

Polygraph

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"SURVEY OF MEMBERS OF THE SOCIETY FOR PSYCHOLOGICAL RESEARCH
CONCERNING THEIR OPINION OF POLYGRAPH TEST INTERPRETATION."*

Conducted for: Patterson, Belknap, Webb & Tyler

By

The Gallup Organization, Inc.

Introduction

This volume presents the final report on a Survey of The Society of Psychophysiological Research concerning Their Opinion of Polygraph Test Interpretation. The Survey was conducted by the Gallup Organization, Inc. on behalf of Patterson, Belknap, Webb & Tyler.

Objective

The goal of the study was to obtain objective measurement of current scientific community opinion of the use of polygraph testing procedures to interpret whether a subject is or is not telling the truth.

To obtain this measurement, questioning was directed to the following subjects:

Have relevant scientists employed polygraph testing procedures themselves to test whether a subject is or is not telling the truth?

Have they been called upon to interpret the results of such tests obtained by others?

What is their current predisposition towards the use of polygraph test interpretations for determining whether a subject is or is not telling the truth? Would they consider them to be sufficiently reliable to be the sole determinant, or to reject them as being of no usefulness, or would they choose a median position that leans either towards regarding the tests as a useful diagnostic when considered with other available information, or of questionable use, entitled to little weight against other available information.

Questioning was confined to opinions of the use of polygraph test interpretation per se; no attempts was made to elicit opinion of the use of polygraph interpretations in any specific applications such as jury trials.

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The Gallup Organization, Inc. is located at 53 Bank St., Princeton, N.J. 08540. This survey was completed in December 1982.

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Interviewing

All interviews were obtained through administration of a questionnaire by telephone by experienced telephone interviewers of The Gallup Organization. The interviews were conducted from our central telephone interviewing facilities in Princeton, New Jersey. Neither the interviewers nor the respondents were informed of the objectives or sponsorship of the survey. All interviewing was conducted in the period of December 7-21, 1982.

Analysis and Report

The completed questionnaires were personally tabulated by the project director, who also prepared this report. All activities relating to the study were undertaken independently by The Gallup Organization. Representatives of Patterson, Belknap, Webb & Tyler approved the questionnaire and were informed of the sampling frame selected for the study, but were in no way consulted or participated in the survey process or the preparation of this report.

The Sample

A sample of 155 members of the Society for Psychophysiological Research was interviewed on the survey. This was drawn from the entire membership of the Society by a simple random selection procedure of every "n-th" name. Members who are not U.S. residents were excluded from the sample.

This Society was chosen as the sampling frame as it most closely demonstrated the attributes of a scientific society that would most likely be recognized by the overall scientific community as the relevant body of scientific opinion regarding the subject of our inquiry. The organization currently has a membership of about 900 persons who are academically or professionally involved in the field of psychophysiology and related disciplines. Although most members are psychologists, the Society also draws members from academic and applied fields of the Medical, Biological, and Physical Sciences.

The Society was started about 30 years ago by a group of psychologists sponsoring a newsletter on polygraph research. This group founded the Society, and the newsletter was replaced by a formal, refereed academic journal, Psychophysiology, which is now in its nineteenth year of publication. The Society holds annual meetings at various locations around the country.

THE FINDINGS

In the following report of the study findings, our commentary is restricted to the division of opinion among the 137 sample members who reported to us that they have received a doctoral degree. In the tabulations which accompany the test, the responses of 18 respondents who hold only an undergraduate or master's degree are also reported in full detail. A "total" column is presented in the tabulations for those readers who may wish to review the distribution of opinion according to the total sample of both doctoral and non-doctoral degree holders.

Gallup Survey of Psychophysicologists

Past Use of Polygraph Testing

About one in ten respondents (11%) claimed they have used polygraph testing procedures to interpret whether a subject is or is not telling the truth. An additional 19% volunteered that they had used such procedures, but only in a classroom or experimental setting. About two in three (68%) said they have not used the testing procedures for this purpose.

Here are the results and how the question was asked:

"In your professional or scientific practice, have you, yourself, ever used a polygraph testing procedures to interpret whether a subject is or is not telling the truth?"

TABLE I: RESPONDENTS' USE OF POLYGRAPH TESTING PROCEDURES

	<u>Total</u>		<u>Doctoral Degree</u>		<u>Non-Doctoral Degree</u>	
	No.	%	No.	%	No.	%
Have used to tell whether subject is telling the truth						
Yes	19	12	15	11	4	
Only in research or experiments	16	10	14	10	2	
Only in classroom demonstrations	10	6	7	5	3	
Only for other purposes	4	3	4	3	-	
Only as a subject, myself	1	1	1	1	-	
No	<u>105</u>	<u>68</u>	<u>96</u>	<u>70</u>	<u>9</u>	
	155	100	137	100	18	

Interpretation of Others' Measurements

Next, all respondents were asked:

"Have you ever been called upon to interpret whether a subject is or is not telling the truth on the basis of polygraph measurements obtained by others?"

Slightly less than one in ten (9%) reported they have been called upon to interpret the results obtained by others. An additional six percent drew distinctions that they had been called but had not served or had been asked to serve only in a classroom or experimental setting. The great majority (85) said "no" to the question.

Gallup Survey of Psychophysicologists

TABLE 2: EXPERIENCE IN INTERPRETING POLYGRAPH MEASUREMENTS

	Total		Doctoral Degree		Non-Doctoral Degree
	No.	%	No.	%	No.
Have been called upon to interpret measurements obtained by others					
Yes	13	8	13	9	-
Only for research or demonstration	5	3	3	2	2
Not for legal tests	2	1	2	1	-
Called, but declined	1	1	1	1	-
Would not even if asked to	1	1	1	1	-
As a consultant	1	1	1	1	-
No	132	85	116	85	16
	155	100	137	100	18

Opinion of polygraph testing

All respondents were then asked:

"Which one of these four statements best describes your own opinion of polygraph test interpretation by those who have received systematic training in the technique, when they are called upon to interpret whether a subject is or is not telling the truth.

- A. It is a sufficiently reliable method to be the sole determinant
- B. It is a useful diagnostic tool when considered with other available information
- C. It is of questionable usefulness, entitled to little weight against other information
- D. It is of no usefulness."

Only one percent each of the respondents chose the extreme position that either it could be used as a sole determinant or that it is of no usefulness. About six in ten (62%) stated it is a useful diagnostic tool when considered with other available information, but 35% questioned the usefulness of polygraph testing for interpreting whether a subject is or is not telling the truth.

Gallup Survey of Psychophysicologists

TABLE 3: OPINION OF POLYGRAPH TESTS FOR INTERPRETING WHETHER A SUBJECT IS OR IS NOT TELLING THE TRUTH

	<u>Total</u>		<u>Doctoral Degree</u>		<u>Non-Doctoral Degree</u>
	No.	%	No.	%	No.
A. It is a sufficiently reliable method to be the sole determinant	1	1	1	1	-
B. It is a useful diagnostic tool when considered with other available information	94	61	85	62	9
"Between 'B' and 'C'"	3	2	2	1	1
C. It is of questionable usefulness, entitled to little weight against other available information	50	32	46	34	4
D. It is of no usefulness	4	3	1	1	3
No opinion	3	1	2	1	1
	<u>155</u>	<u>100</u>	<u>137</u>	<u>100</u>	<u>18</u>

Self-rating on being informed

The greater majority of respondents rated themselves as being "very" (33%) or "somewhat" (57%) informed about the state of the art in polygraph testing and interpretation. Only about one in ten said they are "not well" (9%) or "not at all" (1%) informed.

Here is how the question was worded and the results.

"How well informed do you feel you are about the state of the art in polygraph testing and interpretation -- very informed, somewhat informed, not well informed, or not at all informed?"

Gallup Survey of Psychophysicologists

TABLE 4: RESPONDENTS' SELF-RATING ON BEING INFORMED ABOUT POLYGRAPH TESTING AND INTERPRETATION

	<u>Total</u>		<u>Doctoral Degree</u>		<u>Non-Doctoral Degree</u>
	No.	%	No.	%	No.
Very informed	49	32	45	33	4
Somewhat informed	90	58	78	57	12
Not well informed	14	9	12	0	2
Not at all informed	2	1	2	1	-
	<u>155</u>	<u>100</u>	<u>137</u>	<u>100</u>	<u>18</u>

Informed Opinion

When the responses of only those doctoral degree holders who would say they are very or somewhat informed about polygraph testing and interpretation are considered alone, little difference is found in the division of opinion on the matter of using polygraph tests for interpreting whether a subject is or is not telling the truth. The proportion who maintain it is a useful diagnostic tool drops from 62% to 60%, and the proportion that questions its usefulness rises from 35% to 39%.

Even on this basis, however, the majority opinion of those scientists interviewed is that polygraph test interpretations by those who have received systematic training in the technique, when they are called upon to interpret whether a subject is or is not telling the truth is a useful diagnostic tool when considered with other available information.

Gallup Survey of Psychophysicologists

TABLE 5: OPINION OF POLYGRAPH INTERPRETATIONS BY THOSE WITH DOCTORAL DEGREES AND POSITIVE SELF-RATING ON BEING INFORMED

	<u>Total Very or Somewhat Informed</u>		<u>Very Informed</u>		<u>Somewhat Informed</u>	
	No.	%	No.	%	No.	%
A. It is a sufficiently reliable method to be the sole determinant	1	1	1	2	-	0
B. It is a useful diagnostic tool when considered with other available information	74	60	27	60	47	61
"Between 'B' and 'C'"	2	1	1	2	1	1
C. It is of questionable usefulness, entitled to little weight against other available information	45	37	15	34	30	38
D. It is of no usefulness	<u>1</u>	<u>1</u>	<u>1</u>	<u>2</u>	<u>-</u>	<u>0</u>
	123	100	45	100	78	100

APPENDIX A

TABLE 6: HIGHEST ACADEMIC DEGREE RECEIVED BY RESPONDENTS

	No.	%
Bachelor's degree	6	4
Master's degree	12	8
Ph.D.	123	79
M.D.	12	8
Both Ph.D. and M.D.	<u>2</u>	<u>1</u>
	100	100

Gallup Survey of Psychophysicologists

TABLE 7: RESPONDENTS' CURRENT FIELD OF SPECIALIZATION

	<u>Doctoral Degree</u>
Psychophysiology	31
Physiological psychology	3
Clinical psychophysiology	1
Developmental psychophysiology	1
Psychophysiological brain functions	1
Psychology	14
Clinical psychology	20
Experimental psychology	5
Medical psychology	3
Developmental psychology	2
Neurological psychology	2
Biopsychology	1
Educational psychology	1
Social psychology	1
Psychiatry	6
Clinical psychiatry	1
Psychiatric research	1
Neuroscience	4
Behavioral neuroscience	1
Neurophysiology	1
Neuropsychophysiology	1
Neurological evoked potential	1
Clinical neuroscience	1
Medicine	1
Behavioral medicine	3
Endocrinology	1
Internal medicine	1
Medical research	1
Viadral medicine	1
Obstetrics & gynecology	1
Electrophysiology	3
Surface electrodes	1
Sleep psychophysiology	1
Sleep physiology	1
Sleep disorders	1
Anxiety	1
Autonomic physiology	1
Behavioral sciences	1
Biobehavioral sciences	1
Biofeedback	1
Cardiovascular physiology	1
Child development	1
Cortical and brain evoking potentials	1
Measurement and evaluation	1

Gallup Survey of Psychophysicologists

TABLE 7: RESPONDENTS' CURRENT FIELD OF SPECIALIZATION (cont.)

