Polygraph

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THE POLYGRAPH AND PROBATION

By

Tony Teuscher

Abstract

Since 1973, Judges in Oregon have used the polygraph to keep track of felons placed on special probationary programs. Probationers are selected from among those with prior convictions who are considered ineligible for probation, and who would have been sentenced to prison. The special probation is awarded with the stipulation that they take periodic polygraph examinations, administered by the State Police. The success rate is over 50%.

Judges in Oregon are also experimenting with similar programs involving narcotics offenders who are in jail, and with convicted shoplifters. [Ed.]

On 30 May 1973, Judge John C. Beatty, Jr., Multnomah County Circuit Court, Portland, placed an individual on probation with the special condition that he participate in a program involving periodic polygraph examinations covering the conditions of his parole. Prior to that time Judge Beatty had a conversation with Lieutenant Lloyd Riegel of the Oregon State Police concerning the possibility of the polygraph probation surveillance program, and they agreed to try it. Since that time, and until May 1, 1977, Judge Beatty has placed a total of 107 persons on the polygraph surveillance program as a condition of probation. Other Judges in the Portland area, both in Multnomah and Clackamus County, have placed 10 individuals on the polygraph surveillance program as part of their probation.

In addition to the programs in the Portland metropolitan area, two other polygraph surveillance programs have been set up in the state. The one program in Klamath County is at the present time covering thirty subjects, mostly through the Circuit Court system; however, three are through the District Court system.

Selection

One basic criterion for selection for this program is that if it were not for the polygraph surveillance program, that individual would be sentenced to the penitentiary. Without the polygraph surveillance program,

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The author wishes to express his gratitude to Cpl. Bruce Lattin of the Oregon State Police for his assistance in preparing this article.

For a prior article on this topic, see Riegel, Lloyd "Court Use of the Polygraph in Probation Programs," <u>Polygraph</u> 3 (3) (September 1974): 256-271 probation under normal conditions would not have been granted as there was insufficient control of the individual's behavior to offer the community a significant degree of protection. Therefore, any success with these individuals is deemed a gain in that they are not in the penitentiary. Because of significant changes that have been made in their behavior, while under surveillance, they have worked and contributed to society, instead of being a drain on that society. To date, the results of the alternate sentencing method involving the polygraph surveillance program has been about equal among Judge Beatty's 107 individuals. This is, of course, an excellent record, considering that all of those in the program were otherwise ineligible for probation.

Statistics

Judge Beatty's Program 107 Probationers

SuccessfulUnsuccessful525247 presently on polygraph surveillance
program inside State of Oregon.
3 early termination because of excellent43 revoked and
sentenced.9 absconded

performance.
2 placed on polygraph surveillance program
in other states with participating polygraph examiners in those states.

Other Judge's 10 Probationers

Successful

8

Unsuccessful

Neutral

2 died

1 placed on

program.

out of state

rehabilitation

3

2 revoked and sentenced.

- 6 presently on polygraph surveillance program inside State of Oregon.
- 1 terminated early for excellent performance.
- 1 terminated because end of probationary sentence expired.

Overall Results to Date

60 successful 54 unsuccessful 3 others 117 cases (May 1973 - Sept. 1977) Success Rate 60/54 = 52.6%

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Polygraph Statistics

Type and number of examinations given by State Police from

May 30, 1973 to May 1, 1977:		
Screening exams upon entering program	90	
Examinations given after screening	201	
	291	Total
Number of truthful responses	126	
Number of deceptive responses	73	
Number of inconclusive responses	8	

Admissions During Examinations

The largest number of admissions involve the use of marijuana. However, some have admitted to the use of heroin, LSD and speed. There have also been a significant number of admissions of criminal activity while on probation, including theft, burglary, auto theft and other crimes. Many crimes have been detected that would have otherwise gone undetected. Individuals involved in those crimes have either been revoked and sent to prison, or successfully prosecuted.

Admission to Probation Officer

It should additionally be noted that several individuals whose probation has been revoked during the course of this program have been revoked prior to the time of their scheduled polygraph examination. The violations were confessed to their probation officer because the individual believed they would be detected by the examiners.

Property Recovery

Thousands of dollars of stolen goods and drugs have been recovered. Although detailed statistics have not been kept, in several of these cases, the property that was recovered has been returned to the rightful owner or restitution has been made. There have been several instances where individuals have admitted being in possession of such large amounts of stolen properties in a pawn shop in Vancouver, Washington. Arrangements have been made with that individual and the pawnshop that after the receipt of each paycheck, he must buy back stolen property he pawned with them and return that property to the rightful owners. Also as a result of the polygraph surveillance program, numerous firearms have been recovered from probationers, probably forestalling some violent crimes.

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Revoked Sentences

The individuals in this program are those persons whom the Judge would have incarcerated for a significant period of time. While we do not know what sentences would have been given to those who have succeeded, the length of sentences for those who failed is available. An examination of revoked cases reveals the following sentences.

Probationers	Years Sentenced
2	
1	2
2	3
18	5
1	6
1	7
4	8
15	10
1	12
l	15
1	20

Narcotics Cases - A New Program

There is a new program where 17 individuals are on polygraph surveillance while they are out of jail on their own recognizance on drug charges. These were convicted of use, sale, or promotion of narcotics. This program is relatively new and we are watching it closely to determine the feasibility of its continuance. The total that have been monitored are 32, of which 5 have been found untruthful. Of these 5, 4 have been returned to jail, and a warrant is out for the other individual. Fifteen have been successful.

Shoplifting - A Novel Program

The other area of use of the polygraph is in Umatilla County, under District Court Judge Richard Corsen, Pendleton, Oregon. This program is set up for shoplifters and is still in the experimental stage. It is noted, however, that a considerable amount of stolen property has been recovered or paid for.*

Conclusion

In view of the fact that all other programs within society have failed with these individuals at this point, a better than 50% success ratio achieved in the polygraph surveillance program indicates substantial positive results.

Several individuals have dramatically changed their behavior in society. Especially notable are the four cases whose probations were terminated early because of very good performance during the polygraph surveillance program. Additionally, many individuals who are still on the program have drastically changed their behavior for the better and continue to improve. For these, and for society, the program is a success.

*See also, "Polygraph Used by Judge to Get Shoplifters to Repay All Thefts," APA Newsletter, March-April 1976, pp. 9-10.

PROPOSAL FOR A REVISED SINGLE ISSUE TEST STRUCTURE

By

James Wygant

CHARTS:

<u>3rd</u>	<u>2nd</u>	lst	
1)	<u>8</u>)	1)	irrelevant
2)	2)	2)	symptomatic - Are you afraid that I'll ask you a question we didn't review?
3)	3)	3)	<pre>stim - Do you intend to answer truthfully each question in this test?</pre>
4)	<u>9</u>)	4)	isolated control (not overlapping relevant)
<u>10</u>)	5)	5)	relevant
6)	<u>4</u>)	6)	isolated control
<u>5</u>)	7)	7)	relevant
8)	<u>1</u>)	8)	irrelevant
9)	<u>6</u>)	9)	isolated control
<u>7</u>).	10)	10)	relevant

Rotated Questions Underlined.

WHY ANOTHER NEW TEST?

The test outlined above has obviously been derived from a combination of a pure Backster "You Phase" test and the subsequent modifications done to that test by the Army and by Dr. David Raskin and Dr. Gordon Barland. The emphasis in arriving at the present structure and its method of interpretation has been to try to construct a test format that is as objective as possible, meaning a test intended to produce the highest incidence of repeatable results. This is not a "new" test in the sense that there is anything proposed here that has not previously been suggested in one form or another. This is more in the nature of a "house cleaning." I have taken some old ideas and trimmed them up a little to try to make them work a little bit better.

The author is a graduate of the Backster School and attended the 1976 workshop at the University of Utah presented by Dr. David Raskin with Dr. Gordon Barland. He is in private practice in Portland, Oregon. We must assume that test structures that incorporate avoidable subjective elements do not guarantee the degree of objectivity that should be present in a test that is to be considered a scientific method. Tests in this category might include, for example, those which incorporate specific verbal stimulation of the subject between charts (such as reference to apparent reactions to certain controls or certain relevants); or which rely upon random mixing of the questions between charts, according to some variable choice of the examiner; or which involve examiner selection of the appropriate control to use in scoring, whether it be the weaker or the stronger control when there is an alternative; or which admit some measure of behavioral analysis.

