beaded chain is passed through the cover's locking-feature (figure 5). The tube can be further expanded to cause the desired deflection of the recording pen by moving the chain one bead length through the locking feature (figure 6).

Figure 5
LYING: MORAL CHOICE IN PUBLIC AND PRIVATE LIFE

A Review

By

Clarence H. A. Romig

Could you imagine reading a book that mentions the lie detector just once, yet contains so much fascinating information that it can't be put aside until it is read from cover to cover? Lying is such a book. The author, who teaches medical ethics at the Harvard Medical School, has drawn from her own experiences, as well as from classical and modern literature, some explanations for lying and deception. The resultant book was written as a personal exploration to narrow the gap between the moral philosophers' perceptions of lying and those who daily confront practical moral choices. In other words, lying and deception are traced from antiquity to the present, and it is left up to the reader to decide to what extent lying should be allowed in human intercourse.

Lying explains that there is little written reference material on the subject of lying. The index to the eight volume Encyclopedia of Philosophy contains not one reference to lying or deception. But there are over one hundred references to "truth." The questions about what truth is and whether mortals can attain it have loomed large from the beginnings of human speculation about the world. Despite the preoccupation with truth by the discipline of logic, in epistemology, in theology and in metaphysics, many of the references to truth remain of unsurpassed vagueness. The moral question of whether one is lying or not cannot be settled by establishing the truth or falsity of what was said. One must know whether there was an intention to mislead in order to settle this question.

When the "deception" of others is intended, messages intended to mislead are communicated to make them believe something the communicator well knows is false. This communication can take place by gestures, disguises, by action or inaction, or even by silence. A "lie" is any intentionally deceptive message which is stated, verbally, in writing, by smoke signals, Morse code, or by any other expression conveying words. Thus lying and deception can be placed on a continuum ranging from a serious falsehood to a "white" lie and then to a deceptive shrug of the shoulder or change of subject. Stated otherwise, a clearly intended lie where someone may suffer injury is at the highest level of deception. A marginal form of lying or deception can often be seen as exaggeration, evasion, boasting, understatement, or even in some advertising. The lowest level of lie or deception may include false flattery or gratitude, inflated grades in school and letters of recommendation that extol virtues to the exclusion of describing actual negative traits.

The lowest level of lying and deception can become dangerous to society when no-one can rely upon another during communication. Politicians, doctors, lawyers, and parents have in their own spheres of influence transmitted harmless white lies to such an extent that their audiences have accepted falsehoods, exaggeration and deception as commonplace and a way of life, even at the highest level of lying and deception.
From time immemorial there have been justifications for lying. Noble lies were permitted the philosopher kings. Shakespeare's sonnet about mutual consent to be lied to, "Therefore I lie with her and she with me, and in our faults by lies we flattered be," expressed an expectation of the lie. Today there are four common justifications for lying: avoiding harm, producing a benefit, fairness and veracity. The first two are the most used and are especially apparent to polygraphists in their work. The author would limit justification for lying only to protect the survival of oneself or that of another.

Based upon a philosophical perspective this book has a strong message for the medical profession. Its value for polygraphists lies in the wide-ranging quotations of philosophers that would stimulate any intellectual level. Polygraphists will have to become better acquainted with the viewpoints of others toward lying and deception if they would hope to gain more support for the polygraph technique from the scientific community. Reading this book would be a giant step toward understanding the other person's perception of lying and deception.

Clarence H. A. Romig, the reviewer, is presently adjunct faculty with the Police Training Institute, University of Illinois, in Champaign, Illinois 61820.

* * * * *


A REVIEW

By

Norman Ansley

This book takes a variety of approaches by psychologists studying the relevance of non-verbal communication to interpersonal relationships, by anthropologists interested in how these processes help to integrate societies, and by ethologists extrapolating the results of animal studies to human behavior. This is a scholarly work of interest to the student of behavior with a wide range of activity; written in the humanist tradition of zoology in which by the study of animals we come to better understand ourselves.