	<u>Doctoral Degree</u>
Motivation	1
Nicotine addiction	1
Physics and electronics	1
Political behavioral research	1
Psychodrama	1
Psychophilosophy	1
Sociophysiology	1
Stress management	1
Event-related brain potential	1
	<u>137</u>
	<u>Non-Doctoral Degree</u>
	No.
Psychophysiology	6
Clinical psychophysiology	1
Physiology	1
Electrophysiology	1
Psychology	1
Clinical psychology	3
Developmental psychology	1
Experimental psychology	1
Medical psychology	1
Biomedical engineering	1
Communications engineering	1
	<u>18</u>

TABLE 8: RESPONDENTS' PRIMARY AFFILIATION

	<u>Doctoral Degree</u>
	No.
University	58
University medical school, center	34
Hospital, medical center	7
Veterans hospital	4
Psychiatric hospital	4
Neuropsychiatric hospital	1
Research institute	6
Health Research institute	1
Psychiatric Research institute	1

Gallup Survey of Psychophysiolgists

TABLE 8: RESPONDENTS' PRIMARY AFFILIATION (cont.)

	<u>Doctoral Degree</u>
	No.
Pharmaceutical manufacturer	2
Aerospace manufacturer	1
Electronic manufacturer	1
Instrument manufacturer	1
Federal government	2
Federal government laboratory	1
Mental health clinic	2
Mental health institute	1
Private practice	6
Private group practice	2
Clinic	1
Foundation	1
	<u>137</u>
	<u>Non-Doctoral Degree</u>
	No.
University	12
University medical school, center	3
Research institute	1
Government research institute	1
Telecommunications firm	1
	<u>18</u>

TABLE 9: RESPONDENTS' TITLE

	<u>Doctoral Degree</u>
Department Chairman	3
Professor	32
Associate professor	21
Assistant professor	15
Associate research professor	1
Instructor	1
Laboratory director	7
Center director	2
Clinic director	2
Research director	1
Associate research director	1
Division director	1
Department director	2

Gallup Survey of Psychophysicologists

TABLE 9: RESPONDENTS' TITLE (cont.)

	<u>Doctoral Degree</u>
Associate director	2
Assistant director	1
Laboratory supervisor	1
Post-doctoral research fellow	4
Chief scientist	1
Research scientist	2
Associate research scientist	1
Research psychologist	7
Research physiologist	1
Research associate	3
Research assistant	1
Chief psychologist	1
Senior clinical psychologist	1
Clinical psychologist	8
Consulting psychologist	1
Staff psychologist	1
Psychologist	2
Engineering psychologist	1
Psychiatrist	1
Sociologist	1
Institute coordinator	1
Applications manager	1
Health administration officer	1
Management consultant	1
Management associate	1
Therapist	1
Intern	1
	<u>137</u>
	<u>Non-Doctoral Degree</u>
Doctoral candidate	8
Teaching assistant	1
Program manager	1
Research associate	1
Research assistant	1
Psychologist	1
Clinical psychologist	1
Clinical psychophysicologist	1

Gallup Survey of Psychophysicologists

TABLE 9: RESPONDENTS' TITLE (cont.)

	<u>Non-Doctoral Degree</u>
Biomedical engineer	1
Consultant	1
Administrative assistant	1
	<u>18</u>

APPENDIX B

TIME STARTED: _____

INTERVIEWER'S NAME: _____

TIME ENDED: _____

LENGTH: _____

INTERVIEWER'S ID#: _____

DECEMBER 1982

DATE: _____

THE GALLUP ORGANIZATION

PRINCETON, NEW JERSEY

JOB # GO 82132-2

Hello, I'm _____ calling from The Gallup Organization in Princeton, New Jersey. We are taking a brief survey on scientists' opinions on polygraph test interpretation.

1. In your professional or scientific practice, have you, yourself, ever used polygraph testing procedures to interpret whether a subject is or is not telling the truth?

1[] Yes

2[] No

3[] Other: _____

2. Have you ever been called upon to interpret whether a subject is or is not telling the truth on the basis of polygraph measurements obtained by others?

1[] Yes

2[] No

3[] Other: _____

3. Which one of these four statements best describes your own opinion of polygraph test interpretations by those who have received systematic training in the technique, when they are called upon to interpret whether a subject is or is not telling the truth. (READ LIST.)

1[] A. It is a sufficiently reliable method to be the sole determinant

Gallup Survey of Psychophysicologists

- 2[] B. It is a useful diagnostic tool when considered with other available information
- 3[] C. It is of questionable usefulness, entitled to little weight against other available information
- 4[] D. It is of no usefulness
4. How well informed do you feel you are about the state of the art of polygraph testing and interpretation -- very informed, somewhat informed, not well informed, or not at all informed?
- 1[] Very informed
- 2[] Somewhat informed
- 3[] Not well informed
- 4[] Not at all informed

The following questions are for background information.

5. What is the highest academic degree you have received?

- 1[] Bachelor's degree
- 2[] Master's degree
- 3[] Ph.D. (Doctoral degree)
- 4[] M.D.
- 5[] Other (specify): _____

6. What is your current field of specialization?
- _____

7. With what type of institution are you now affiliated? IF MORE THAN ONE MENTIONED ASK: Which is your primary affiliation?
- _____
- _____

8. What is your title or occupational specialty?
- _____
- _____

I HEREBY ATTEST THAT THIS IS A TRUE AND HONEST INTERVIEW.

(Interviewer's Signature)

So that my office can check my work in this interview if it wants to, may I have your name?

PRINT CLEARLY: _____

INTERVIEWER VERIFY AND RECORD TELEPHONE NUMBER:

Area Code: _____ Phone _____ - _____

* * * * *

STATEMENT OF NORMAN ANSLEY, CHIEF, POLYGRAPH DIVISION,
OFFICE OF SECURITY, NATIONAL SECURITY AGENCY BEFORE
THE ARMED SERVICES COMMITTEE, U.S. SENATE, MARCH 7, 1984

Mr. Chairman, I appreciate the opportunity to appear before the Committee today to explain the polygraph program at the National Security Agency.

NSA, and its predecessor agency, has used the polygraph as a personnel security screening technique since 1951. Originally it was used as an emergency measure to expedite the security processing of new employees who were awaiting clearance. In 1953, the polygraph examination became a condition of access for all civilian job applicants. Since the 1950s a polygraph examination has also been a requirement for contractor personnel requiring sensitive compartmented information (SCI) access. We also polygraph other affiliates such as GSA custodial personnel, Federal Protective Service Police and consultants. In late 1982 we initiated a program to polygraph Military assignees once they are on-board at NSA. I will say more about this later.

The function of the polygraph is threefold:

First, to assist in verifying the identity of an individual being considered for access to SCI. Secondly, to assist in focusing upon suitability and counterintelligence issues, though I must add that from my point of view all our polygraph questions and programs are concerned with counterintelligence. Third, to detect espionage, sabotage and terrorism or the potential for same.

We have three basic polygraph programs at NSA which are integral to our overall personnel security supervision program. This program includes background and special investigation, professional security officers assigned to major agency organizations and an aggressive security awareness program.

The first polygraph program is for initial access to sensitive information. Here we conduct full screening polygraph examinations of applicants for employment, contractor applicants for access, GSA personnel and a few other categories of affiliates. The full screening polygraph examination consists of relevant life style and counterintelligence questions. A second program is for single or special issues. Here we use the polygraph to help resolve issues bearing on the continued access of an affiliate - for example to resolve allegations of drug use or possible espionage by an affiliate.

We have had these two programs for more than 30 years.

Our third program is the aperiodic and reinvestigation polygraph. In August 1982 Deputy Secretary of Defense Carlucci, acting on recommendation from the DoD Select Panel on Personnel Security, authorized polygraph examinations of DoD affiliates who held sensitive compartmented information access. The Director directed this program be implemented at NSA. Since then we have been polygraphing on-board affiliates, persons having access to sensitive NSA information: employees, contractor personnel, and

Military assignees. The program applies to everyone. It is mandatory. The scope of this polygraph program is limited strictly to counterintelligence questions: Espionage, sabotage, unauthorized disclosure of classified information, unauthorized contact with agents of foreign governments and knowledge of others involved in the foregoing. For our purposes today I will call this the aperiodic polygraph program though in fact we polygraph our affiliates under this program under several criteria:

- . Randomly, aperiodically
- . At the time of the five year reinvestigation
- . For especially sensitive projects

Some statistics on this newest NSA polygraph (and I must add here that in years past we have had versions of this program but lacking the mandatory feature) are quite interesting. During the last ten months of 1983 we polygraphed 1770 affiliates under the aperiodic program. Of these 1699 showed no specific reactions to the relevant polygraph questions. Of the 71 who continued to show reactions, 67 were cleared up in a second polygraph examination and the remaining four in a third examination. Thus, of 1770 cases we have zero cases where we have unresolved issues based on our analysis of the polygraph charts. Some 30 of these 1770 people did provide us relevant information requiring a more detailed clearance evaluation. None of these 30 are spies. The information they provided is quite miscellaneous - I will give you three examples.

- . An individual said that he kept a classified military manual in his possession at his residence for several years. He originally took the manual home to study for a test. He returned the manual to us.

- . An individual knew of improper destruction of crypto keying material. However, he was not personally involved.

- . Another individual described a suspicious approach by foreign personnel and had failed to report this incident previously. This information is under investigation.

The aperiodic program has been well received by our affiliates. No one has refused to take the polygraph examination. And, so important for research and validity purposes, we have no cases in these 1770 where a person is under a cloud because of polygraph chart analysis. All cases have been resolved - no one stands accused.

Now I'll describe the overall scope and impact of our polygraph activities. In 1983 we conducted a total of 10,712 polygraph examinations in all the programs I've described. During 1983 we completed the security processing of 4531 applicants. We cancelled out 2563 or more than 50 percent for a variety of reasons including the applicant declining to participate in further applicant processing or declining a job offer. NSA's applicant review panel composed of personnel, security and medical managers, looks at problem cases to decide if processing should proceed. The problem may be medical, psychological, security, or employability. This panel rejected 815 people for further processing (included in the 1563 I mentioned above). I estimate that in 90 percent of the panel cases - or

733 of the 815 - information obtained during the polygraph interview was relevant to the decision not to further process.

While the polygraph process is a significant collector of information in our applicant processing it is no less a factor in the clearance processing of contractor personnel. During 1983 we polygraphed 1946 contractor personnel. Two hundred and fifty-seven were denied access based on information developed during the polygraph interview.

The NSA Personnel Security Program is established in Public Law 88-290 and we adhere to the standards set by the DCI for access to sensitive information. Most disqualifying information disclosed during the full screening polygraph examination concerns extensive drug use or undetected crimes. While of course rare, we have had some extraordinary admissions made by applicants during the polygraph interview - murder and train wrecking for example. You will see examples of important information developed during our polygraph examinations in two studies being put before you - The DOD/NSA Study on The Accuracy and Utility of Polygraph Testing* and the DCI Security Committee summary of major polygraph cases in the intelligence community Polygraph Utility Study, February 1984.

Prior to Mr. Carlucci's August 1982 policy we did not routinely polygraph military assignees. This is on the verge of being fixed. Under the new, proposed DoD polygraph program military personnel are to be polygraphed (CI questions only) by their parent service prior to assignment to NSA. And, as I mentioned they are under the mandatory NSA aperiodic polygraph program. Since December 1982, 679 military personnel have been polygraphed at NSA under this program.

These then, are the polygraph programs. They are only as effective as the polygraph and those that use it can make it.

The current instruments used by federal agencies are the product of 85 years of development by scientists and practitioners. The physiological channels which they record are the product of lengthy research. The instruments, which are of scientific quality, record respiration, electrodermal responses, and cardiovascular responses. The physiological information is recorded on a moving chart which has a speed of 2 1/2 millimeters per second (about six inches per minute). In each polygraph examination, there are at least two polygraph charts of several minutes each. In more complex situations, there may be as many as six or seven charts. The minimum time for an interview, including a polygraph examination is about one hour, but it more often takes from one and one half to three hours, and occasionally longer than that.