Obviously the least scientific approach to lie detection is pure subjectivity, involving a determination of truth or deception based entirely on personal judgment of an issue, no other information furnished as background, no instrumentation permitted. Each of us exercises these judgments daily in our personal lives. But the fact that we even have lie detection emphasizes that subjective findings are not reliable and frequently are not credibable, largely because they are based on variable interpretations of data which itself may not even be apparent to some one else trying to confirm the judgment. Consequently, to whatever degree subjectivity is allowed to enter the test structure, the test results are made less reliable. The perfect test would be one in which an instrument, by itself, following routine procedures, could tell us absolutely when someone was being truthful or deceptive. That would be totally objective; but it is also totally impossible. Even with the best instrumentation imaginable, we would still need an examiner to formulate the questions. Obviously there will always be an element of subjectivity in lie detection, but the goal of any examiner should be to reduce that element to the smallest manageable level.

With allowances for the occasional failings of individual examiners, it should be possible for any number of examiners, given the same subject and issue, to devise and administer a standard test, to obtain similar raw data on the charts and to analyze that data in a standard way, so that the same conclusions are reached. Moreover, one examiner should be able to confirm another's determination simply by reading the charts and knowing no more than the locations on those charts of the various kinds of questions employed in the test. This is proof of reliability and, along with the validity established by verified tests and lab studies, we can demonstrate that lie detection is a science and not just a modern form of witchcraft.

With the increasing prominence of lie detection testimony in criminal courts, it is important to be able to convince the court that the test was not "manipulated", that routine procedures were followed as in every other test and that the results, therefore, were actually determined by the subject, not the examiner.

THE SINGLE ISSUE TEST ...

The definition of a single issue test is really the definition of the relevant questions in that test. A single issue test does not just ask

questions about one issue, for instance a burglary or a rape or an embezzlement. It asks the one question about that issue; and that question is usually some version of "did you do it?" The best test of that oneness is to use two questions about each relevant question: can a guilty subject who is deceptive to the relevant issue answer this one truthfully?; and can an innocent subject who is truthful to the relevant issue answer this one deceptively?¹ Consider the following three versions of a relevant question:

- 1) Did you steal (take) that money missing from Petunia's gas station?
- 2) Did you steal (take) that money from the safe at Petunia's gas station last Tuesday?
- 3) Did you steal (take) that money reported missing from the safe at Petunia's last Tuesday?

Assuming that question #3 contains the appropriate details, question #1 could draw a deceptive reaction from a subject innocent of this theft but guilty of previous, possibly undetected, thefts. Question #2 might permit a truthful reaction (i.e., lack of reaction) from a guilty subject who knew that the money he stole had been carelessly left out of the safe before it was closed. Question #3 passes the test of an issue defined narrowly enough to exclude deceptive reactions from innocent subjects, while not making assumptions that permit guilty subjects to answer truthfully. Other relevant questions should be similar.

The intent of this is to avoid that gravest of risks in a mixed issue test; a deceptive showing on only one issue because a subject has fixed with single-mindedness on what threatened him most in the test, to the exclusion of other issues to which his deception may remain undetected. As a corollary, there is of course the overall defect of a smaller number of data points upon which to base any determination, allowing the possibility for error resulting from careless question formulation.

The single issue test is meant to confirm with the highest possible accuracy the truthfulness or deception of a subject to a single accusation. This test is of limited value as an investigative aid where a police examiner has a multitude of subjects or issues, or degrees of subject involvement, but it could be the final test in any series.

DERIVATION ...

The Backster test, the single issue "You Phase" examination which is designed for specific examinations, is a set piece which has been used successfully for years. It incorporates three of Cleve Backster's significant contributions to lie detection: systematic numerical scoring; symptomatic

¹Paraphrased from p. 10, "Standardized Polygraph Notepack and Technique Guide" by Cleve Backster, 1963. [Ed.]

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questions; and isolated control questions which do not overlap the relevant issue.² A typical test on a theft would be:³

- 1) Is your first name John?
- 2) Regarding whether or not you stole that money last Tuesday from Petunia's, do you intend to answer truthfully each question about that?
- 3) Are you completely convinced that I will not ask you a question during this chart that has not already been reviewed?
- 4) Between the ages of 18 and 24 (assuming a present age of 25), do you remember ever stealing anything?
- 5) Last Tuesday at Petunia's gas station, did you steal that money that was reported missing?
- 6) During the first 18 years of your life, do you remember ever stealing anything?
- 7) Did you steal any or all of that money reported missing from the safe last Tuesday at Petunia's?
- 8) Is there something else you are afraid that I will ask you a question about, even though I promised you I would not?

I have taken the liberty of not using Backster's unique question numbers, which are confusing to someone not familiar with his indexing system and which are unimportant to a discussion about test structure.

The test begins appropriately with an irrelevant question to absorb the usual first-question reaction.⁴ The second question, which is not considered in the final determination of truth or deception, is identified sometimes as a "sacrifice" relevant and is intended to get the subject accustomed to the idea of being asked relevant questions. The portion of the question that appears after the comma is always the same. The third question is the first of two symptomatics (the other is number 8) which are always the same and are meant to discover whether the subject is distracted by the worry of a surprise question or some unrelated issue, perhaps an undetected crime. Reactions to those questions should cause the examiner

²It also introduced juxtaposition of all control and relevant questions to only one issue per set of charts. [Ed.]

³Questions 9 and 10 in The Backster Series are (44j) "Regarding Medication - are you holding back information about any pills or medicine you have taken during the last 8 hours," and (44k) "Regarding other lie detector tests - are you holding back information about any other time you have taken a lie detector test?" [Ed.]

⁴The Notepack has three irrelevants: born in the U.S., last name and first name, but not all three are necessary for an opening. [Ed.]

to reassure the subject, but never to probe for the troublesome issue. The two controls, questions 4 and 6, contain age cut-offs to isolate them from the occurrence of the relevant issue. And the relevant questions themselves contain enough specific information about the issue to mentally transport the guilty subject back to the crime and to isolate out the truthful subject. The relevant questions, 5 and 7, are switched on the second chart and, if a third chart is run, the questions are restored to their original positions. The test is scored by comparing the reactions at the first relevant question to the lesser of the two adjacent controls and comparing the second relevant to the preceding control. In other words, the test has a slight bias against deceptive subjects. This is a very strong and valuable test for deceptive subjects; but without some assistance, truthful subjects may tend to fall near or into the inconclusive category. The assistance that is suggested is specific verbal stimulation between charts in the form of advice to the test subject that he is not doing well on the certain questions (which we call controls). The justification for this is that it is not possible to over-stimulate on controls and that this procedure is only used when the first chart looks inconclusive or is already tending toward truthfulness. However, pre-judging test results is an extremely hazardous business and, I believe, unjustifiable when it becomes the basis for specific stimulation between charts. I am not convinced - lacking any reliable evidence --- that it is impossible to over-stimulate a deceptive subject on control questions, especially if the examiner has properly done his job of explaining to the subject that all of the questions in the test are important and relate to his truthfulness about the specific incident under inquiry.

The Army uses the older Backster system which has another controlrelevant pair after question 8, and nearly reversing the scoring procedure by comparing the first relevant to the adjacent control showing the greater reaction. No stimulation is needed between charts with this kind of scoring because of the extra points of comparison offered by the third controlrelevant pair.⁵

But because of the option of controls to match against the first relevant, the test contains a subjective element that weighs it slightly toward truthful subjects. Again, it should be stressed here as with the Backster test, this test works well. But it has that handicapping aspect to it that, if eliminated, might reduce the extent of subjectivity with a corresponding improvement in validity.

Raskin and Barland have taken the Army test and made a refinement toward greater objectivity. They compared relevant question reactions to the preceding control and then switched around the questions between charts to try to match strengths and to avoid the problems of a subject either anticipating a question or habituating to the location of questions. This rotation is done only when necessary according to the subjective judgment of the examiner.