* * * * *

New Journal of Behavioral Assessment

A new journal from Plenum is entitled the Journal of Behavioral Assessment. The announcement states that the journal is a "new, broadly conceived journal concerned with the measurement of human behavior in terms of cognitive, motoric, and physiologic indices with a particular focus on the objective application of empirically based techniques." The Editor is Henry E. Adams, Ph.D., Department of Psychology, University of Georgia, Athens, Georgia 30602. The publisher is Plenum, 227 West 17th Street, New York, New York 10011. The institutional rate is $39.00 and the individual rate is $19.00 per year, quarterly. A free examination copy is available on request.

* * * * *
POLYGRAPH REVIEW

By

Norman Ansley

How would you score on a licensing examination? Although the examination below is not from a licensing examination, it is half of a written comprehensive examination given in 1979 at the University of Baltimore to graduate students who were taking Polygraph Technique II, Psychology 651. A score of 91 to 100 is an A, and a score of 81 to 90 is a B. Grades below B are tantamount to failure in graduate school, but 71 to 80 would be a C for an undergraduate. The answers are related to specific techniques and materials used in the University course and may not be universal in the polygraph field. For example, the course included the Backster Zone, but the Army M.G.Q.T. instead of Reid's CQT. It included the Weir R/I Technique instead of the Keeler R/I Technique. Following the APA requirement, the course gives familiarization lectures on all techniques, and includes test questions on techniques not taught at U.B., such as Arther's CQT and the Positive Control Technique. The course is accredited by the APA.

1. T F Frye v. U.S. was a 1923 murder case in the District of Columbia.
2. T F Akonum v. State is a Maryland appellate case admitting polygraph.
3. T F State v. Valdez is an Arizona case often used as a model for stipulation.
4. T F The New Mexico case permitting introduction of polygraph evidence over objection is Commonwealth v. A Juvenile.
5. T F When the results are inconclusive, stipulated cases usually prevent any mention of the examination in court.
6. T F Some states hold that the use of the polygraph is so intimidating that any confession which follows is tainted and inadmissible.
7. T F A Miranda warning is not required before conducting a private screening examination.
8. T F The APA Standards and Principles of Practice requires that prior to every examination the subject must be advised of his rights against self-incrimination and invasion of privacy.
9. T F In Schmerber v. California the Supreme Court said polygraph evidence is testimonial, not physical.
10. T F Some EEOC decisions have found the polygraph examination to be discriminatory per se.
11. T F Commercial pre-employment polygraph examinations have been banned by law in the District of Columbia.
12. T F EEOC rules on interviewing applicants apply to commercial pre-employment screening examinations.
13. T F You need a license to conduct polygraph examinations in Virginia.
14. T F The APA Code of Ethics permits only "fair and reasonable" fees.