In the pretest interview, the subject of the examination reads a full statement of his rights. In all cases that includes mention of the Fifth Amendment right to avoid self-incrimination, mention that the subject may refuse to answer any questions, and that the subject may terminate the interview at any time. In a criminal case the Miranda warning is included, or Article 31 of the Uniform Code of Military Justice. When the polygraph is used in determinations for clearance and access to classified

* Published in the March 1984 issue of Polygraph.

information, we advise of the Privacy Act of 1974 which includes a discussion of the principal purposes for which the information will be used and mentions that the disclosure of the information is voluntary, and the information will be considered confidential. It warns the person that any information provided relating to violation of criminal laws will be disseminated to law enforcement agencies.

Following the explanation of the subject's rights, there is a review of the subject's general health, and fitness to take a polygraph examination. After that the examiner reviews the issues that are to be resolved during the polygraph examination which includes an opportunity for the subject to explain in detail their view of the matter under consideration. Working with the examiner, the subject and examiner arrive at mutually acceptable questions to resolve the issues. When the technique involves control questions, these questions are also reviewed in discussion with the subject and must be agreeable to the subject. This is also true of irrelevant questions and other questions that are part of the technique. The testing technique is then explained in detail to the subject. The attachments which are placed on the subject are also explained in detail. The subject is asked to sit still, pay attention to the questions and answer with a definite "yes" or "no", as appropriate.

Basically, the polygraph examination is a method of questioning whereby an individual is required to unequivocally respond with a yes or no answer to direct questions which have been previously reviewed with and the answers agreed upon by the subject of the examination. This questioning is done while the examinee is attached to a very sensitive instrument which monitors the person's respiration, electrodermal response, and cardiovascular activity to determine if there are any significant and consistent changes in these areas in direct response to any of the questions. The objective is to ascertain that there are no such reactions which would indicate that at the time of the examination, the answers posed no problems nor stirred any anxiety. Should significant and consistent reactions occur to any one or more of the questions, this would be a definite indicator that the answer provided to the question as worded on the test was not considered completely satisfactory by the examinee.

Reactions are significant changes from the baseline recording which is established as the norm in each of the recorded areas at the beginning of each polygram or chart. Depending on the individual examinee, these changes may be as massive as a total cessation of breathing or a major increase in blood pressure or as subtle as a change in the inhalation - exhalation pattern of respiration or slight decrease in skin resistance. the point is that the reactions will occur specifically at the problem question and not randomly, they will be significant to the trained examiner, and they will be consistently occurring at the problem question whenever it is asked.

Upon completion of the test series, the examiner makes an initial evaluation of the charts. If the results indicate deception, the subject is told that, and the specific questions are discussed. The subject is given every opportunity to explain his specific reactions to these questions and to make any admission that he chooses. The information provided will be the basis of additional or modified test questions in those areas in an effort to resolve the issue.

Just as there are several standardized intelligence tests and several standardized aptitude tests, there are also a number of standardized polygraph test formats. Each of these has its own name and format. Within the federal government, the commonly used techniques include Zone Comparison, Modified Reid Control Question Technique, Relevant-Irrelevant Technique, and Peak of Tension Technique. There are also standard variations of each of these. I am prepared to discuss these techniques in greater detail if the Committee so desires. First, however, I would like to show you a brief television tape of about three minutes that displays a portion of a polygraph test.

At NSA, at the conclusion of the examination and interview, the information provided by the examinee is reviewed with him by the examiner to ensure that it has been accurately noted by the examiner. When the examiner begins to prepare his report of the examination, he will again analyze the charts prior to making his final determination. The report of the examination, including the polygraph charts, the examiner's original notes, and the audio tape of the examination and review with the examinee, is reviewed by a supervisor senior examiner. This individual will do a separate analysis of the charts and then review the report with the tape to ensure accuracy. Once satisfied in these areas, the report is forwarded to our clearance division, a completely separate entity within the Office of Security, where the information will be evaluated to determine the individual's eligibility for access to sensitive compartmented information in accordance with the standards established by Director of Central Intelligence Directive 1/14 (DCID 1/14).

If the information provided is considered disqualifying and the individual is a military assignee, the sponsoring service is notified and usually takes appropriate action to reassign the person to other duties. If the information is not considered disqualifying but the assignee did not pass the polygraph examination, another exam will be scheduled with another examiner to attempt to resolve this matter.

This then, is the manner in which a "real world" polygraph examination is conducted and the quality control procedures work at NSA.

The validity of polygraph techniques has been the subject of research over a period of more than 85 years involving scientists in over a dozen nations. Lengthy research projects have been conducted in the United States, Japan, Israel, Canada, and a number of other nations. All of them arriving at rates of validity significantly above chance and high enough to indicate the positive value of the technique. There are two kinds of polygraph research. One involves the follow-up of real criminal cases in which the polygraph results are compared with either the final outcome of the case or an independent adjudication of the case file. More than 1900 criminal cases have been followed up in the United States, Israel, and Canada and the average agreement is above 96 percent. More than a dozen such projects have been conducted, with the largest being one by the Commonwealth of Virginia in which the validity of 959 cases was 98.3 percent. The range of all these studies is 86.3 percent to 100 percent. These statistical results, based on the follow-up of real cases, do not include those examinations in which the results were reported as inconclusive. It is the use of inconclusive range that gives the field examiner the opportunity to be fair and safe, and say, "I don't know."

Senate Testimony

Inspector Doran, of the FBI, has spoken of the importance of this inconclusive range. He said, "The inconclusive range serves a purpose - it is the safety zone and should be protected to avoid unnecessary errors. No examiner should render a judgment if he/she is not completely comfortable with his/her findings."*

When research is conducted in a laboratory setting where truth and deception is known (except to the examiner), the validity of polygraph techniques average 93.6 percent, with a range of 69.0 percent to 100 percent. Not all of the laboratory projects were conducted to determine validity. Some were projects to evaluate variations in techniques, methods of analysis, specific and often single physiological recordings, and differences in subject populations. For example, the third study by Hec- kel was of institutionalized delusional psychotics, which produced a low validity, 69 percent; while the several studies of psychopaths have surprised us, with an average detection rate in excess of 90 percent. One observation about laboratory work is that when the experient is close to field conditions, using trained examiners and good polygraph instruments, the results are uniformly high. That polygraph techniques are cross-cultural is evidence from the similarity of the results of studies made in Israel, Iceland, Japan, Canada, India, and the United States.

Among the major techniques, there is little difference in their accuracy. The laboratory validity of control question formats average 95.2 percent, relevant-irrelevant format average 96.8 percent, peak of tension formats average 91.2 percent, and guilty-knowledge formats average 94.4 percent. Analysis of research projects on screening examinations produced an average of 96.7 percent. Since field examiners often use combinations of techniques, no average can describe the accuracy of examinations for individual cases. Moreover, these percentages are so close that the differences are insignificant. It must be noted that screening is not a specific format. There are several standard techniques which are used in criminal investigations which are also used in government screening. The research shows that when these formats are used in screening examinations, the errors are not evenly divided, but show a slight trend toward calling deceptive persons truthful.

There are five scientific studies that are directly related to the validity of screening (Barland, 1981; Blum and Osterloh, 1968; Correa and Adams, 1977; MacNitt, 1942; Hemsley, Heselgrave and Furedy, 1979). There are others which have a relationship to the issue of validity in personnel security, but the research was not conducted for that purpose (Edel and Jacoby, 1975; Lykken, 1960; Leiblich, Naftali, Shmueli and Kugelman, 1974).

The first scientific study of the validity of screening was conducted by Professor MacNitt of Wilmington College 1942. Working with the Columbus Ohio Merchants Audit Bureau, they set up an experiment where he would give polygraph screening tests to 59 employees of various stores. The Audit Bureau picked some employees whose honesty and integrity were considered above reproach, some employees who had confessed to stealing

*"Inspector William Y. Doran Addresses Federal Examiners." Polygraph 10(2)(June 1981): 61-62. Inspector Doran was Deputy Assistant Director, Laboratory Division, FBI.

merchandise and money from their employers, and some employees who were known to have stolen goods but had not been confronted. All denied stealing during the tests. Using a relevant-irrelevant technique, MacNitt was able to correctly identify the guilty and the innocent employees in every case, for an accuracy of 100 percent. When he used supplemental searching peak of tension tests, he failed in getting a few details correct, as to the amount stolen, the year stealing started, and other specific details.

In 1968, Blum and Osterloh of Stanford University undertook a study in which real police informants were tested by police examiners, with regular polygraph instruments, using a relevant-irrelevant technique, as to the truthfulness of the informant's reports. Working with their police handlers, some informants gave completely true statements about what they had observed or heard, statements which were supported by investigations. Some informants gave partly true and partly false statements; and some gave totally false statements that were credible and compatible with their background. The informants were genuinely afraid to appear at police headquarters and be tested because of the consequences if discovered by their associates.

In screening these 20 informants, the examiners were able to identify whose stories were totally true, those whose stories were totally false, and those who told stories that were partly true and partly false. However, the examiners were not able in every case to correctly classify the individual items that were true or false, told by those informants who gave stories that were only partly true. Of seven subjects who told partly true stories, the examiners erred four times on the specific details of stories told by three of the informants. However, the examiners correctly identified 102 of 106 specific details of stories, for an accuracy of 96 percent; and were 100 percent correct in separating the truthful and lying informants.

In 1977 Correa and Adams, at the University of Georgia, simulated polygraph screening with 40 subjects. The tests consisted of three series of questions about information on a pre-employment data sheet. As in real screening, subjects who reacted to relevant questions were asked about these responses, and when appropriate, questions were rephrased and included in the next chart series.

The screening tests successfully identified all those who were completely truthful and all of those who were untruthful to one or more of the questions, for an accuracy of 100 percent. In regard to identifying the specific questions that subjects lied to, the accuracy was less than perfect. There were 180 specific lies told by the lying subjects with respect to items on their pre-employment data sheets. In addition, there were 60 control lies about a pre-employment interview, questions added as checks since some participants might not fully cooperate in truthfully answering questions on the pre-employment forms. One hundred and fifty (83 percent) of these questions were correctly identified as deceptive, and 30 (17 percent) were not. No truthful persons were called deceptive. The research had a secondary purpose, to decide if there was a difference in detectability of those with high motivation, a cash incentive, and those with low motivation. There was no difference in total detection of truthful and lying subjects, as that was 100 percent. There was a difference, in that the detection rate for specific lies was higher for

motivated subjects, but the difference was not statistically significant. The technique was relevant-irrelevant, a technique which uses control questions.*

One of the theoretical questions raised about screening, and other applications of polygraph technique, is whether detection is above chance when the subject is not emotionally involved. Some laboratory evidence suggests that if the subject doesn't care, the detection rate might be reduced. Another question is whether they will be detected at all. Hemsly, Heslegrave and Furedy at the University of Toronto in 1979 tested two groups of ten each, in which one group gave misinformation on parts of their biographical forms but no particular issue was raised about this. The other group was entirely truthful in filling out forms, and in both groups the stimulus intensity was minimal. The question was whether the autonomic nervous system, as measured by skin conductance, would show greater activity for those who were untruthful than those who were truthful. The results showed the skin resistance responses were significantly greater for deceptive responses than truthful responses.** The authors concluded that skin conductance could, in the laboratory, detect pure, unemotional deception.