⁵The original zone also allowed for the use of a guilt complex question in lieu of the third relevant. [Ed.] It should be pointed out that these tests are scored using simplified versions of the system developed by Backster in which points of plus or minus 1, 2 or 3 are assigned to each tracing (treating double pneumos as a single scorable tracing) for each control-relevant pair, a plus indicating a greater reaction to the control and a minus indicating a greater reaction to the relevant and a zero indicating equivalent reactions or no reactions. The numbers tell the degree of difference in reactions: 1 for subtle; 2 for obvious; 3 for dramatic⁶ (except for actual vertical linear counts in GSRa 2:1 ratio scores 1, 3:1 scores 2, and 4:1 or greater scores 3). The scores are then totalled and a sum greater than the specified cut-offs (the lowest possible score to safely permit a determination) is considered a conclusive finding of truth or deception.

THE CHANGES

Various people who have tampered with Backster's "You Phase" test have zeroed in on the wordiness of the questions. The two symptomatics (3 and 8) are particularly offensive in length; and the first one contains a double negative which frequently needs some explanation to test subjects. Beyond that, however, the second symptomatic question seems to raise the ugly spectre of a prove into the test subject's secret life, even though the intended purpose of this question is to aid the examiner in reducing outside interference. Few of my subjects fail to react to the question "Is there something else you are afraid I will ask you a question about, even though I promised you I would Not?" This question seems to function almost as a control. It certainly does little, in my opinion, to reassure the test subject that the examiner intends to stick to the case under inquiry.

The theory that the examiner should be given a device for detecting a distracting issue or uncovering a test subject's lack of confidence in the examiner seems to have much merit. However, the notion that an examiner can get any benefit from a reaction to a question like the second symptomatic is doubtful. Everyone probably has something he or she would not want to be asked in a lie detector test; and, by raising the possibility, the examiner injures the very rapport and confidence which he has been attempting to establish. Specific reinforcement between charts (for example, "You had a slight reaction to that question, but I told you we weren't going to get into any other areas and we didn't, did we?") does not, in my experience, seem to have a diminishing effect on the reaction. In many cases, it seems to stimulate an even greater reaction.

After extensive use of a modified version of the first symptomatic, "Are you convinced that I'll only ask you questions that we've reviewed?", which did away with the double negative problem (and using the second

⁶Actually, Backster and the Army employ specific rules for these levels of 1, 2, and 3, but the author's generalization is sufficient for his point. A description of the rules now taught at the Backster and Army schools would take several pages, and are irrelevant to this text. [Ed.]

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symptomatic intact); I concluded it would be better to devise a single question that incorporated elements of both of the Backster symptomatics. What I wanted was: a question which revealed a fear of surprise questions; a question which revealed a distracting issue, without encouraging the subject to search his mind for one; and a question that was short and easy to understand. The desireability of a single question to accomplish that purpose was two-fold: in a ten question test, every question must have demonstrable value--parsimony seemed to dictate, in relation to the narrowly defined benefit derived from these questions, that one would be superior to two; and it seemed worthwhile to avoid such excessive reassurance that the test subject developed fears or uncertainties that may not have occurred to him otherwise. You can only tell some one "I'm not going to hit you," so many times before he starts ducking.

The question which seemed suitable to this purpose was: "Are you afraid that I'll ask you a question we didn't reveiw?" The use of the singular ("a question" rather than "any questions") provides for what was revealed in the second symptomatic, while the balance of the question reproduces what was formerly covered in the first symptomatic. There is another crucial difference: this is a "no" answer question. The former test structure specified three "yes" answer questions (including the first symptomatic), followed by the first "no" answer in the test, a control. In the absence of any reliable test data that there is anything any more stigmatic in making a denial than in making an affirmation, my instinct suggests that a denial, the "no" answer, is probably inherently more stigmatic and therefore more likely to cause a reaction. Consequently it seems that prefacing a "no" control with three "yes" questions is going to cause an enhanced reaction to that control, both because the "no" answer is contrary to the pattern of "yes" answers before it and because it is simply the first "no" answer in the test. Use of the symptomatic to obtain that first "no" answer and to break the pattern of "yes" responses seems to be an additional benefit. Unfortunately this is only a judgment as the difference produced in the test, if any, would be subtle and difficult to measure.

This revised symptomatic was placed in the second position in the test, following an irrelevant which is intended to absorb the first-question reaction. For the second symptomatic, question 8, a second irrelevant was substituted. The justification for this is that the test subject needs a vacation at about that point if he is expected to respond evenly throughout the entire test. I have observed that the second symptomatic drew reactions as great or greater than those occurring on either side of it. This meant that the test subject was going through most of the test in a nearly constant reactive state, which contributed to general fatigue and, more specifically, diminished reactions on the last questions of each chart. Additionally, that subject was answering seven consecutive questions with the same "no" response (except for some victim tests with "yes" relevants), which for some subjects would have a conditioning effect resulting in diminished reactions.

My new symptomatic was inserted in position 2, instead of the third place, primarily because it was considered not as important as question 3;

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meaning that position 2 is generally considered a much more vulnerable position than 3 in that it is that much closer to the beginning of the test and any residual of the first question reaction. Another consideration was the desire to get questions about the test structure, as opposed to questions about the issue under inquiry, out of the way; so they would not intrude on the subject's thought processes about the issue being tested.

Question 3 is now a revised version of Backster's question 2, the "sacrifice" relevant, which was supposed to sound enough like a relevant to get the test subject accustomed to those kinds of questions; but it did not approach the issue under inquiry directly and was not scored. It was a cushion for the test subject, especially the truthful subject, a way of easing him into accusatory relevant questions. My form is: "Do you intend to answer truthfully each question in this test?" and it is identified as a stim question, having as its sole purpose in the test the stimulation of all subjects, truthful and deceptive. It is still not scored. The critical difference between the Backster and this version is that this new question clearly applies to all following questions in the test and does not stimulate either the controls or the relevants specifically (although there is probably a slight residual stimulation to the first control, only because the questions are adjacent).

The Backster version of the question began with reference to the issue under inquiry and then asked "Do you intend to answer truthfully each question about that?" That clearly refers to the relevant questions; but the test subject who sees all of the questions as related to the relevant issue would tend to identify this question as applying to a lesser degree to the control questions as well. This kind of ambiguity may cause a test subject to process information mentally and consequently experience a reaction. Information processing is part of the control question concept, and I believe this kind of ambiguity belongs entirely within the control questions and nowhere else in the test. It is not wise to risk creating in the mind of the test subject the notion that the examiner is trying to confuse him with certain questions or that any questions in the test, except possibly the controls, might mean something other than what they most apparently ask.

There has been the nagging possibility that for some subjects the "sacrifice" relevant question "set" them on the relevant questions and even c aused them to anticipate those questions to the exclusion of the controls, which is desirable only if the subject is going to be deceptive. Depending on how the question is understood, it does carry the possible implication that answers to the controls are not as important as those given to the relevant questions. In the interests of objectivity, a question clearly about both the controls and the relevants seems most suitable, one that is simple and does no damage to the subject's inclination to form his own "set" on either the controls or relevants.

The remaining questions in the test, the controls and relevants, are modeled along the usual lines. It is not necessary that the examiner be certain he is obtaining a lie in response to a control question, only that the response is a probably lie, or at least, is accompanied by enough uncertainty that a reaction will occur in a subject not otherwise troubled by the relevant questions. A good control should not permit the subject to be sure of his answer; for instance, I have had consistent success in theft tests with the control, "Between the ages of — and —, do you remember ever taking or receiving something you weren't entitled to?" Any confusion about the meaning of such a question should be turned back on the subject; the examiner should not attempt to answer or explain it for the subject ("You're the one who's got to answer it in the test—what does it mean to you?"). A "yes" answer in the pre-test to a control should be pursued and eliminated with the added phrase "besides what you told me", or something similar. Finally, the best controls, as shown in studies at the University of Utah, are those isolated from the occurrence of the relevant issue by the use of age brackets or some similar device.

Of course, the broad, non-specific and ambiguous nature of control questions precludes any finding of truth or deception with regard to them. Only relevant questions are constructed in such a way to permit that conclusion. It is axiomatic that a reaction does not necessarily indicate a lie; that conclusion depends on what was being asked, how it was constructed and the context in which it occurred.

ADMINISTRATION OF THE TEST ...

Question pacing is 20 seconds on the relevants and controls or at least whatever it takes to capture four breathing cycles between the start of one question and the beginning of the next. Pacing on the other questions in the test is not as critical, except that they should not be so close together to draw attention to the wider spacing of the controls and relevants. Accurate twenty second pacing on all ten questions is only a little more than three and a half minutes per chart.