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15. T F APA rules require you to calibrate your instrument at least once a week.
16. T F False or misleading advertising is specifically prohibited by the APA Standards and Principles of Practice.
17. T F A systole is the contracting of the muscles of the heart chamber.
18. T F The brachial artery is in the wrist and hand.
19. T F The distal capillaries expand rapidly as blood pressure goes up.
20. T F Arteries are surrounded by cardiac muscle.
21. T F Capillaries connect arterioles and venules.
22. T F The spinal cord is part of the central nervous system.
23. T F Every sympathetic activated organ has a parasympathetic counterpart neuron to stop or slow activation.
24. T F The autonomic nervous system consists of two chains of ganglia, the sympathetic and parasympathetic.
25. T F The pulmonary artery and pulmonary vein connect the heart and lungs.
26. T F Each receptor neuron is directly connected to a motor neuron.
27. T F The galvanograph is recording electrodermal activity which is primarily secretion of sweat.
28. T F The thoracic pneumograph records the upper bodily movement associated with breathing.
29. T F Heart rate can be obtained from the cardiosphygmograph and from a plethysmograph.
30. T F Extra systoles are an indication of a serious heart condition and the test should be halted immediately.
31. T F A subject should be instructed not to take prescription drugs on the day of their examination.
32. T F Psychopaths are always unfit for examination.
33. T F Where the condition is evident from the subject's behavior, your report on the examination should include a psychiatric opinion.
34. T F Vittorio Benussi is responsible for introducing the systolic blood pressure technique.
35. T F If the pneumograph pattern appears to slant to the left, it is probably centered too low.
36. T F The theory of psychological set does not apply to the R/I examination.
37. T F Cesare Lombroso introduced the use of the hydrosphygmograph for lie detection.
38. T F You are obligated to inform a subject of his reactions to relevant questions.
39. T F John Reid developed the control question technique.
40. T F When a nerve cell fires it is all or nothing.
41. F An axon is part of a neuron.
42. T A downward stroke of the pneumo pen on exhalation is caused by a vacuum in the pneumograph tambor.
43. T Serrated pneumograph patterns are often caused by the heart beat.
44. T The adrenal gland ceases to secrete when stimulated by the parasympathetic nervous system.
45. T A guilt complex question should not be used in an R/I series.
46. T A guilt complex question is meant to be obviously fictitious to the subject.
47. T Stimulation tests are essentially R/I examinations.
48. T You must never ask a question that has not been reviewed with the subject.
49. T The Backster S.K.Y. series includes a question about prior knowledge of the crime.
50. T The M.G.Q.T. has a control question for each relevant question.
51. T In an R/I examination, a control question is always placed at the end of each chart.
52. T A false key may be used as a control in a known solution peak of tension test.
53. T In a searching peak, the least likely item should be at the beginning.
54. T You may not call a subject deceptive if you get reactions in only the galvanometer, and not in the other channels.
55. T A suppression is a form of apnea.
56. T A high dicrotic notch indicates that the cardio pressure is too low.
57. T All court decisions supporting stipulated agreements have required the stipulation to be in writing.
58. T The only way to test a deaf subject is with sign language (finger talking).
59. T The primary purpose of a control question in an R/I series is to determine that the subject is still capable of reacting.
60. T Each R/I chart should have one or more overall truth questions.
61. T The S.K.Y. is not scored like the Backster You-Phase.
62. T Peak of Tension tests should never be used before an R/I chart.
63. T Innocent subjects rarely attempt countermeasures.
64. T Thinking of something else during the test is a form of dissociation.
65. T In an R/I chart a strong reaction should be followed by an irrelevant question.
66. T The Backster target selection method is not applicable to an M.G.Q.T.
67. T Target intensity refers to distinctness of issue.
68. T F In the Backster You-Phase the pseudo-relevant question on truth mentions the crime or issue.

69. The two chambers on the right side of the heart are:
right ________________
right ________________

70. When the cardio pattern rises and falls at the same rate as the pneumo the effect is called ________________.

71. The initials NDI mean ________________.

72. The kymograph speed of the Stoelting instrument is ________________, and the speed of the Lafayette is ________________.

73. The three elements in reading an R/I chart are:
A. ________________
B. ________________
C. ________________

74. The four elements in reading Backster charts are:
A. ________________
B. ________________
C. ________________
D. ________________

75. The electrodermal section (galvanograph) records:
a. skin conductance
b. skin resistance
c. skin potential
d. all of the above

76. In a zone comparison test the controls are separated from the relevants by:
A. ________________
B. ________________

77. In the Army M.G.Q.T. the relevant questions are numbered:
A. ________________
B. ________________

78. The kind of peak of tension test you use to locate evidence is a ________________.

79. At the beginning of a chart you have three opportunities to adjust the sensitivity of the galvanometer. They are:
A. ________________
B. ________________
C. ________________
90. Controlled breathing most often appears to be:
   A. Too fast
   B. Too slow
   C. Sharp and peaked at the inspiration

91. List at least two instructions that you must give in the pre-test which if not included will cause excessive general nervous tension.
   A. ____________________________________________
   B. ____________________________________________

92. The Positive Control Question Technique requires the subject to answer each question twice, first with a ____________ and then with ____________.

93. The 3T question in the Arther technique is a ____________________.

94. List five topics you could justify in screening pharmacists:
   A. ____________________________________________
   B. ____________________________________________
   C. ____________________________________________
   D. ____________________________________________
   E. ____________________________________________

95. ____________________

   I know the answer to question number _____ but I am confused by the wording of the question. I would therefore prefer to give an explanation:

   * * * * * *

ANSWERS

1. True, a precedent setting case denying admissibility.
2. False, the Maryland Court of Special Appeals denied admissibility.
3. True, it is.
4. False, the precedent setting case is State v. Dorsey, often used as a model for admissibility over objection. A Juvenile is a case of admissibility in Massachusetts.
5. True.
6. False, there are no cases indicating that the polygraph is intimidating per se, but there are a few cases where the polygraph along with other actions rendered the confession inadmissible.
7. True, but a warning of the subject’s Fifth Amendment rights is required by the APA.
8. True.
10. False, test cases have found the contrary to be true, it is not discriminatory.
11. True.
12. True, and examiners in private practice must know this.
13. True.
14. True.
15. False, the rules merely state "periodically and keep a record of the dates of calibration."
16. True.
17. True.
18. False, the brachial artery is in the upper arm.
19. False, the capillaries contract when blood pressure goes up.
20. False, arteries are surrounded by smooth muscle.
21. True.
22. True.
23. False, sweat glands and the adrenal gland do not have parasympathetic stimulation.
24. True.
25. True.
26. False.
27. True.
28. True, and the abdominal recording is the lower.
29. True.
30. False, they are rather common.
31. False, such an instruction would be dangerous to his health, and contrary to his best interests and yours; as the object of a prescription drug is to have the patient in a normal health condition.
32. False, experimental evidence suggests that they are fit for examination.
33. False, unless you are a psychologist or psychiatrist, you may not render such an opinion. However, you may describe precisely what happened and what was said. See Section 7 of the APA Principles of Practice.
34. False, he introduced the usefulness of the pneumograph.
35. True.
36. False.
37. True.
38. True, see Section 6 of the APA Principles of Practice.
39. True.
40. True.
41. True.
42. False, it is caused by pressure in the tambor from the compressing pneumograph tube.
43. True, and whether they are from the heartbeat or nervousness can be determined by counting the rate to see if it matches the heart rate.
44. False, see the answer to question 23.
45. False, it is often used in an R/I examination.
46. False, the subject should think it is relevant.
47. False, they are essentially peak of tension tests.
48. False (except in Utah where the regulations forbid this). Some techniques include a review of the topics but not the precise wording of the questions.
49. True, but the Army S.K.Y. appended to a zone series is much shorter and does not have this question.
50. False, this is one of the ways in which it differs from the zone.
51. False, it is used at the end of the last chart of a non-deceptive subject (NSR, Weir R/I series), to determine if the subject remains capable of responding.
52. True, a feature introduced by Richard O. Arther for the known solution peak of tension.
53. True.
54. False.
55. True.
56. True, and a low notch indicates too much pressure.
57. False, see particularly U.S. v. Oliver, 8th Circuit (1975).
58. False, there are other ways, using printed signs, projectors, etc.
59. True, see 51 above.
60. True (both Weir and Keeler technique).
61. True.
62. False, but it is not common. Sometimes done because the R/I relevant questions would give away the peak of tension items.
63. True, but sometimes they try to be helpful by controlling their breathing or doing other things which frustrate the examiner.
64. True, a countermeasure.
65. True.
66. False, the target selection method is applicable to all techniques.
67. False, each is a separate item in the target selection.
68. True.
69. ventricle and atrium
70.
71. vagus
72. No Deception Indicated
73. Stoelting is 6 inches per minutes, Lafayette is 2.5 mm per second.
74, 75, 76. Consistent, specific, and significant ("conspecnificant").
77. amplitude, duration, clarity, and lack of distortion.
78. c. skin resistance.
79, 80. a. years. b. age. Army trained examiners would also use: by place.
81, 82, 83, 84. a. 3, b. 5, c. 8, d. 9.
85. Searching peak.
86. Left ventricle.
87, 88, 89. pumping up the cuff, announcing the beginning of the test, and after the first irrelevant question.
90. b. Too slow.
91, 92. The cuff will make your arm feel numb, there will be more than one chart, questions will be repeated, etc.
93, 94. lie, than answer with the truth.
95. form of guilt complex question.
96, 97, 98, 99, 100. abuse of prescription drugs; theft of goods from a former employer; theft of money from a former employer; selling or giving drugs without a prescription; truthfulness of his application form (particularly his license, degree, experience).

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A B S T R A C T S

Employee Theft


A brief description of the cost of employee theft and theft from industry. Projecting the Department of Commerce's 1975 and 1976 figures to 1978, Forbes estimates that theft of various kinds cost U.S. business $40 billion last year. The rate, said Forbes, has grown at a compound rate of 15% a year.