An Army Intelligence Study, subsequently analyzed by Dr. Barland, considered three difference ways to read screening charts. The screening of 40 subjects employed a control question technique.*** Three methods were used to evaluate the charts: A Zone Method, a Greatest Control Method, and a Relevant-Irrelevant Method. The first two used a numerical system comparing relevant and control question responses. The latter considered the size and consistency of responses to relevant questions without direct comparison with control question reactions. Omitting inconclusive results, the Zone Method identified 81 percent of the deceptive persons and 75 percent of the truthful. The Greatest Control Method identified 68 percent of the deceptive and 83 percent of the truthful. The Relevant-Irrelevant Method identified 86 percent of the deceptive persons and 76 percent of the truthful.

When responses were analyzed for individual questions (250 truthful, 80 deceptive), only the Relevant-Irrelevant Method identified deceptive responses at greater than chance, the range being 54 to 69 percent. All of the methods were better than chance at identifying truthful questions, the range being 91 to 97 percent. The value of this research was in the variations resulting from difference analytic approaches.

* All current relevant-irrelevant techniques use control questions, but are not classed as control question techniques because of a fundamental difference in evaluating the charts.

** $S + 2.28$ Umhos for deceptive, $x + 1.40$ Umhos for truthful. There was no habituation effect, nor was there a sex difference.

*** Although the polygraph technique used for this research is not widely used for screening, the comparison of analytic techniques would not have been possible without it.

Another issue is to what extent can people be detected when they lie about personal details of their life, details they do not want to be detected. Is the act of deception of sufficient magnitude to be detected, as compared to the act of deception in denying a serious crime? In this experiment, there was an added complication, as the subjects were trained to confuse the examiner by producing false reactions. Dr. David Lykken of the University of Minnesota devised this experiment in 1960, in which 20 subjects were given practice in producing false electrodermal responses, with biofeedback reinforcement. Subsequently they were given a multiple choice-type test* in which correct biographical information was listed among five similar items of incorrect information. Only electrodermal recordings were made. The issue was whether the correct items could be detected from the incorrect items when the subject was actively trying to prevent that detection. There was a financial reward of ten dollars if they could defeat the test.

The personal information belonging to each subject was correctly identified by scoring the amplitude of electrodermal response in each of the 20 cases. The detection was 100 percent, despite the countermeasures.

Edel and Jacoby studied the consistency with which ten experienced polygraph examiners read charts from screening examinations conducted at a federal agency. The examiners were required to determine whether there was or was not a significant physiological reaction in each of the three physiological channels, respiration, electrodermal and cardiovascular, following each question. They looked at all the charts in 40 cases. Those charts involved 2530 questions. Thus the examiners, reading the charts blind, made 7590 decisions. The original examiners for each of the 40 cases were also asked to score their charts blind (and long after they were conducted). The agreement between the original examiners and other examiners was 96 percent. The average agreement between the blind raters was 94 percent.

Lieblisch and other at the Hebrew University of Jerusalem explored the effect of repeated presentations to subjects, and the ability to detect the subject's first name from among five. There were 58 subjects. The series of five names were repeated ten times, altering the sequence each time. There was a ten second interval between presentation of names, and only an electrodermal recording was made. The experiment was complicated by having high and low motivation groups and a subgroup among the high motivation group that attempted countermeasures. Chance was 20 percent.

Cumulative scoring (common to most polygraph formats) increased the detection rates for the 28 in the low motivation group from 60 percent on the first series to 90 percent. The high motivation group detection rate improved from 55 percent to 93 percent. The high motivation group that attempted countermeasures improved from 60 percent to 100 percent. The overall average improvement of detection was from 57 percent on the first series to 94 percent with cumulative scoring.

I have described these research projects in some detail to discredit the notion that there has been no research to validate the use of

* Called a Guilty-Knowledge Test.

polygraph techniques applied to personnel screening.

In regard to countermeasures, a well trained examiner will detect all of those common methods talked about on the street and published in popular books. Detecting and defeating countermeasures is part of our training in basic and advanced courses. Most of those so-called countermeasures do not even prevent the examiner from getting readable charts. Among the few that do, the subject's attempts are readily apparent.

Now it is obvious that truthful people do not engage in countermeasures where the test results are important to them. They want the examiner to succeed. The use and detection of those countermeasures which may prevent the examiner from getting charts that he can read is a sufficient basis for interrogation or further investigation. The practical consequences of detected countermeasures are the same as those test results indicating deception.

There is concern in the government about highly sophisticated countermeasures which may involve lengthy training of selected persons. DoD and other agencies are now involved in planning long term research projects in those areas.

In addition to the research described in the DoD Reprt, you should know that we have in DoD a number of research projects underway. There is a long term project, in its second year, developing a much improved instrument, including computer analysis of the physiological recordings. There are other projects looking at biofeedback as a means of enhancing polygraph techniques, and studies of countermeasures. There are several other research projects that will be sent out for bids soon. In addition, the National Security Agency and the Federal Bureau of Investigation are establishing a specially equipped joint research laboratory, staffed with psychophysicologists who are polygraph examiners. In addition to the two Ph.D. examiners, there will be a laboratory assistant, staff examiners and clerical support. They will conduct research on new equipment, the development of improved techniques for specific issue and screening applications, and other technique matters of mutual interest.

The utility of the polygraph was addressed earlier in my testimony and also will be evident from the 50 polygraph cases described in the report prepared by the DCI Security Committee.

In addition, the DoD Report on The Accuracy and Utility of Polygraph Testing gives more examples of the utility of polygraph testing. It describes cases where only the polygraph test gave us a lead into espionage cases; and it describes cases where innocent persons have been saved from trial, conviction, and even from jail because of polygraph tests. It describes how polygraph results compare with the results of background investigations, and the unique contributions made by both, plus the need for both methods, rather than one or the other. The report also compares the results obtained with interviewing without the polygraph, with the results obtained by interviewing supported by the polygraph. Last, the report describes all the major research conducted on polygraph validity, with a thorough analysis of the strengths, weaknesses and significance of that research.

Senate Testimony

Let me conclude on the most important point. We in the security and CI business must evaluate any program, including the polygraph, on the basis of its effectiveness in detecting or deflecting espionage. We at NSA have been saved from major problems by this invaluable tool. Both the DOD/NSA Report and the Security Committee Report contain summaries of such cases. Some are not without ambiguity and I don't propose to recount all these cases here. Let me summarize just two cases from recent years:

. A military person about to retire from active duty where he had access to sensitive compartmented information applied for a job with NSA. He had a clean record. He reacted to polygraph questions about espionage. He was confronted with these reactions. He said that only days before he had visited the Soviet Embassy in Washington to make arrangements to defect. However, the Soviets suggested he complete his processing for sensitive employment.

. An applicant for employment at NSA reacted to espionage questions. He then admitted knowing and working with a foreign intelligence officer. He declined to give us details and he continued to react to the relevant counterintelligence questions.

This information could have been gained no other way - only our skilled polygraph examiners saved us from potential disaster.

I have every confidence in the polygraph as a valid technique and every confidence in the skill and integrity of my polygraph examiners.

If you have any questions, I will be happy to answer at this time.

* * * * *

ALCOHOL AND THE PSYCHOPHYSIOLOGICAL DETECTION OF DECEPTION*

By

M.T. Bradley and D. Ainsworth

Abstract

Psychophysiological detection of deception examinations were conducted on 40 subjects. Of these, 32 were "guilty" of a mock crime and 8 were innocent. Sixteen guilty subjects committed the crime while intoxicated and the remaining 16 committed the crime sober. These two groups of guilty subjects were subdivided such that half of each group was examined with the polygraph while intoxicated and the other half was examined while sober. Two questioning techniques were used in the examination, a Control Question and the Guilty Knowledge Test. Measures of skin resistance, heart rate and respiration were recorded. The principal findings were that alcohol intoxication during the crime reduced detectability with detection scores derived from the measurement of skin resistance responses on the Control Question Test and on the Guilty Knowledge Test. The analyses of guilt/innocent classifications, based on the detection scores, showed these classifications to be affected by alcohol intoxication.

Successful psychophysiological detection of deception in a criminal interrogation depends upon the occurrence of larger physiological responses to crime-relevant questions than to control questions. This relationship may be affected by a wide variety of factors such as memory (Waid, Orne, & Orne, 1981), the perceived effectiveness of the detection apparatus (Bradley & Janisse, 1981a), individual differences (Bradley & Janisse, 1981b; Waid & Orne, 1980; Waid & Orne, 1981), and drugs (Waid, Orne, Cook, & Orne, 1981). The present experiment was designed to study the effects of the drug alcohol on detection. If alcohol affects detection, it is not only of theoretical significance but it is of practical importance since intoxication during a crime is common (Glaser, 1978) and alcohol ingestion prior to an interrogation has been considered as a countermeasure (Reid & Inbau, 1977).

The only published detection of deception experiment which examined

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drug effects involved the tranquilizer meprobamate (Waid et al, 1981). "Guilty" subjects, attempting to conceal information, given meprobamate before an examination were more difficult to detect than those given either a placebo or nothing. That is, skin resistance responses in a Guilty Knowledge Test examination were reduced to critical questions but not to control questions. The authors speculated, in accordance with the purpose of tranquilizers, that this result was due to anxiety reduction. Although such results seem straightforward, a recent as yet unpublished attempt at replication and extension failed to find drug induced differences in detectability (Boisvenue, 1982). "Guilty" subjects, attempting to conceal information about a mock crime they imagined (with the aid of a film) that they participated in, were detectable at high rates whether they received the tranquilizer diazepam, the stimulant methylphenidate, or a placebo. The contradictory findings from the two experiments suggest that more investigation is needed to understand drug effects.

Whereas the above mentioned studies focused on drug effects during the polygraph examination, the present study extended the investigation to alcohol intoxication during both the crime and the interrogation. Since alcohol affects emotion (McGonnell & Beach, 1968) and memory (Storm & Caird, 1967) and these processes may be operative during a crime, polygraph examination, or both, it was predicted that examinations could be affected whether the suspect was intoxicated during the crime, examination, or both.

Two polygraph examination techniques, the Control Question Test (Backster, 1969) and the Guilty Knowledge Test (Lykken, 1959), were selected because they might be differentially sensitive to particular disruptions from intoxication. That is, the Guilty Knowledge Test could be affected to the degree that intoxication disrupted recognition memory, whereas the Control Question Test could be affected to the degree that intoxication reduced emotional responsivity. Memory effects were expected with the Guilty Knowledge Test because of the necessary condition of the test that subjects recognize (remember) crime-relevant details. Since alcohol depresses memory (Julien, 1978), it was predicted that the Guilty Knowledge Test would be less efficacious whether alcohol was ingested before the crime (encoding the relevant details) or before the interrogation (recognition memory). Emotional effects were expected to play only a secondary role in the Guilty Knowledge Test since, if a crime-relevant detail were remembered, it would evoke an orienting response relatively larger than the responses to the appropriate control questions over a wide range of emotionality.

The predictions regarding intoxication, emotionality, and the Control Question Test were slightly more complex because the effects could depend upon when subjects were intoxicated. To understand this, it is necessary to point out, as Raskin (1979) suggested, that questions on the Control Question Test should evoke higher levels of emotional responsivity than questions on the Guilty Knowledge Test. This is because both control and crime-relevant questions on the Control Question Test are accusatory, threatening, and personal. In addition, for guilty subjects, the crime-relevant questions should result in greater responsivity because those questions require a direct denial of activities that subjects carried out. If the emotional impact of committing a crime were reduced by alcohol intoxication during the crime, it was predicted that responsivity to crime-

relevant questions on the Control Question Test would be reduced relative to control questions. Thus, guilty suspects would tend to appear innocent. Following the speculations of Barland and Raskin (1973), it was suggested that intoxication during the polygraph examination would have no effect on Control Question Test accuracy. Even though Barland and Raskin (1973) believed intoxication during the test would reduce arousal, they noted that it would reduce arousal for both crime-relevant and control questions such that the relative relationship between the two types of questions would remain the same. Thus, intoxication during the crime was expected to reduce responsivity specifically on crime-relevant questions, whereas intoxication during the examination would affect both types of questions.