The questions are all reviewed in advance with the subject in the manner favored by Backster. Relevants are reviewed as a group first, then controls, then the remaining questions. This is to establish as clearly as possible in the subject's mind that there is a group of controls and a group of relevants, one group dealing with past incriminating behavior and the other group dealing with the issue under inquiry. This is a simple but effective method of reinforcing a subject's psychological set on one group or the other, rather than on various questions of both groups. The subject should be given as much opportunity as possible to comprehend that there are questions specifically about the crime and other questions about similar activity but not including the crime.

The subject is advised that the order of the questions will be different on each chart; and he is candidly told that the reason for this is to cause him to listen to the questions and to avoid anticipating any particular question. The questions are first asked in the order shown in the test outline at the beginning of this report. On the second chart, the two irrelevant questions are switched in position and the last control (number 9) is moved up to number 4's position and 4 and 6 are each bumped down one. The numbering appearing on the chart would then be: 8-2-3-9-5-4-7-1-6-10. On the third chart the two irrelevants and the controls are restored to their original positions and the bottom relevant is brought up and the other two moved down, so the numbering on the chart is: 1-2-3-4-10-6-5-8-9-7. On a fourth chart, if there appears to be need for one, only the two

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irrelevants, 1 and 8, are switched. To avoid depressed reactions on the last chart, the subject is always told initially that at least three and possibly as many as five charts will be run; he is never told when the last chart is about to occur and, by personal preference, I never run five charts. If I ever foresaw a possibility of running five, I would initially advise the subject of the possibility of running six.

As written out above, the question rotation appears confusing, but with the numbers for the second and third charts written in the correct positions next to the questions which will be rotated (see the test outline), it is relatively simple to ask the correct question at the appropriate time.

There are actually only two kinds of question rotation occurring. The two irrelevants are switched so that the subject will not hear the same question first through all three charts and then react to the first rotated question just because it has that distinction. And the controls and relevants are alternately switched to provide exposure of every relevant to every control. For example, control question 4 is followed by and compared to relevant question 5 on the first chart, relevant question 7 on the second chart and relevant question 10 on the third chart. Additionally, no question is always in either the first or last position.

There is no between-chart stimulation on any specific question or type of question. The subject who seems to be running inconclusive may be told between charts that he is apparently having a little problem with a couple of the questions but that the problem will clear up by itself as long as he tells the truth. There is no indication, under any circumstances, that this means either control or relevant questions. He is left to draw his own conclusion and to "set" on whatever represents the greatest threat to him. The subject who asks is simply advised that he cannot be told specifically how he is performing on certain questions, in order to avoid compromising the test results. It should be stressed that even this kind of stimulation is to be avoided if possible, again in the interests of objectivity.

SCORING ...

The scoring techniques of Backster, the Army and Raskin and Barland are very similar except with regard to the selection of questions to be compared. This test is scored by those same general methods. Briefly, scores are obtained by analyzing pairs of controls and relevants. As expe cted from the manner in which the questions were rotated, the scoring pairs are determined on an objective basis: a relevant is always compared to the preceding control. It was previously shown that the rotation method described puts each of the three relevant questions against each of the three controls in a three chart test, so if any questions have unforeseen weaknesses or defects that caused greater or lesser reactions, it all averages out.

Values of 0, 1, 2 or 3 are assigned to breathing, GSR and cardio for each control-relevant pair, as previously discussed. There will invariably be some pluses and some minuses. The individual scores are then totalled; +6 or better indicates conclusive truthfulness to all three relevant questions (this is a single issue test); -6 or worse is conclusive deception; and anything inbetween is inconclusive. In this test format the number of charts run is irrelevant to the cut-offs, which can remain plus or minus 6 because neither truthful nor deceptive scores are enhanced on any chart by "handicapping" (i.e., comparing a relevant to the most favorable or least favorable control) and because the simple addition of a series of plus and minus scores has the effect of averaging. A subject who scores +9 after three charts will not score much higher or lower after six charts (assuming the subject can still be tested) because the same inconsistencies, some pluses among the minuses or vice versa, will continue to appear in each chart. The preceding method of scoring applies only to the single issue tests.

When it is unavoidable, this test format may be used for a mixed issue test, that is a test with three different relevant questions. Then, however, the examiner can not total his score for the entire test to arrive at a single determination of truth or deception. He must accumulate three totals, one for each relevant question, and establish cut-offs to differentiate between inconclusive and conclusive results. I have assigned plus or minus 3, the total for any single relevant question, as being a conclusive result. This number is based upon the observation that strong results on a single question seem to achieve no greater score than 6 or 7, while average is 2, plus or minus. For a deceptive subject to be identified as truthful, or vice versa, his reactions to a single relevant question and the three controls it was paired with would have to be inaccurate by at least six scored points, an unlikely occurrence but not as unlikely as the twelve point spread on three questions in the single issue test. There is no way to build as great a safety margin into this mixed issue test; and the examiner must recognize that conclusions will suffer from a severely diminished data base. In a single issue test in which the examiner reviews the breathing, GSR and cardio tracings for three controls and three relevants over three charts, that examiner has made 54 judgments and assigned 27 separate scores to one issue before arriving at his final determination. In this mixed issue test the number of judgments per issue is only 18, the number of separate scores only 9.

CONCLUSION ...

The rationale for this test structure is objectivity, which translates into as little interference by the examiner in the test as possible. This test works well, but so do others. There is no perfect system, but that does not deny that some may be better than others. This is only an attempt at improvement. What is important and has been stressed before by many others is that some kind of justifiable system is necessary for any examiner. The time is rapidly approaching when the examiner who cannot explain his test and produce charts which permit confirmation by other examiners will no longer be regarded as an expert. This mems a desireable goal.

* * * * * *

THE PEAK OF TENSION TESTS

UTILIZED IN THE ASHMORE KIDNAPPING

By

Owen M. Wilkerson

Abstract

A series of searching peak of tension tests were successfully used on a suspect in a kidnapping case to locate the bodies of the victims.

On March 17, 1977, at 3:30 p.m., Lori Ashmore, daughter of Phillip and Kendall Ashmore, telephoned her father, a Construction Company President, at his business office in Tulsa, Oklahoma, and inquired as to the whereabouts of her mother. She informed her father that a student was at the Ashmores' ranch waiting for a riding less on. Mr. Ashmore told her to call her mother on the mobile telephone in the truck Mrs. Ashmore was driving. Lori attempted to call her mother, but when the telephone rang, it sounded as if someone picked up the receiver, then immediately placed it back on the telephone. Lori again telephoned her father and told him what had happened. He then telephoned the mobile telephone in the pickup and received the same results.

At 4:30 p.m., Phillip Ashmore arrived at the ranch. He made several attempts to contact his wife on the mobile telephone with negative results. At 6:30 p.m., Ashmore received a telephone call from a man who said he was holding Mrs. Ashmore and Kathy Brown, the Ashmores' horse trainer. The caller told Mr. Ashmore to put \$500,000 in a canvas sack and he would call again the following day with instructions.

The Oklahoma State Bureau of Investigation and the Federal Bureau of Investigation were contacted and a kidnap investigation was initiated.

A telephone trap was placed on the Ashmores' telephone. A telephone trap keeps the circuit open even after the caller has terminated his call, thereby enabling the circuit to be traced to the originating instrument.

On March 18, 1977, an acquaintance of the Ashmores who had been told of the kidnapping, noticed the Ashmore truck parked at the 91st Street and Memorial Drive intersection in Tulsa, Oklahoma.

On March 18, 1977 at 6:54 p.m., Phillip Ashmore received another telephone call from the suspect who told him to place the money over the fence at the rodeo grounds in Jenks, Oklahoma. The telephone trap revealed

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The author is an Agent of the Oklahoma Bureau of Investigation, a graduate of the Zonn Institute of Polygraph, and an APA Member. He has received official commendations from the Governor of Oklahoma, the Oklahoma Bureau of Investigation, and the Tulsa District Attorney's Office for this case.

the call had originated from the trailer part in Jenks, Oklahoma, and records indicated the number was listed to an ex-convict named Larry L. Chaney.

At approximately 7:39 p.m., Ashmore placed the ransom money at the rodeo grounds. At 9:28 p.m., he received a second call telling him he had left the money in the wrong place, and that he would be called again the following night with new instructions. This call was traced to a telephone booth located in south Tulsa. The booth was processed for latent prints and a palm print belonging to Chaney was found on the receiver.