An additional cost is the security industry which employs tens of thousands of people as guards, extra-policemen, insurance adjusters, etc. The author states that "The Department of Commerce insists that the rip-off business by employees has reached 'epidemic' proportions. 'Businessmen mistakenly assume that most inventory losses are caused by shoplifters when actually employees account for the major portion of inventory shrinkages,' this government agency maintains."
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ABSTRACTS

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employees has reached 'epidemic' proportions. 'Businessmen mistakenly assume
that most inventory losses are caused by shoplifters when actually employees ac-
count for the major portion of inventory shrinkages,' this government agency
maintains."
Fear of Crime

A special issue on the fear of crime will be published by Victimology: An International Journal in 1979. The issue focuses on positive and negative correlates of the fear of crime to actual crime statistics; manifestation of the fear of crime among females, the elderly, and the young in various social settings.

Individual copies of the journal and subscriptions may be ordered from Visage Press, Inc., 2333 North Vernon Street, Arlington, Va. 22207.

Microneurology


The article discusses the technique of microneurography and its limitations. Stimuli capable of changing sympathetic neural discharge, recorded from peripheral nerves in conscious subjects, are noted. The notion that both internal and external stimuli can alter sympathetic activity should encourage us to examine these factors as possible elements used by subjects to process signals representing a component of autonomic behavior. Since the technique involves impalement of nerves through the skin, it must be supervised by a physician. The article includes an interesting table comparing sympathetic outflow to muscles with sympathetic outflow to skin, based upon such activities as mental stress, relaxation, electrical shock to the skin, smoking, changes in environmental temperature, and other activities.

Address requests for reprints to Steven L. Wolf, Ph.D., Center for Rehabilitation Medicine, 1441 Clifton Road, N.E., Atlanta, Georgia 30322.

Psychopaths

Ronald Blackburn, "Cortical and Autonomic Arousal in Primary and Secondary Psychopaths," Psychophysiology 16 (2) (March 1979): 143-150.

Abnormal offenders were classified as primary or secondary psychopaths, or as conforming or inhibited nonpsychopaths by means of empirically derived dimensions of psychopathy and social withdrawal. Measures of electrocortical, electrodermal and cardiovascular activity were taken during rest, during repeated auditory stimulation, and during the cold pressor test.

Psychopaths were not significantly differentiated from nonpsychopaths, but several differences were found between primary and secondary psychopaths. Primary psychopaths were more aroused cortically and electrodermally, and showed less rapid adaptation and habituation. Secondary psychopaths were least aroused and showed signs of increasing drowsiness with repetitive stimulation. Secondary psychopaths in this study performed like primary or undifferentiated psychopaths in other reports, and possible explanations are discussed. The high arousal of primary psychopaths is not consistent with current theories of psychopathy, and attention to the relationship between psychopathy and the labelling of arousal is suggested. [Author abstract].
Validity


The author states that the polygraph has an accuracy of 64% to 71% against chance of 50% when the charts are scored blindly and are thus uninfluenced by clinical impressions of the subject or of the evidence against him. The test is biased against truthful subjects, at least half of whom are classified as deceptive. The author states that it seems probable that deceptive subjects could be taught to artificially augment their polygraph responses to the so-called control questions and thus avoid being scored deceptive. The author states that the impression that the lie test is highly accurate is erroneous and dangerously misleading.

For copies of reprints write to David T. Lykken, Department of Psychiatry, University of Minnesota Medical School, Box 392, Mayo Memorial Building, 420 Delaware Street, S.E., Minneapolis, Minnesota 55455.


The authors state that Lykken's critique is erroneous and his selective presentation of the data is misleading. Summarizing five studies (Horvath & Reid, 1971; Hunter & Ash, 1973; Slowik & Buckley, 1975; Wicklander & Hunter, 1975; and Raskin, 1976) the authors conclude that the combined results indicated that correct decisions were made with blind analysis from verified guilty and innocent subjects in 90% of the guilty subjects and 89% of the innocent subjects. The authors also take issue with Lykken's position on training subject's to beat the control tests and his position opposing admissibility of polygraph evidence.

For copies of reprints write to David C. Raskin, Department of Psychology, University of Utah, Salt Lake City, Utah 84112.

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