Memory effects were not expected to be an important factor with the Control Question Test. The Control Question Test does not concentrate on details of the crime but concentrates rather on the simple issue of whether subjects committed certain actions or not. Pilot work in our laboratory had shown, at the levels of intoxication intended for this experiment, that subjects do not forget committing the crime although they may forget some of the details used on the Guilty Knowledge Test.

To simulate field conditions (Podlesny & Raskin, 1977) the present study used a mock crime paradigm involving a murder and the theft of money and information. All subjects were examined by a Control Question Test (Backster, 1969) and the Guilty Knowledge Test (Lykken, 1974).

Physiological measures of skin resistance, heart rate, and respiration were used for the polygraph examination. Of these measures skin resistance responses have been consistently effective in virtually every reported laboratory study of deception (Barland & Raskin, 1973). Heart rate measures have not been so effective but have yielded detection rates better than chance (Orne, Thackray, & Paskewitz, 1972). Laboratory results with respiration have indicated that it is only marginally successful (Podlesny & Raskin, 1977).

METHOD

Subjects

Subjects were 40 Caucasian male university students between the ages of 19, the legal drinking age, and 25 who volunteered after reading a consent form. The consent form told subjects that they would be interrogated for a mock crime which they may have committed or may be innocent of depending upon the condition to which they were assigned. The crime, the interrogation, or both, depending upon the assigned condition, could be carried out while they were under the influence of alcohol. Because any subject might receive alcohol, all had to be prepared to spend 5 supervised hours in the psychology lounge area following each phase of the experiment to allow blood alcohol levels to be reduced. It was required that subjects have previous drinking experience, and if they were aware of any medical problems that could possibly be complicated by alcohol, they were to obtain a doctor's written certification before participation could be considered.

Apparatus

A Grass polygraph was employed to measure heart rate, respiration and skin resistance response (SRR). Heart rate was detected from the little finger by a Grass photoelectric transducer embedded in an elasticized foam finger attachment. The pulse wave was recorded on one channel and pulse rate, in bpm, was recorded from a Grass cardiograph on a second channel. Respiration was measured by chest bellows positioned in the thoracic area immediately above the diaphragm. The bellows were attached to a Grass volumetric pressure transducer. Skin resistance was measured using Grass cup-shaped silver-silver chloride electrodes that were 1 cm in diameter. These were attached to the medial phalanges of the first and second fingers. The cups were filled with a 0.05 molar NaCl Unibase electrode paste. The signal was recorded with a Grass Low-level DC Preamplifier 7P1 with a sensitivity set according to each subject's response characteristics.

Interrogation questions were presented on a Sony portable tape recorded and the onset of each question was marked on the polygraph chart by pressing a connected hand button.

A medical demonstration mannequin dressed as a man in a trenchcoat and hat was used as the murder victim. The murder weapon was a metal model of a revolver.

Alcohol Dosage

Subjects in the intoxication conditions received a 1.0ml/kg of body weight dose of alcohol by drinking three glasses of 80 proof vodka (which is equivalent to 40% alcohol) mixed with orange juice. The drinks were given at 20-min intervals such that at the end of one hour as their blood alcohol approached the .12 level, the subjects were ready for the required tasks (Ray, 1978). Subjects in the sober conditions received an equivalent amount of pure orange juice in the same time intervals. No subjects were told which drink they had received in an attempt to keep them blind to the drug condition.

Design

The design involved 40 subjects, 32 who were guilty of a mock crime and 8 who were innocent. The 32 guilty subjects were subdivided such that 16 were intoxicated with alcohol and 16 were sober while committing the mock crime. At the time of the polygraph test, held approximately 24 hours later, 8 of each of the intoxicated and sober crime groups were intoxicated for the polygraph test while the remaining 8 from each group were sober. Half of the members of each group received one polygraph test first and the other second. Thus the design for guilty subjects included 2 levels of intoxication (sober or intoxicated) during the crime and polygraph test and 2 orders of test presentation. None of the innocent subjects received alcohol on their first day in the experiment. Four of them received alcohol prior to the polygraph examination while 4 remained sober. Groups of innocent subjects differed only on whether they were sober or intoxicated during the test and the order in which they received their polygraph tests.

Procedure

Each subject served in the experiment over two consecutive days. On the first day, after arrival at the laboratory, subjects were asked their weight. If they were in an alcohol condition, the laboratory assistant referred to an alcohol-weight chart, derived from Ray (1978), and then served them three measured glasses of vodka and orange juice at 20-min. intervals. Those in no-alcohol conditions were served orange juice in the same time periods. Following this, each of the 32 subjects in guilt conditions was taken individually to the door of a small office where after entry each found instructions on the desk. The 8 subjects in the innocent condition remained under the supervision of a laboratory assistant.

The guilt instructions portrayed a situation for subjects to read over and then act out. The underlined items in the following outline were used as critical items for the Guilty Knowledge Test. Each read that the room was in the back of a tavern and that the mannequin sitting in the chair across the room was a man with a safe combination (30-25-15) and a one dollar bill. The subject procured the items from a blue envelope in the man's left coat pocket after shooting him three times with a gun. The gun was in the top drawer of the desk. After memorizing the combination written on the envelope flap and placing the money in his right front pant's pocket, the subject hid the gun in a wastepaper basket and then left the office to spend the remainder of the day under the supervision of a laboratory assistant.

On the second day, when subjects returned to the laboratory area, they were served juice or the juice alcohol mixture, depending on the condition. After consuming the appropriate amount of beverage, they were accused of the crime, led to the polygraph room, and prepared for the polygraph examination.

Just prior to meeting the examiner, all subjects were reminded that though they were to cooperate in the interrogation they were to deny any involvement in or knowledge of the crime in an attempt to appear innocent. Also, guilty subjects were told that any money stolen in the crime could be kept if they were found innocent. As a final caution, subjects were informed that the examiner was blind not only to their guilt or innocence but also as to whether they had received alcohol at any time during the experiment. Therefore, they were not to reveal this information.

Subjects were seated by the polygraph after being introduced to the examiner. There, in a short pre-test interview (5-10 min), it was explained that the examination included two tests, the Control Question Test and the Guilty Knowledge Test. The major purposes of the interview was, however, to review questions on the Control Question Test. The crucial part of this test contained crime-relevant questions paired with control questions. Prior to the review, subjects were reminded that they must, on the one hand, answer "NO" to all crime-relevant questions because the innocent were truly innocent while the guilty were attempting to conceal their guilt. On the other hand, all subjects were to feel that they could discuss questions about their past life so that ambiguities could be clarified, making it possible to answer these questions with a "NO." This was done to make the verbal responding comparable between each of the crime-relevant and control question pairs. Subjects who did clarify ambiguities

on control questions were told to consider those tape-recorded questions as being prefaced by "Except for what you have told me..." The examiner has employed this technique in several studies with the Control Question Test and found it effective (e.g., Bradley & Janisse, 1981a, 1981b).

The questions and sequence were as follows:

1. Is your name _____?
2. Regarding the money, do you intent to answer all questions about it truthfully?
3. Are you convinced that I will only ask questions on this test that you have already okayed?
4. Before the age of 18 did you ever steal any money?
5. Did you shoot the man and steal the money and information?
6. While you were in school did you ever take anything of value?
7. Did you steal the money and information from the man?
8. Before the age of 18 did you ever physically harm anyone in any way?
9. Did you shoot the man?

Questions on the Guilty Knowledge Test were not reviewed and subjects were informed only that they would be asked a series of questions about items containing certain information only the guilty knew. All subjects were instructed to answer "NO" to every question. The critical details, the nine items underlined in the description of the instructions, were each embedded in sets of similar items to create the test. Two examples, one involving the one dollar stolen and the other the wastepaper basket where the gun was hidden, are presented below:

Regarding the money taken:

- Was it two dollars?
- Was it five dollars?
- Was it one dollar?
- Was it fifteen dollars?
- Was it twenty dollars?

Regarding the gun, did you hide it:

- behind the bookcase?
- under the desk?
- in the wastepaper basket?
- under the chair?
- in the filing cabinet?

The position of the key item in each set was randomly determined over the last four positions in the set. The first item served as a buffer item for the orienting response and that response was not included in the scoring of the test.

At the end of the polygraph test, after being told that the results would be available at a later date, subjects were sent to the supervised area to report to the laboratory assistant. The assistant administered a memory test for the crime-related items, under the strict assurance that none of the information would be available to the interrogator before he made his judgment. Following that, subjects were asked if they received alcohol and responded on a six-point scale (1 = not at all ... 6 = extremely) as to how intoxicated they were. They were briefed, reminded of their promise not to reveal critical information, and were released if they had in fact received no alcohol.

Instead of scoring polygraph records immediately after the subjects left, they were given to a laboratory assistant who numbered them according to a code known only to him. At the end of the experiment the records were returned to the examiner who then scored them. In this way no record could be associated with any particular subject.

The questions in both techniques had been prerecorded for presentation so that the examiner's vocal inflections would not vary across subjects. The recorded questions were spaced at 20-s intervals and it took 15 min to deliver the 45 questions on the Guilty Knowledge Test. The 9 questions on the Control Question Test were also recorded at 20-s intervals and each of the 3 presentations took 3 min to present. Depending on predetermined counterbalancing, subjects received either the three presentations of the Control Question Test or the one presentation of the Guilty Knowledge Test first.

Data Analysis

Three dependent measures were derived for analysis: heart rate deceleration, respiration cycle time, and SRR. Heart rate deceleration was obtained from the cardiograph output by subtracting the lowest rate in the 15 s following a question from the average of 3 s of baseline prior to the question. The amount of time to complete the first two cycles of breathing following the onset of a question was measured in mm for the respiration score. The SRR was measured as the maximum decrease in resistance in mm which occurred within 10 s following the beginning of the question. The expectations were that the greatest decreases in heart rate, longest respiration cycle times, and largest SRR amplitudes would be associated with deception. Detection scores were derived by a modification of procedures described by Barland and Raskin (1975) for the Control Question Test and by Lykken (1959) for the Guilty Knowledge Test. With the Control Question Test, for each physiological measure, every control and relevant question pair was assigned a score of +1, 0 or -1, depending on whether the measured response to the control question was larger than, the same as, or smaller than the response to the crime-relevant question. The test had 3 such question pairs and was repeated 3 times. Summing these scores yielded values which could range between +9 and -9. Subjects with scores in the positive direction would be responding more to control questions than to crime-relevant questions and thus would more likely be classed as innocent. The converse would hold for those judged as guilty. With the Guilty Knowledge Test, each of the 9 question sequences received a score of 2, 1 or 0 depending on the relative magnitude of the response to the critical item. If response to the critical item was largest, it received a score of 2, if second largest 1, and finally 0 for any other

response magnitude. In this test with nine, 4-item sequences plus a buffer item per sequence, the scoring ranged from 0 to 18. The higher the scores the more likely a subject was to be considered guilty. For each test a composite detection score was created by adding the three physiological measures together. For the Control Question Test composite, scores ranged from -27 to +27. For the Guilty Knowledge Test composite, the range was from 0 to 54.