On March 19, 1977 at 3:00 a.m., Chaney was arrested at his residence and charged with kidnapping. He denied any knowledge of the kidnapping or the women's whereabouts. The area at 91st Street and Memorial Drive was searched with negative results.

On March 21, 1977, four days after Kendall Ashmore and Kathy Brown disappeared, Chaney's attorneys agreed to a polygraph examination concerning the location of the missing women utilizing the "searching peak of tension" technique. It was agreed the examiner would ask only geographic locations and Chaney would answer, "No," to all locations.

On March 22, 1977, OSBI Agent/Polygraph Examiner Mike Wilkerson, two defense counselors, and Tulsa District Attorney S. M. Fallis, met with Chaney. The attorneys requested that a tape recorder be placed in the room to ensure that all promises were kept. One attorney advised against taking the examination because, "The machine doesn't work and everybody knows it." Both attorneys examined the test questions and maps which had been prepared the previous night.

Agent Wilkerson found Chaney to be a meek, well-mannered man, thirtyfive years of age. His build was a stocky 165 pounds on a 5'8" frame, and he wore a high-quality, medium-length hair piece. Chaney's cousin had mentioned that Chaney was so self-conscious about his hair piece that his cousin had not observed it off his head in the two years they had lived together.

It was readily discernible that Chaney was disarmed by courtesy and kindness and a good rapport was established. The examiner complimented him on his physical condition and referred to him as a "hoss," a term used in the southwest denoting physical strength and masculinity. It was obvious Chaney was looking for a friend, one who would tell him how "macho" he was.

The tests had been prepared by counties, in lists of five, with the middle county being the only relevant one on the list. It was hypothesized th at if Chaney knew the actual location of the missing women that location would represent the greatest threat to his well-being. The counties used as padding were located in areas deemed very unlikely to contain the actual location. Since there was only one relevant location on the list, if it was the correct one, Chaney's reactions should build to that point.

It had been previously determined through investigation that it was unlikely Chaney had had time to take the women over one hundred miles from Tulsa. The counties in eastern Oklahoma within that radius were therefore used as the relevant counties on the test. The area to be covered was roughly the size of the state of Massachusetts.

The preparatory question used on each of the tests was: "Regarding the location of those women, do you know if they are in ...?" The instrument used was a Stoelting model 22608 Emotional Stress Monitor.

Before beginning the peak of tension tests, a simple open stimulation test was run on Chaney to ascertain his ability to respond and his response pattern to generally reinforce the premise that he could not beat the test. His pulse rate at that time was 96 beats per minute.

At that time Chaney admitted he had not slept at all the preceding night and asked if the lack of sleep would affect the reliability of the test. He was assured that it would not.

Before the beginning of the first test chart, Chaney was told not to try to interpret what the instrument was indicating to the examiner, and that if the examiner seemed to concentrate on one location, it did not mean he thought Chaney was lying. Chaney was continuously reassured and advised not to read anything into what the examiner seemed to be doing. It was feared that as the test moved closer to the actual location of the women, Chaney might terminate the examination.

When the test began, a list of five counties printed in dark letters was placed on the wall in front of Chaney. The relevant county was Muskogee. The examiner had decided not to ask a "coverall" question, e.g., "somewhere else I have not mentioned," because he had had trouble with that question in "one-word" peak of tension tests. It sometimes seemed to invite a response because it is a sentence-type question injected at the end of a one-word list. There was no significant response to Muskogee County and the pulse was 108.

The next test used Tulsa as the relevant county. There were significant responses to Tulsa County; however, they were not of a magnitude which would indicate the true location. The women had been kidnapped in Tulsa County and possibly killed there, and this could certainly have caused the response. Chaney's pulse rate was still 108.

The third test was Cherokee County, which drew spot responses, but nothing consistent. Chaney's pulse rate was 120.

By eliminating these counties, it began to appear more and more likely that the women may be located in Sequoyah County, since it was known that Chaney owned property in that area. This area had been previously searched on two occasions with negative results. Cherokee County is located next to Sequoyah County, and this could explain the spot responses. The Sequoyah County list was then placed in front of Chaney, while the examiner made small talk with Chaney to "let his arm rest." It was obvious the chart made him nervous and he could not take his eyes off the list. After approximately five minutes the first chart was run. Chaney's cardio tracing was almost solid. The tracing built to Sequoyah County and the moment he said, "No," it dropped dramatically. Chaney responded consistently through this chart series in exactly the same manner. Before the end of this test, the examiner told Chaney the counties would be mixed up, so he would not know in which order they would be presented. Sequoyah County was avoided so Chaney would not be certain he had been caught. His pulse rate was 144.

The next test was a list of ten counties, with the first two and the last two being irrelevant. The middle six were potentially relevant counties with Sequoyah County being in the sixth position. The cardio tracing on this chart built until Sequorah County, then dramatically fell. To make sure this was not a relief reaction to the number five county, an irrelevant county was put in that position on the next chart. The tracing again peaked on Sequoyah County. Chaney's pulse rate was 120-144.

Maps had been made the night before of all the counties in eastern Oklahoma, and divided into quarters lettered A, B, C, and D. Chaney was told that all the counties in eastern Oklahoma were to be divided in this manner, and he should not read anything into the order in which they were presented.

Chaney's responses were strong and consistent in section C of Sequoyah County, which is the section where his property is located.

Plat maps of Sequoyah County for section C were then divided into quarters and Chaney was assured that this was routine procedure. Chaney then had large responses to section A, the section in which his property is located. This section was then divided into quarters and Chaney responded to section D. Chaney was then asked if he had any property in this area and he said, "Yes," very nervously. He was asked to point out the location of his property and his hand was shaking as he pointed to section D. The examiner could then tell by Chaney's outward manifestations that for the first time he knew he had been caught. The examiner asked if a certain pond was on his property and Chaney nervously replied that it was, but it was "too shallow to put anything in."

The polygraph components were removed from Chaney and he was informed that he was lying and that the examiner believed the women were located on Chaney's property near the pond. Chaney replied that the examiner was wrong, but he realized that he was just doing his job. It has been my experience that an innocent person rarely, if ever, tells the examiner, "You are just doing your job," after he has been told he is a kidnapper and possibly a murderer.

Chaney was returned to his cell at approximately 9:10 a.m., and according to District Attorney's Investigators, he was highly nervous. At approximately 9:15 a.m., the District Attorney was told by Wilkerson that the polygraph tests indicated the women were located on Chaney's property and the area around the pond was circled. Chaney's property is approximately one hundred miles east of Tulsa. Approximately two to three hundred eastern Oklahoma law enforcement officers, supported by airplanes, helicopters, radio communications, dirt bikes, and dogs then coverged on the densely-wooded area in the heart of "Oklahoma's Green Country."

According to jailers, when Chaney learned the officers had left to search the area, he requested a radio and "began to pace his cell and listen to news reports." The search party arrived at Chaney's property at approximately 12:30 p.m., and after organizing the search and setting up radio communications, Tulsa County Sheriff Deputies moved into the area on dirt bikes. At 1:15 p.n., Deputy Art Lee located a shallow grave covered with brush west of the pond on Chaney's property, and within the area circled on the plat map. At 1:40 p.m., the bodies of Kendall Ashmore and Kathy Brown were uncovered in the grave. According to District Attorney's Investigators, Chaney heard the news of the discovery at approximately 1:45 p.m., at which time he screamed and had to be sedated.

On September 15, 1977, Larry Chaney was found guilty of First Degree Murder and was sentenced to death by drug injection.

* * * * * *

A FURTHER STUDY OF THE DICHOTOMIZATION THEORY

IN DETECTION OF INFORMATION

By

Dr. Gershon Ben-Shakhar

Abstract

The purpose of the present study is to test two predictions of the "dichotomization Theory" on the detection of information. This theory relates the differential autonomic responsivity in the detection of information task to basic psychophysiological phenomena—the orienting response and its habituation. The theory assumes that two independent habituation processes take place in the typical detection experiment: that of the relevant stimuli and that of the neutral stimuli, with a complete generalization of habituation within each stimulus category. It is suggested that this theory can explain results of past experiments unaccounted for by any of the other theoretical approaches in the area.