The numerical data derived through these procedures, that is based on the sum of +1 to -1 pair rankings for the Control Question Tests and the sum of the response ratings for the Guilty Knowledge Test, were subjected to multivariate and univariate analyses of variance to test the major hypotheses. The analysis, outlined in the design section, for guilty subjects was a $2 \times 2 \times 2$, with two levels of intoxication (sober or intoxicated) during the crime and polygraph test and the two orders of test presentation. Innocent subjects, because they had received alcohol only prior to the polygraph examination but not prior to the crime, were not included in that analysis. To determine whether innocent subjects differed from guilty subjects and if intoxicated innocent subjects differed from sober innocent subjects, t-tests were used.

To determine how subjects might be judged in regard to the categorical classifications of "guilt" or "innocence," cutoff scores were determined for the two polygraph examination tests. A post facto method outlined by Raskin and Hare (1978) was used for the Control Question Test. Through graphing the detection scores, cutoff points were set which yielded the maximum number of accurate decisions while keeping the number of inconclusive judgments low. For the Guilty Knowledge Test, cutoff points were assigned to the lowest values that avoided classifying any innocent subject as guilty.

Chi square tests were used to ascertain not only whether subjects could be correctly classified by the various tests and measures but also whether the different experimental conditions altered detection rules. Statistical significance for all tests in this study was accepted at the .05 level of probability.

RESULTS

Detection Scores

Guilty Subjects: Control Question Test. A multivariate analysis of variance performed on the detection scores found that subjects who committed the crime while sober were more detectable than those who committed the crime while intoxicated ($F_{3/22} = 3.70$). No other main effects or interactions were significant. Examination of the univariate test for each measure revealed that the SRR scores in the sober crime condition ($\bar{X} = -3.25$) were lower than in the intoxicated crime condition ($\bar{X} = -0.63$), $F(1,24) = 8.12$. The detection scores for respiration and heart rate deceleration did not differ significantly between those who committed the crime while sober and those who committed the crime while intoxicated. No other main effects or interactions were significant with the individual response measures.

Guilty Subjects: Guilty Knowledge Test. No main effects or interactions were significant on the multivariate analysis. The univariate analysis with the SRR measure revealed that subjects who committed the crime sober had higher guilt scores ($\bar{X} = 11.07$) than subjects who committed the crime intoxicated ($\bar{X} = 9.25$), $F(1/24) = 5.45$. The analysis using heart rate resulted in a crime state by test state interaction, $F(1/24) = 7.25$. Simple main effects analysis showed no differences between examination states among subjects who committed the crime while sober. There was a difference between examination states among subjects who committed the crime while intoxicated ($F(1/24) = 6.45$) such that those examined while sober were more detectable ($\bar{X} = 9.5$) than those examined while intoxicated ($\bar{X} = 6.7$). Testing across crime states while holding examination states constant showed no difference among subjects examined while intoxicated ($F(1/24) = 4.50$) such that those who committed the crime while sober were more detectable ($\bar{X} = 10.0$) than those who committed the crime while intoxicated ($\bar{X} = 6.7$).

Guilt and Innocence Mean Differences. Analyses using t-tests were conducted to compare the detection scores of guilty and innocent subjects. On the Control Question Test, innocent and guilty subjects differed on the composite scores, $t(38) = 3.53$ ($\bar{X}_i = 5.0$, $\bar{X}_g = -3.5$); SRR, $t(38) = 3.82$ ($\bar{X}_i = 2.5$, $\bar{X}_g = -1.9$); and heart rate deceleration, $t(38) = 2.48$ ($\bar{X}_i = 2.1$, $\bar{X}_g = -1.1$), but not on respiration. The results with the Guilty Knowledge Test showed that innocent and guilty suspects differed on the composite score, $t(38) = 8.47$ ($\bar{X}_i = 11.0$, $\bar{X}_g = 26.1$); SRR, $t(38) = 6.74$ ($\bar{X}_i = 4.2$, $\bar{X}_g = 10.3$); heart rate deceleration, $t(38) = 4.4$ ($\bar{X}_i = 4.1$, $\bar{X}_g = 8.5$); and respiration, $t(38) = 4.0$ ($\bar{X}_i = 2.8$, $\bar{X}_g = 7.3$).

ACCURACY OF CLASSIFICATION

Guilty and Innocent Subjects. The accuracy of classifying subjects into categories of deceptive and nondeceptive, with the additional category of inconclusive for the Control Question Test, is displayed in Table 1 for each of the interrogation tests and dependent measures. The post hoc classification cutoff points were ± 2 , for all Control Question Test Scores including the composite, 8 for each of the individual Guilty Knowledge Test scores, and 18 for the composite (the sum of the measures). Before chi square analyses were conducted, the accuracy data were collapsed across the experimental conditions. This was done to avoid small expected cell frequencies and yielded, for example, with the composite scores on the Control Question Test, 28 correct, 7 incorrect and 5 inconclusive judgments. Significantly better than chance classification was obtained with the composite score ($\chi^2(2) = 24.35$), SRR ($\chi^2(2) = 16.6$), and heart rate deceleration ($\chi^2(2) = 10.5$), but not with respiration.

Collapsing the accuracy data across cells with the Guilty Knowledge Test before the chi square test showed, with the composite measure for example, that 38 subjects were correctly classified while 2 were incorrectly classified. Significantly better than chance classification occurred with the composite score ($\chi^2(1) = 30.6$), SRR ($\chi^2(1) = 21.0$), and heart rate deceleration ($\chi^2(1) = 7.2$), but not with respiration.

Hypotheses Tests on Classification Data: Guilty Subjects. Chi square tests were conducted on the classifications of guilty subjects by the Control Question Test. These scores are displayed in Table 1. The tests

Alcohol and Detection of Deception

Table 1
Accuracy of classifications with the Control Question Test and Guilty Knowledge Test

Crime Conditions	Alcohol Conditions		Accuracy of Classifications				
			Control Question Test			Guilty Knowledge Test	
			Correct	Incorrect	Incon	Correct	Incorrect
Composite Measure							
Guilty	Sober	Sober	7	1	0	8	0
		Intox	7	1	0	8	0
	Intox	Sober	3	2	3	8	0
		Intox	5	2	1	6	2
Innocent	Sober	Sober	4	0	0	4	0
		Intox	2	1	1	4	0
Skin Resistance							
Guilty	Sober	Sober	6	0	2	8	0
		Intox	6	0	2	7	1
	Intox	Sober	4	1	3	7	1
		Intox	3	1	4	5	3
Innocent	Sober	Sober	3	1	0	4	0
		Intox	2	0	2	4	0
Heart Rate							
Guilty	Sober	Sober	4	1	3	5	3
		Intox	6	1	1	7	1
	Intox	Sober	4	3	1	6	2
		Intox	5	2	1	3	5
Innocent	Sober	Sober	3	0	1	4	0
		Intox	1	2	1	4	0
Respiration Cycle Time							
Guilty	Sober	Sober	2	0	6	2	6
		Intox	3	0	5	2	6
	Intox	Sober	2	3	3	7	1
		Intox	4	4	0	3	5
Innocent	Sober	Sober	1	0	3	4	0
		Intox	1	2	1	4	0

were done to determine whether alcohol effects on detection scores were evidence on the distribution of classifications. To avoid expected cell frequencies smaller than that necessary for a meaningful interpretation of chi square, various cells were collapsed together. For example, with the Control Question Test composite, to test if the distributions of subjects among classifications differed between those who committed the crime while sober and those who committed the crime while intoxicated, the classifications of alcohol conditions during the polygraph examination test were added together. This resulted in 14, 2, and 0 sober mock crime subjects, and 8, 4, and 4 intoxicated mock crime subjects in the categories of correct, incorrect, and inconclusive respectively. The distribution of classifications of sober and intoxicated crime subjects were different ($\chi^2(2) = 6.3$) with the composite measure. Such differences were not found after following the same procedure for the SRR scores and heart rate deceleration scores. Respiration classifications differed ($\chi^2(2) = 11.69$). No

differences on any measure were found when crime states were collapsed and tested between sober and intoxicated interrogation states. It was not possible to do hypotheses testing with classifications based on composite or SRR scores with the Guilty Knowledge Test because of low expected cell frequencies. Chi squares were done with heart rate deceleration and respiration but the results were not significant.

ADDITIONAL ANALYSES

Guilty Subjects: Memory Test. A 2 x 2 analysis, crime state x test state, of the number of crime items remembered revealed no differences among the groups. Nineteen of the 32 guilty subjects correctly recognized all 9 items, 8 recognized 8 items, while 5 subjects recognized only 7 items. No differences were found on any of the physiological measures or composites when detection scores were compared between the 19 subjects who remembered all items and the 13 who forgot one or more items.

Innocent Subjects. To discover if sober and intoxicated innocent subjects reacted differently to questions on the detection examinations, several t-tests were conducted. No significant differences were found with either of the two detection tests or any of the three physiological measures. Because there were only 8 innocent subjects (4 sober, 4 intoxicated), it should be pointed out that the power of these analyses was low.

Alcohol Awareness. For experimental design considerations, an attempt had been made to keep both the interrogator and the subjects blind as to whether they received alcohol or not. The interrogator was able, even though uninformed as to subjects' alcohol conditions, to judge accurately the alcohol state of 17 of 20 intoxicated subjects and 18 of 20 sober subjects. This judgment was made after attaching the measurement devices but before beginning the physiological recording.

Subjects, though uninformed, were generally accurate in their assessment of their alcohol state. The 20 subjects who received alcohol prior to the interrogation responded that they believed they had been given alcohol. On average they rated their degree of intoxication as 3.7 on a scale where 3 was designated as "mildly intoxicated" and 4 as "moderately intoxicated". Of the 20 sober subjects, 17 indicated that they received no alcohol before the interrogation. All of the 3 who said they had received alcohol rated their intoxication level as 2, "slightly intoxicated" the lowest intoxication level available on the scale.

DISCUSSION

Those who ingested alcohol prior to the mock crime scored as less guilty on the Control Question Test than those who committed the mock crime while sober. This result occurred with the multivariate composite of scores and the SRR scores. The findings replicate results found by the present authors in a pilot study using essentially the same design but with no innocent subjects. Analyses of the post hoc classifications of guilt, innocence and inconclusive based on detection scores revealed differences due to alcohol intoxication. Those ingesting alcohol prior to the crime were more likely, when classified on the composite scores, to be classified incorrectly as innocent or inconclusive than those who were

sober during the crime. A similar trend appeared with SRR classifications but it was not significant. A Control Question Test classification difference was found with respiration. The difference was a result of a large number of subjects who committed the crime sober being classed as inconclusive. In general, alcohol intoxication during a mock crime can affect detection scores and not surprisingly the effects may significantly alter classifications based on these detection scores.

It is worth noting that the classifications in this study were determined on a post hoc basis and thus are not strictly comparable to studies classifying on a a priori basis. That is the classification results could differ if done on an a priori basis. The essential findings with detection scores, however, remain unaltered by the method of setting classification cutoff points. From this perspective the present authors attribute little interpretive importance to the respiration classification results since the underlying detection scores between the sober and intoxicated crime groups did not differ. Respiration generally has not been effective in detection studies (e.g., Podlesny & Raskin, 1978) with only Timm (1982) reporting high levels of detection scores.

It is not clear why intoxication would influence detectability on the Control Question Test. If, however, this type of test depends upon the emotional arousal of guilty subjects to crime-relevant questions, then these results indicate that the questions were less arousing if the crime had been committed under the influence of alcohol. Thus, it is possible that alcohol substantially reduced the emotional impact of committing the crime.

Another source or potential source of emotional arousal affecting reactivity is incentives contingent upon detection. In field situations the consequences of detection are severe. As such any reduction in reactivity to crime-relevant questions from alcohol intoxication during the crime could possibly be more than compensated for by the severity of the consequences contingent upon being judged as guilty in the interrogation. If that is a factor, then the generalizability of the present results to field situations may be limited especially since the incentive to avoid detection was only one dollar in this study. Raskin (1979) has emphasized the role of strong incentives even in laboratory studies and perhaps further studies on alcohol intoxication and the detection of deception should use stronger incentives.

In conformity with speculations by Barland and Raskin (1973), alcohol intoxication during the polygraph test did not affect the results. They had suggested that emotional responses to both control and crime relevant questions would be reduced somewhat equally. Thus, although responses would be small, the crime-relevant response would still be relatively larger.

On the Guilty Knowledge Test, alcohol effects were found with the SRR and heart rate deceleration. The SRR results showed that those who committed the crime sober had detection scores more in the guilty range than those who committed the crime while intoxicated, regardless of the test state. Test state interacted with crime state on the heart rate measure such that, only subjects who were intoxicated during both the crime and the polygraph test had low detection scores.

Since alcohol can affect learning and memory (Julien, 1978), and the Guilty Knowledge Test depends upon accurate memory (Waid, Orne, Cook & Orne, 1978), the most attractive explanation of the SRR results would be that, the learning of crime-related material while intoxicated was impaired. This explanation is difficult to support however, because the recognition memory test given at the end of the experiment showed high rates of recall that were equivalent across all groups. On the other hand, the final memory test could have been insensitive to disruptions in memory during the polygraph test for two reasons. The presentation of the Guilty Knowledge Test was serial and auditory such that, if the critical item in a set of similar items had not been given, subjects could be confused or uncertain about which is the correct item until they have actually heard it. In the final typewritten memory test all items were simultaneously present and subjects had only to recognize the correct item from among the incorrect items. Thus they did not have to make a decision about each item in isolation. The other problem was that the final memory test was the second testing so that subjects had the benefit of a prior experience with the exact questions asked. Because of these considerations, alcohol effects on memory for details cannot be discounted and could possibly emerge with a nonprompted recall test given after a greater delay following the interrogation.

As a countermeasure alcohol was not effective with the SRR and only effective with heart rate deceleration if the crime had been committed while intoxicated. It is interesting to note that the examiner, blind to the alcohol conditions, accurately judged the alcohol state of most of the intoxicated and sober subjects. Thus, unlike the results with a tranquilizer (Waid et al., 1981a), the probability is high that an examiner would be able to detect the presence of alcohol intoxication.

The results are potentially of great practical importance for field interrogations since suspects who committed a crime while intoxicated would have a better chance of appearing innocent than those who committed the crime sober. It would be revealing and possibly easy to find out, on a routine basis, whether or not suspects were sober or intoxicated at the time of a crime. Since many crimes are committed under the influence of alcohol (Glaser, 1978), an adequate quantity of data should be available.

A noteworthy feature of this study is the shift in focus away from drug effects during the interrogation. In the present study the effects of drugs from both the crime and polygraph examination are assessed. This strategy, besides reflecting field situations, allows the investigation of drug effects during the crime situation on memory and emotions and, although not found in this study, could reveal state dependent effects both for learning and emotion.

Because the present experiment included both a Control Question Test and the Guilty Knowledge Test, it is tempting to compare the relative effectiveness of the two tests. One should be cautioned against this temptation. The aim of the present study was to understand the differences between alcohol conditions on each test. There was no systematic plan to create equally favorable conditions for the tests. To attempt such a comparison would be difficult because of many factors involved. These include the wording of questions, the magnitude of incentives, the pre-test interrogation procedures, and the number and salience of critical items.

Factors such as the scoring technique may create differences. For example, Podlesny and Raskin (1978) report high detection rates with the Control Question Test using a seven-point judgment scale for each control and crime-relevant question pair. Yet another consideration may involve the wide variety of measures studied by such researchers as Dawson (1980) and Raskin and Hare (1978). Whether some of these measures would be more effective with one type of polygraph examination test than another remains an open question. Unless a series of experiments is designed for comparison purposes the temptation to interpret small differences between tests should be resisted.

In summary, alcohol intoxication during enactment of a mock crime affects detection rates on both Control Question and Guilty Knowledge Tests. Because these effects were the result of intoxication during the crime, it was speculated that emotional and memory processes were involved at this point. Alcohol intoxication during the polygraph test does not significantly affect the test results, which argues against its use as an effective countermeasure. Although these results are of interest to field detection, the limitations of the study must be kept in mind. For example, we do not know if the results would generalize to real crime situations. In addition, only two levels of intoxication, no or moderate intoxication, were compared. Perhaps different results, especially during the test, would occur at higher levels of intoxication. Alcohol effects on learning and memory are complex and include state dependent learning effects. A parametric study would be necessary to obtain a fuller understanding of its relationship to the detection of deception.

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ANALYSIS OF AGREEMENT IN POLYGRAPH CHARTS*

By

Eugene Edel and Lane A. Moore, Jr.

Abstract

A study was made of the reliability of judgements of polygraph examiners in analyzing polygraph charts. Forty representative polygraph interviews were utilized as case material. Polygraph examiners judged the significance or nonsignificance of physiological responses to 2530 individual questions. Percent-agreement scores were tabulated for examiners and for the three physiological measures.

The results indicate that there is a high degree of reliability even among polygraph examiners who were not present during the interview. Substantial consistency was found in determining the significant responses for all three physiological response measures.

Background

Orlansky (1962) has outlined one of the basic and most realistic methods for determining the reliability of polygraph results as follows:

"Comparing the results achieved by two or more polygraph examiners working independently on the same case material."

Kubis (1962, 1965) has reported on the reliability of polygraph results utilizing this technique and has reported a wide range of agreement scores for various studies. However, this research was based upon a "simulated theft situation" corresponding to the use of the polygraph in criminal investigations. Also, the raters utilized in the Kubis studies were relatively inexperienced in polygraph evaluation. These facts cast some doubt as to the generalization of these results from the laboratory to the "real life" polygraph screening interview as it applies to NSA.

Purpose

The purpose of this study was to assess the reliability of judgements among experienced polygraph examiners in independently judging the significance, or lack of significance, of physiological responses recorded on polygraph charts during applicant screening interviews. All case

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material utilized in this study was obtained during actual job applicant screening interviews conducted at the National Security Agency.

Specifically, the objectives of the study were to determine the magnitude of agreement between polygraph examiners in assessing the presence or absence of significant physiological responses to questions asked during the polygraph screening interview. The study also examined and compared the percent of agreement between examiners on each of the three physiological response measures, i.e., cardiovascular response (C), galvanic skin response (GSR), and respiratory response (R).

Procedure

A total of 40 polygraph cases, randomly selected were utilized as the case material for this study. Each case contained two or three polygraph charts and from 80 to 120 questions. In all 40 cases, responses to 2530 questions were recorded. All polygraph interviews were conducted under similar conditions using a patterned interview.

Ten polygraph examiners were utilized in the study. The examiners ranged in experience from several months to over ten years of actual polygraph interview experience. Each examiner acted as the examiner (E) on four cases, i.e., actually conducted the polygraph interview with the job applicant on a face-to-face basis. In addition, each examiner acted as a rater (R) on eight different cases, i.e., independently reviewed and judged the significance of responses on the polygraph charts without face-to-face contact with the job applicant or any knowledge of the information derived from the interview.

Method: Each polygraph examiner reviewed the polygraph charts and judged the physiological responses to each interview question on each of the three physiological response measures. The polygraph examiner reviewed the polygraph charts and categorized each response to each question as being: no specific reaction (NSR), or as a specific physiological reaction (SPR). If a physiological response was adjudicated as SPR, the examiner indicated in which of the three physiological response measures it occurred or in what combination of measures it occurred.

Responses were identified as follows:

NSR No Specific Response

SPR Specific physiological reaction

Those responses identified as SPR were then categorized as follows:

SPR in C

SPR in GSR

SPR in P

SPR in C and GSR

SPR in C and P

SPR in GSR and P

SPR in C, GSR, and P

For the analysis of the data, an agreement was defined as identical coding of physiological responses, *i.e.*, as being NSR, or if SPR, in which of the physiological response measures or combination of measures, the response occurred. For example, if both judges agreed a response occurred in the C tracing, but no response in the P or GSR, the total number of agreements was 3. If both agreed there was a C response, but one also reported a response in the GSR, and neither reported one in the P, then the total number of agreements was 2. Agreements were tabulated between pairs of examiners and a percent-agreement score was computed.

A further analysis of these data examined the degree of agreement with respect to the three physiological response measures. For this phase of the study, agreements and disagreements were defined as stated above.

For both analyses, the total proportion of agreements (*p*) was computed by dividing the total number of agreements by the total number of agreements plus disagreements.

The proportion of agreements was computed for the ten polygraph examiners across the 40 cases to obtain a percent agreement score for all judges. In addition, the proportion of agreements was computed across the ten polygraph examiners to obtain percent-agreement scores for the three physiological measures. Finally, the percent-agreement scores for cases where an examiner acted as E was compared with those obtained when acting as R, to determine if face-to-face contact with the examinee improved the consistency of response judgements.

Results

The percent-agreement scores between E and R and R and R, are presented in Table I.

TABLE I
Percent-Agreement Scores of Examiners and Raters

		Cardio	GSR	Respiratory
	Total judgements	Percent-Agreement	Percent-Agreement	Percent Agreement
E vs R	5,060	96	95	96
R vs R	2,530	96	91	96
Total:	7,590	96	93	96

As the table illustrates, the percent-agreement between E and R was 96 percent for C, 95 percent for GSR, and 96 percent for P. The percent-agreement for R vs R was 96 percent for C, 91 percent for GSR, and 96 percent for P. The overall mean percent-agreement score for E vs R was 96 percent and for R vs R, the percent-agreement score overall was 94 percent. Using Guetzkow's test for the reliability of categorizations

Analysis of Agreement in Polygraph Charts

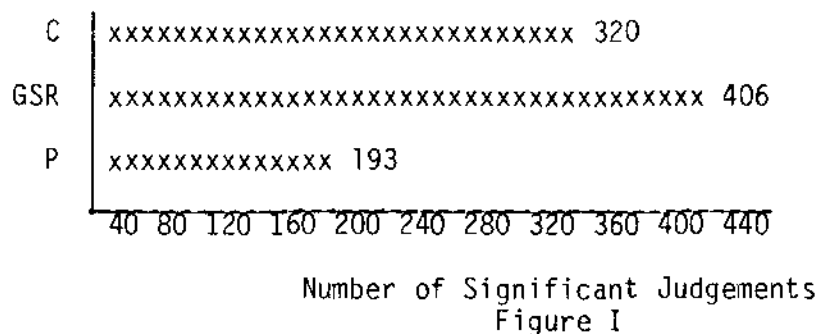
(Guetzkow, 1950), the probability of obtaining percent-agreement scores of this magnitude purely by chance is less than one in 10,000.

The percent of agreement between polygraph examiners was also computed for identification of responses according to the physiological response measure. Table II shows the percent-agreement scores for the three physiological response measures.

TABLE II
Percent-Agreement Scores for the Three Physiological
Measures (all responses)

	Total Judgements	Number of Agreements	Percent of Agreements
C	7,590	7,264	96
GSR	7,590	7,098	93
P	7,590	7,264	96
Total:	22,770	21,626	95

The preceding analyses were concerned with all agreements and disagreements between the polygraph examiners, including both those responses judged as NSR and SPR. An additional analysis was also made to compare the productivity of the three physiological measures in terms of responses judged as significant. Figure I illustrates the fact that the GSR was the most productive measure yielded slightly more than twice as many SPR evaluations than did the P measure.



[Number of Responses to 2,530 Questions Judged as Significant
for the Three Physiological Measures]

Discussion

The overall percent-agreement scores obtained suggest substantial reliability of polygraph chart analysis both in terms of between examiner agreement in determining the significance or nonsignificance of physiological responses and also in terms of the reliability of the three

physiological responses measures (C, GSR, and P).