Two predictions of the dichotomization theory were tested using the skin conductance response in a "card test" type of experiment. Two hundred subjects participated in the experiment and were randomly assigned to five equal-sized groups. The results tend to support the present theoretical approach.

On the basis of the results of the present study and previous ones, it is suggested that a two-factor theory could be a sufficient explanation for the detection phenomenon. One factor relates to the role of habituation in the detection task which is described by the dichotomization theory, and the second factor relates to possible "signal value" property of the relevant stimulus. [author abstract.]

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The use of the polygraph as a tool for interrogation is a major application of psychophysiology. Lykken (1974) has described the great discrepancy between the broad use of this tool in the field, with its important social consequences, and the lack of theoretical knowledge and understanding of the basic psychophysiological mechanisms underlying the detection phenomenon.

The present study is an attempt to relate the differential autonomic responsivity in the information detection situation to more basic psychophysiological processes such as the orienting response and its habituation. It is hoped that such an approach will contribute to a better understanding of the theoretical basis of information detection, with possible implications for its use as an interrogation device.

Several hypotheses have been formulated to explain how autonomic responses might be used successfully in the detection of lying. Davis (1961) suggested three: the conditioned response hypothesis, the punishment hypothesis, and the conflict hypothesis. 1) The conditioned response hypothesis assumes that the relevant question produces enhanced responsivity because it was conditioned to the subject's past experience (e.g., crime). 2) The punishment hypothesis suggests that the emotional response to the relevant question is due to fear of consequences of the subject's failure to deceive. These two hypotheses seem intuitively plausible in the context of police interrogations which usually involve crime and punishment. They have, however, difficulties in accounting for many laboratory experiments which demonstrate successful detection of a card number picked by the subject, a situation which does not involve strong emotions and certainly no punishment. Most embarrassing to these hypotheses are experiments that show no effect of the possible consequences of the polygraph test on the detection rate (Kugelmass & Lieblich, 1966), and no effect of the act of lying on those rates (Kugelmass, Lieblich, & Bergman, 1967). 3) The conflict hypothesis attributes the enhanced autonomic responsibity to the relevant stimuli to the conflicting tendencies between telling the truth and lying. This conjecture is partially supported by the study of Gustafson and Orne (1965a) which showed that verbal lying enhanced detection rate. On the other hand, this study demonstrated that significant detection of relevant information is possible even in a condition where the subjects do not respond verbally to the questions. The conflict hypothesis also has difficulty in accounting for the results of Kugelmass et al.(1967).

Gustafson and Orne (1963, 1965b) proposed a theory to account for the laboratory situation as weak as for the real life interrogation situation. Their approach is related to the punishment hypothesis in referring to the consequences of being detected, but instead of fear it refers to the subject's motivation to succeed in the detection task. Success in the detection task is defined by these authors as a function of the demand characteristics of the situation; in some situations it could mean being detected by the polygraph, and in others it could mean avoiding detection. This explanation received experimental support from the above mentioned studies (Gustafson & Orne, 1963, 1965b); it has some difficulty, however, in accounting for the result of a study by Thackray and Orne (1968) which showed no significant decrease of detection rate in a condition where the subjects were not aware of the fact that they were tested by a polygraph, and for the results obtained by Lieblich, Naftali, Shmueli, and Kugelmass (1974), which showed no effect of motivation to deceive on name detection rates.

Lykken (1959, 1960) opposed the assumption held by many field investigators that there is a distinct pattern of physiological activity associated with lying. He has offered the concept of "guilty knowledge" as a basis for differentiating persons who are involved in a given event from those who are not. Lykken assumes that the involved persons are familiar with certain details of that event and therefore are likely to respond differentially to those details. Persons who are not involved in the event do not have any knowledge of its details and therefore are expected to respond uniformly to all questions. On the basis of this theoretical approach, Lykken (1959, 1960) has suggested a detection method: the guilty knowledge technique.

A more recent approach that also avoid the concept of lying was suggested by Lieblich, Kugelmass, and Ben-Shakhar (1970) and Ben-Shakhar, Lieblich, and Kugelmass (1975). This approach tries to relate the differential responsivity in the information detection situation to the more basic psychophysiological concept of the orienting response, with the possible assumption that the relevant stimulus in the detection situation has properties of a signal stimulus (Sokolov, 1963). The most important assumption of this approach is that the relevant stimuli and the neutral stimuli create two distinct categories which habituate independently. That is, the response to a given stimulus is a function of the number of previous presentations of stimuli of its category and is independent of the number of previous presentations of stimuli of the other category. Finally, this approach assumes complete generalization of habituation within each stimulus category.

In terms of Sokolov's theory (1963), it can be suggested that two independent neuronal models are being developed: one for the relevant category and another for the neutral category. This means that the subject relates just to one property of the stimulus---its being relevant or neutral. Because of this assumption, the theory was termed "the dichotomization theory." By this assumption alone, without assuming a differential habituation pattern for the two categories, Ben-Shakhar et al. (1975) were able to predict the order of the information detection efficiencies in various information detection tasks. Efficiency is defined as the area under the ROC curve produced by the two response distributions-the responses to the relevant stimuli and the responses to the neutral stimuli. The origin of this approach is the results of Lieblich et al. (1970) and Ben-Shakhar et al. (1975) that showed a negative relationship between the relative frequency of the relevant stimulus and the detection efficiency. This relationship could not be explained by any of the earlier approaches, and it was felt that additional assumptions were needed. Indeed, if we accept the dichotomization approach, it is clear that the greater the number of stimuli in a given category the more these stimuli will habituate and the less the overall reactivity to them will be. This approach can explain as well the results of Kugelmass et al. (1967), because the two categories in that experiment were defined by the act of choosing one card out of a pile of cards. Those categories are independent on the verbal responses to the questions, and therefore are independent on the lying-truth telling variable. An interesting implication of the dichotomization theory is that

since detection efficiency is a function of the number of stimuli in each category, it is possible to increase this efficiency just by manipulating those numbers properly. It is also clear that any report of detection efficiency is meaningful only in relation to the number of stimuli in each category.

Another factor that could enhance detection efficiency is the number of "buffer" stimuli that are used prior to the first question; all these buffer stimuli are neutral, and as such contribute to the habituation of the neutral category. Orne, Thackray, and Paskewitz (1972) described an experiment of Geldreich that showed an increase in detection rate up to 100% when 20 to 50 buffer items were used.

It should also be noted that almost all laboratory information detection experiments used one relevant stimulus and a set of 4 to 6 neutral stimuli; in addition, the first stimulus presented to the subject was always a buffer, neutral stimulus which was not taken into account. It is therefore possible that the detection rates reported in the literature (and perhaps also those reported by field investigators) are merely a function of the procedure being used in those experiments rather than the fact that one of the stimuli is relevant to the subject in some sense or the result of some psychological mechanism accompanying lying. Of course, that is not to say that any one of the information detection experiments is not valid in terms of the treatment effect being studied; the suggestion is, rather, that the findings may not generalize to other experiments in which the ratio of category sizes is different.

The only experiments that used equal numbers of stimuli in each category are those of Lieblich et al. (1970) and Ben-Shakhar et al. (1975). The former of these studies achieved significant detection rates in the equal categories condition, while the latter study did not. In both studies the equal categories condition produced the least efficient detection.

The present study further investigated the dichotomization theory and examined whether the dichotomization assumption was sufficient to account for information detection results, or whether an additional assumption concerning the nature of the relevant stimulus is needed. Two preductions of the dichotomization theory were tested. One related to the situation, that had never been tested in this context, in which the relative frequency of the neutral category was less than that of the relevant one. The prediction of the dichotomization theory in this case was a so-called "negative detection" or detection of the neutral stimulus, that is to say, an enhanced responsivity to the neutral stimulus. This preduction was tested in an experiment which was an extension of the study by Lieblich et al. (1970) and included all the conditions of that study and an additional condition in which one neutral stimulus and 7 relevant ones were presented to the subjects. A second prediction was tested by comparing the detection efficiencies in two conditions, both of which included a relevant category with relative frequency of 1/8. The first condition was comprised of one relevant stimulus and one neutral stimulus, with the latter having been presented 7 times more often than the former. The second condition was comprised of one relevant stimulus and 7 different neutral stimuli, each stimulus having been presented to the subjects an equal number of times. The prediction of the dichotomization theory in this case was that no difference in efficiency was

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expected between the two conditions. However, if we had assumed that the subject was responding to stimulus content rather than to stimulus category, we should have expected a faster habituation to the neutral stimulus in the first condition and therefore a greater detection efficiency in this condition. Both predictions were tested using one autonomic variable, the skin conductance response.