These data indicated that polygraph examiners can consistently judge the significance of physiological responses. It would appear, that of the three physiological measures utilized, the GSR was the most sensitive and produced a larger number of responses judged as significant by polygraph examiners. However, the consistency with which significance is found in the three physiological measures was equally high. Finally, these data indicated that polygraph examiners who judge the significance of physiological responses using the polygraph charts alone, achieved the same high degree of consistency as the examiners who actually conducted the polygraph interviews on a face-to-face basis with the job applicant.

Summary and Recommendations

A study of the degree of agreement of experienced polygraph examiners, working independently on actual case material, indicated that there was a high degree of consistency in their judgment of physiological responses. Responses to 2,530 questions from forty polygraph interview cases were reviewed. Percent-agreement scores between examiners ranged from 91 to 96 percent, and between physiological measures from 93 to 96 percent, when all possible judgements (NSR and SPR) were included.

It is recommended that additional studies be conducted to further investigate the reliability of polygraph procedures. Of particular interest would be a study designed to assess the reliability of examiner conclusions based upon responses measured on the polygraph chart.

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THE PENILE PLETHYSMOGRAPH:
A NEW TRANSDUCER USED FOR DETECTION
AND THERAPY WITH SEXUAL DEVIATION CASES

By

Stanley Abrams, Ph.D.*

Abstract

The penile plethysmograph, which measures blood flow in the penis, is being employed to determine if suspects in child molesting cases had propensities in this direction. Since these findings may be used in conjunction with polygraph findings the writer has briefly reported on the various uses of this technique and its strengths and weaknesses.

A number of attempts have been made to study different aspects of physiologic functioning other than those already used in the field of polygraphy. Recently, a new technique has been developed which, while not an instrument to differentiate truthfulness from deception, serves a similar function.

The penile plethysmograph measures changes in blood flow in the penis that are associated with sexual arousal. While it has been employed principally for the diagnosis and treatment of those individuals with sexual deviations, it is not being utilized as an investigative aid as well. Typically, it is used in child molesting cases to determine if the suspect has propensities in this direction. A transducer loop similar to the device employed in polygraphy to measure blood flow in the fingers is wrapped about the penis. With the assistance of the subject, sexual arousal is brought about until a full erection is obtained. After relaxation, the subject is then shown sexually stimulating pictures of both nude women and nude children and with sexual arousal, an increased flow of blood to the penis results causing varying degrees of erection. A comparison of the individuals response can be made with his full tumescent state previously obtained.

Diagnosis

If the subject demonstrates eighty percent of his total erective capability in response to the stimuli of the nude women as compared to twenty percent in reaction to the child, this could be viewed as a strong argument for his innocence of any involvement in the child molesting. On the other hand, if opposite results are obtained, it is likely that the suspect has propensities toward being a pedophile. As will be discussed later, however, this approach is far from infallible.

The evaluation of the measurement of sexual arousal is accomplished through the comparison of the amplitude obtained for each stimulus or the total response to each stimulus. In the case of the latter it is a

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measure of the total area under the response curve. It would be comparable to measuring only the height of the GSR reaction, or to measure the entire rise and length of the response between questions. No advantage has been found for one technique over the other.(Abel, 1981a) The changes in penile circumference are compared to the percentage of the individual's full erection. The stimuli employed to cause sexual arousal may be visual or auditory and will vary in content depending upon the purpose of the examination. In contrast to the pedophile the suspected rapist would be shown stimuli depicting sex between consenting adults, a rape scene, and pictures showing a non-sexual assault upon a woman. Rapists in comparison to normals generally respond with sexual arousal to not only the rape scenes but to the stimuli showing non-sexual physical violence to women as well. In the case of homosexual rape, suspects would be compared in their response to heterosexual and homosexual activities. The logic of this approach can be easily comprehended by the lay population so it is understandable how this approach could have an impact on a jury.

For diagnostic purposes, this technique has been successful in differentiating among various kinds of sexual disorders. A rapist, therefore, will not necessarily respond to stimuli associated with sexual activity with children or homosexual activities.(Abel, 1981b) Moreover, large differences have been shown in the direction of no arousal at all to normal heterosexual activity in contrast to large responsiveness to some deviant behavior.

Therapy

From a therapeutic standpoint, these techniques are effective in charting the progress of a patient in treatment. A successful course of therapy would be demonstrated by increased responsivity to normal sexual objects and a reduction in sexual arousal to deviant stimuli. Through these findings, the therapist can determine if treatment should be intensified, altered, or terminated. Research findings have varied on the precise impact of the treatment. Some studies have reported that as deconditioning of the deviant sexual orientation occurs there is an almost automatic increase in sexual stimulation to normal sexual objects. Thus the penile transducer demonstrates with treatment that a pedophile who originally showed large arousal patterns in response to children and a low reaction in response to women will reverse this if the deviant behavior is corrected. In contrast to this, other studies have shown that treating the deviation alone is not sufficient.(Van Deventer, 1978) Instead, aversive conditioning such as having the patient inhale some unpleasant smelling substance like rotting umbilical cords while viewing stimuli associated with his particular sexual aberration only reduces his sexual disorder but does not enhance his reaction to women. In order to increase the patient's response to the opposite sex adult, the individual is instructed to masturbate at first in response to fantasies associated with his deviant behavior but to shift his fantasy to a normal heterosexual interaction immediately before ejaculation.(Brownell, 1977) Repeated trials of this procedure with the patient gradually starting the heterosexual fantasy closer to the initiation of the masturbation has been found to cause greater responsiveness to normal sexual objects.

Diagnosticians and therapists who have demonstrated some success in treating these patients have now expanded their role to evaluating

suspects in child molesting cases. Polygraphists inevitably will interact with these professionals who will be testing the same subject but from a different vantage point. They are not utilizing their instrumentation as a lie detector but only determining if the suspect has propensities in the particular area under study. Because they are not determining truth or deception this writer does not feel that they fall under the purview of any of the polygraph licensing laws.

Since there will be times when differences of opinion occur between polygraph findings and the results of the penile transducer, it is most important to be aware of the weaknesses of the latter technique.

Differs from Polygraph

The theoretical foundation of polygraphy is based on the concept that the fear of detection, generalized excitement, and/or emotional conflict cause sympathetic nervous system arousal.(Abrams, 1977) Some of the physiologic changes that occur are associated with changes in the cardiovascular system. The blood vessels in the digestive and genital areas constrict thereby reducing the blood in these regions. It is obvious that the body has little need for either genital or digestive activity when the organism is threatened. In contrast to this, dilation of the blood vessels occurs in the heart and skeletal muscles because one makes greater use of these areas during threat and the increased blood flow provides more nourishment and necessary hormones to these parts of the body allowing the individual to fight or run more effectively.

False Positives from the Penile Transducer

In the case of the subject being evaluated with the penile plethysmograph, while the sexually stimulating material might cause an increased blood flow to the penis, his awareness of the test as a threat would result in the opposite reaction. The fear of the consequences of his sexual aberration being discovered would cause sympathetic arousal and in turn a loss of blood flow to the genitals. It would seem likely that this could counteract the impact of the deviant sexual stimuli resulting in a false positive response, that is diagnosing a guilty person as innocent.

This thinking is corroborated by the impact that fear has upon sexual arousal in the functionally impotent. The male, fearful of being unable to respond sexually assures this very response by his fear. As soon as he becomes afraid of not being capable of either getting or maintaining an erection, the fear causes sympathetic dominance thereby reducing the blood flow to the penis resulting in the loss of his erection. He now is better able to fight or run but he will be unable to perform sexually or show tumescence on the penile plethysmograph.

Some research findings have demonstrated that individuals with various sexual disorders are well able to blunt their responses on the penile transducer when shown deviant sexual stimuli by fantasizing of non-stimulating objects. Moreover, they have been able to falsify sexual responses to normal sexual stimulation to which they would not ordinarily respond. In addition to this, they have successfully caused inaccurate finding through masturbatory activities or actually physically manipulating the sensor by inserting something between the penis and the transducer loop.

The false pattern of response obtained through these dissimulations is believed to be undetectable by even a sophisticated examiner.

In consideration of these findings, one must be most cautious in interpreting penile plethysmograph responses since "it is entirely possible to produce phony increases in sexual response in the presence of non-preferred stimuli and it is entirely possible to suppress the erection response in the presence of a preferred stimulus." (Laws, 1978) Freund (1963) showed that homosexuals were able to falsify a response to heterosexual stimuli through cognitive manipulation; and Henson and Rubin (1971) reported that normal subjects could quite easily suppress sexual responses in the presence of stimuli known to be effective in causing arousal reactions. In essence they were able to produce a perfectly believable set of tracings that no one could detect as a faked record.

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PASSING THE PRE-EMPLOYMENT LIE DETECTOR TEST
Command Publications, 1984, 38pp.

A Book Review

By

Vickie T. Murphy

This book takes an applicant on a step-by-step detailed version of a typical pre-employment polygraph interview with simple explanations of each phase, questions, theory, chart interpretation and employer use of admissions in obtaining job suitability. In addition, the author coaches the applicant on how to take a polygraph test without making any type of admissions, as well as pointing out typical examples of physical methods which may be self-induced by the applicant in an attempt to distort physiological responses.

The major theme of the publication is two-fold:

1. Stressing how important it is for the applicant not to make any type of admissions of wrongdoings, minor or small, and
2. How to use physical methods of self-stimulation to make responses stronger to the truthful areas of a subject's background as well as irrelevant areas.

The author points out that instead of trying to change or minimize responses when the applicant wants to lie, "an easier and more reliable way to conceal something is to make your response stronger to the truthful questions that do not threaten you... If your response to a truthful question is just about as strong or is stronger to a lie question, the examiner cannot determine which is which ... because the examiner compares one response with another in order to diagnose a lie response."

The author provides a list of methods for muscular activity and things to cause pain to use as a form of self-stimulation which includes:

drawing or contracting the toes inside of shoes
contracting or flexing calf muscles
straining or contracting thigh muscles
grasping arm chair (with free hand) to the point of straining
tensing or flexing biceps (on free arm)
contracting or tightening sphincter & buttock muscles
tensing jaw muscles & biting teeth
biting the tongue
digging thumbnail under the nail of another finger
biting the lip sharply

In addition, the author stresses:

"If an applicant offers an admission of wrongdoing or confessed a damaging fact at any point during the test, the test for him is concluded ... if you confess or make an incriminating admission, you won't get the job."

Book Review

"you want to exert this self-stimulation without the knowledge of the examiner and without calling his attention...since much of the examiner's time is taken up with questions, markings and the fact that they may be seated with their back to the examiner."

"...timing of your self-stimulation..start...about the moment of your answer and let up about 5 or 6 seconds..."

"it is in the applicant's favor if he approaches...in a cooperative manner with an attitude of straightforwardness and sincerity...good composure and dress...and don't project a sarcastic or skeptical attitude."

"let the examiner do the talking, and you just react pleasantly giving out as little information as possible."

"success depends on duplicating your strong(self-stimulated) responses by the first chart...if you follow the same stimulation plan it will support the trend of the first chart..."

and finally, how the applicant can maintain control in the post-test phase, continuing not to make any fatal admissions and provides the applicant with examples of how to answer when the examiner points out significant responses.

The author has laid out in detail for the applicant, lists of sample questions and formats, commonly used irrelevants, methods for distortions, and a sample self-programmed exercise using a possible chart for practice with explanations and reminders of the do's and don'ts.

The format is extremely informative of all aspects of the examination for any applicant, and is a must for examiners to be aware of counter-measures.

Finally, as I have referred throughout this review with "the author," it should be noted that at no point in the text, is the author's name even listed in his own text.

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