Method

Subjects

Two hundred Hebrew University students participated in the experiment; they were paid for their time. The subjects were divided into five equalsized groups.

Instruments

A constant current $(40\mu A)$ GSR apparatus coupled to a Brush II recorder was used. The recording system was placed in a control room separated by a one-way mirror from the room in which the subject was tested. Beckman electrodes were used for GSR measurement. A Revox tape recorder was used to present questions to the subjects.

Procedure

Groups 1-4. The subject was seated at a table facing a blank wall. Beckman electrodes were attached to the volar side of the index and fourth fingers of the subject's left hand, using Beckman electrode paste to ensure a proper contact. All testing was carried out in an air-conditioned laboratory maintained at 26° C. At the end of 3 min baseline recording, the subject was instructed to choose X cards¹ from 8 alternative cards placed before him and to record the number of each card on a supplied form. The subject was told that he would hear a series of questions about the cards and was asked to sit quietly and listen to them. The subject then heard a series of 16 questions of the form: "Did you choose card number ____?" Each of the 8 card numbers was presented twice in the same order for all the subjects. The sequence of numbers was: 5, 8, 3, 6, 9, 7, 2, 4, 8, 6, 5, 2, 7, 4, 9, 3. The interstimulus intervals (ISIs) were determined randomly within the range of 11-19 sec., with a mean of 15 sec. Once determined, the same pattern of ISIs was used for all subjects. All questions were transmitted to the subject through a tape recorder.

Group 5. The physical conditions were the same as for Groups 1-4. Following a 3 min rest period, the subject was instructed to choose one card from two alternative cards placed before him and to record its number on a supplied form. The subject was told that he would hear a series of questions about the cards, and was asked to sit quietly and listen to them. The subject then heard a series of 16 questions of the form: "Did you choose card number ____?" The chosen card number was presented twice, while

¹X was 1 for Group 1, 2 for Group 2, 4 for Group 3, and 7 for Group

4.

the other card number was presented 14 times. The order of the stimuli within the series was random. The ISIs were the same as for Groups 1-4.

Results

Analysis of the responses to each stimulus (card number) was carried out by determining the maximal conductance change observed within 5 sec after presentation of the stimulus (the card number). For each subject the conductance changes to all 16 stimuli were transformed into standard scores relative to the subject's mean and standard deviation to eliminate individual differences in reactivity.

For each of the five conditions, an ROC curve was generated using the standardized responses to all the chosen card numbers as SN events and to all the other numbers as N events. The construction of the ROC curves was described in Lieblich et al. (1970). The ROC is a measure of the distance between 2 random variables. If x and y are 2 random variables with distributions F and G respectively, the ROC curve is F(c) as a function of G(c)where c assumes values from $-\infty$ to $+\infty$. In our case, the ROC curve describes the degree of separation between the distribution of the responses to the chosen cards and the distribution of responses to the other cards. The area under the ROC is a statistic that assumes values between 0 and 1. An area of 0.5 could mean that the two distributions are identical and therefore it is not possible to tell which card the subject had picked by his response. An area of 1 means that there is no overlap between the two distributions, and therefore the chosen card could be detected without any errors. An area less than .5 means that the responsivity to the nonchosen cards is generally greater than the responsivity to the chosen cards. The ROC curves of Conditions 1 and 5 are presented in Figure 1. The ROC curves of Conditions 1 to 4 are presented in Figure 2. The areas under each of the ROC curves are: .691, .597, .488, .467, and .687 for Conditions 1 to 5. respectively.



ROC curves for Conditions 1 and 5





In a recent article Bamber (1975) showed that the area under ROC curve has an asymptotic normal distribution. Bamber described a method for estimating the variance of the area statistic and for computing confidence intervals for the true area when fairly large samples are being used.

Using the method described by Bamber (1975) a 95% confidence interval was computed for the area in each of the five conditions. The intervals are:

Condition 1	. 630 753
Condition 2	•547-•647
Condition 3	•443-•532
Condition 4	. 400 534
Condition 5	.617756

The asymptotic normality of the area statistic can be used to test the significance of the difference between two areas. The difference between the areas in Conditions 1 and 5 was not found to be significantly different from 0 at the .05 level (Z=.092).

In order to present the results in terms of a more traditional method, the rate of correct detection in each condition was computed. The subject is defined as being detected if his mean response to the chosen card numbers is greater than his mean response to all the other card numbers. The detection rates are: .775, .600, .450, .475, and .725 for Conditions 1-5 respectively.

The difference between the detection rates in Conditions 1 and 5 was tested using the normal approximation to the binomial distribution. This difference is not significantly different from 0 at the .05 level (Z=.517).

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The difference between the detection rates in Conditions 1-4 was tested by a x^2 test and was significant at the .05 level ($x_2^2 = 10.844$).

Discussion

Two predictions of the dichotomization theory were tested in the present experiment. The hypothesis that habituation generalizes within category was tested by comparing the detection efficiencies in Conditions 1 and 5. This hypothesis implies that the detection efficiencies in those conditions should be the same. Both the ROC analysis and the detection rates demonstrate similar efficiencies in the two conditions. The two ROC curves are overlapping, the corresponding areas are almost identical, and the confidence intervals for the areas are very similar. The difference between the detection rates in the two conditions is in the same direction as the difference in the areas, and its magnitude is not significantly greater than zero.

It could be argued that the subjects perceive Conditions 1 and 5 in a different way. The subjects in Condition 5 could have known that the experimenter knew which card they had picked. This may have resulted in a lower ego involvement and motivation in Group 5. It is true that in this experiment in general there are conditions for minimal detection, since no verbal response is required from the subjects and since they are not encouraged to deceive or to "beat" the machine. This is true for all five conditions in this experiment and cannot account for the results. However, from discussing the matter with the subjects after the experiment it appeared that in neither condition did they know whether the experimenter knew which card they had picked.

The other prediction tested in this study also tends to support the dichotomization theory. The findings of Lieblich et al. (1970) and of Ben-Shakhar et al. (1975) were replicated as seen in Figure 2. The generalization of this finding to the case in which the relevant category has a high relative frequency is less clear because the ROC curves are overlapping, but the order of the areas under the ROC curves in the four conditions is as predicted, and the area in Condition 4 is indeed less than .5. This means that a somewhat enhanced electrodermal responsivity to the neutral stimulus occurred as predicted by the dichotomization theory, although the area measured in this condition is too close to .5 to enable any strong conclusion. It should be mentioned that the area under the ROC curve in the equal frequencies condition was also less than .5, implying that it was not possible to detect the relevant stimuli in this condition.

Inspection of the confidence intervals for the areas in Conditions 1-4 suggests that enhancing the proportion of the relevant stimuli reduces the efficiency of detection only up to the point where this proportion is .5, beyond this point there seem to be no real differences in the detection efficiency.

The detection rates suggest a similar conclusion, i.e., while there is an overall difference between the detection rates of the four conditions, it seems that when the relative frequency of the relevant stimuli is .5 or .875, the detection rates are similar and are very close to .5.

Although it is tempting to conclude from these results that the dichotomization assumption is a sufficient description of the information detection phenomenon, it is felt that any interpretation should be done with great caution at this time. The main reason for the reservation is the asymmetry of the areas under the ROC curves in Conditions 1 and 4. While in Condition 1 the area was 0.691, almost .20 more than the area expected by chance alone, in Condition 4 the area was 0.467, only about .03 less than a "chance area" of .5. This asymmetry may imply that two factors are involved in the detection process: one, the habituation factor, the behavior of which is described by the dichotomization theory, and two, a "relevant factor," that is, to use a Sokolov (1963) term, the relevant stimulus having properties of a "signal stimulus." In Condition 1, both factors contribute to enhancing responsivity to the relevant stimulus, and in Condition 4 they produce contradictory tendencies. The assumption of a relevance factor is consistent with the results obtained by Thackray and Orne (1968) that personally relevant material was more detectable than neutral material made relevant in the experimental context. This assumption is not supported, however, by the result of the equal frequencies condition (Condition 3). Given this two-factor explanation, we should expect an area somewhat higher than .5 in Condition 3. It should be mentioned that in a previous study (Ben-Shakhar et al., 1975), a similar condition produced an ROC curve with area of .59, and in another unpublished study done by the present author a similar condition produced an ROC curve with area of .53.

On the basis of the available data, a two-factor approach seems to be the most reasonable conclusion. This conclusion posits the dichotomization theory as complementary to earlier theories rather than a contradictory to them. The three explanations of Davis (1961) deal with the relevance factor and suggest a possible psychological mechanism by which that factor may operate. The motivation approach of Orne and his colleagues could be viewed as an important variable that facilitates the process of dichotomization, and it is possible that under the condition of no motivation, no distinct categories will be formed, and therefore detection efficiency will be very low.

The "guilty-knowledge" concept defines a necessary condition for the creation of distinct categories, and it is obvious that for the innocent person all stimuli are of one category, and therefore the expected responses should be the same or should depend only on the order of the question pre-sentation, provided that a guilty-knowledge procedure is used (Lykken, 1974).

The dichotomization idea raises some interesting possibilities for interpreting results in the detection-of-information paradigm and in the differential-autonomic-responsivity paradigm in general. Lieblich (1970) suggested that lack of differential responsivity in his sample of children could be a result of their lower dichotomization ability. It is known to psychologists that there are cultural differences in the way people organize and categorize stimuli (Cole, Gay, Glick, & Sharp, 1971). At the same time there is evidence of cultural differences in the efficiency of information detection (Kugelmass, Lieblich, & Ben-Shakhar, 1973). It would be interesting to try to tie these facts together, and the dichotomization idea may be a valuable approach in this regard. Another possible line of research would be to investigate to what extent the dichotomization idea could account for other paradigms of differential responsivity such as autonomic conditioning and autonomic differentiation. The validity of these generalizations is viewed as an important test of the dichotomization theory.

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A CASE STUDY OF UNSUCCESSFUL POLYGRAPH COUNTERMRASURES

By

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and

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This is a brief presentation of an employee theft case which led to four separate polygraph examinations. An employee of a large fast-food restaurant chain was suspected of stealing in excess of one hundred dollars from the cash register. She was polygraphed on two occasions by the senior author. She was then tested a third time (by another examiner) and the unanimous conclusion of the examiners was that she was deceptive. One month later she came to the same office for a pre-employment examination and denied ever stealing from a previous employer! This case seems noteworthy because it not only illustrates several classic countermeasure attempts, but presents an interesting study of human boldness.

Background Information

The test subject was a Caucasian female aged 25 years. She told the examiner that she had graduated from high school and completed one year of college. At the time of testing she was married (but separated) and was employed as a food server and cashier at a fast-food restaurant. She was in good general health except for a mild bladder infection and her reported "bad nerves." She told the senior author that she had been taking tranquilizers because of a combination of marital, financial, and emotional stress. She expressed guilt feelings about giving up an illegitimate child for adoption several years prior to testing. She was suspected of stealing the money for several reasons: she had unsupervised access to the money in the register and the manager knew that she had a strong need for cash (her husband refused to provide financial support).

According to the examinee, she was taking Sulfa tablets to combat her bladder infection. She was also taking an unspecified tranquilizer prescribed by her physician (a general practitioner) to help her nervous condition.

During the first examination she appeared heavily medicated----more so than one would expect from a mild tranquilizer. There was extreme pupil-lary dilation and her speech was slurred and sluggish. Although she claimed to have slept well the night before, she fell asleep in her chair in the waiting room prior to testing!

A Lafayette model 76056 polygraph was used for all four examinations. This model has upper and lower Pneumo components and an electronicallyenhanced Cardio section (KEC). The GSR component was set in the Automatic Self-Centering mode for all of the examinations. A standard Velcro cuff was used to obtain blood pressure-pulse data.

Test Data

The first examination was administered while the examinee was heavily sedated. Dick Arther's question construction technique and format was used. The cuff was inflated to 65mm pressure and the Sensitivity setting on the EEC was "2". During this first test her mean heart rate was 72 beats per minute, her mean respiratory rate was 22 breaths per minute, and her galvanic skin repsonse reading was balanced at 297,000 ohms (sensitivity setting "6"). Figure 1 illustrates the first chart of her first specific theft examination (Labeled I-1).

Because of the very flat, nonreactive GSR tracing, the sensitivity level was increased to the maximum setting of "10". Even without the obvious signs of over-medication, her nonreactive GSR and the lack of any significant reaction to control or relevant questions indicated that a retest was necessary. Figure 2 depicts the first chart (II-1) in her second specific examination.

The examinee appeared less lethargic during this retest. She told the examiner that she had slept seven hours the night before the test and had not ingested any tranquilizers in 3 days. A modified Zone Comparison test was administered. Backster-symptomatic questions were not incorporated in the test structure.

The examinee's mean heart rate on this examination was 86 beats per minute, mean respiration rate was 34 bpm, and skin resistance upon initial balancing was 345,000 ohms (sensitivity setting "10"). Note the very responsive blood pressure changes to relevant questions "5" and "7". Note also the "staircase" suppression response in the Pneumo tracing of Figure 2, Question "5". As a result of this examination the subject was advised that the polygraphist believed that she was deceptive regarding theft of the missing money. Because of her repeated protestations of innocence she was administered a third examination.

The third examination was administered by Mr. Pennington. He utilized the Arther Technique and the same instrument as on the previous tests. On this examination her mean heart rate was 92 bpm, mean respiratory rate was 26 bpm, and skin resistance was 386,000 ohms upon initial balancing, Figure 3 depicts the first chart in this third examination.

The reader is referred to the Cardio responses to relevant questions "5" and "8". Note also the extreme GSR responses to relevant questions "3K", "5", and "8". Mr. Pennington diagnosed her charts as deceptive. The examinee refused to sign a confession admitting guilt, but did pay back all of the missing money! The polygraphists thus consider the deceptive diagnosis of her charts to be confirmed.






Discussion

Several interesting countermeasures were employed during these first three examinations. As noted in Figure 1, the examinee's primary countermeasure during the first examination was to ingest an unknown amount of a tranquilizing drug. She also attempted to sway the examiner with her numerous marital, financial, and emotional problems. On the retest (Figure 2) she did not ingest tranquilizers, but instead relied upon sustained muscle tension in an attempt to "beat" the examiner. Note the serrated GSR tracing in Figure 2 (marked by tiny arrows). The polygraphist ensured that the electrodes were not on so tight that they picked up pulse data. He could observe her as she pressed downward on the GSR electrodes. She also appeared to be attempting to control the rhythm and amplitude of her breating. The rather labile GSR tracing may also indicate that she was engaging in "mental gymnastics", but this is not confirmed.

On the third examination (Figure 3) the examinee's primary countermeasure was to introduce movement artifacts onto the chart. The reader is referred to Question "5" in Figure 3 (Marked with an arrow). The notation "m/leg" indicates that the subject was moving her leg at this point. Note that there are no obvious breaks in the Cardio tracing like one usually finds with extreme limb movements. This points out the need for alert examination observation during testing to detect the sort of subtle body movements which can sometimes create error in chart interpretations.

One month after she paid back the missing money the same examinee came to our office for a pre-employment valuation. She was examined by the senior author. Figures 4 and 5 illustrate segments of two charts on this examination. The reader is referred to the question number "5" and "8" in Figure 4. The questions were as follows:

- 5. Are you now concealing any information about arrests or convictions?
- 8. Are you now concealing any information about use of narcotics?

The examinee had denied arrests, drug use, or thefts from previous employers during the pre-test interviews. She showed significant autonomic arousal when asked these two questions. Note especially the Cardio and GSR reactions. Question number "ll" (See Figure 5) is as follows: "Are you now concealing any information about stealing more than \$10 in value from a previous employer?" She responded in the negative. Compare her responses on questions "5" and "8" (Figure 4) to the reaction on question "ll" of Figure 5.

While the GSR reactions are similar in amplitude, the Cardio responses are much greater to questions "5" and "8", arrests and drugs, than they are to question "11" about previous employee thefts (a verified lie). In fact, the decrease in relative blood pressure at question "11" may be a relief reaction. Note that the final control question (23c on Figure 5) shows a significant increase in blood pressure and a good deal of constriction response. As the reactions to question "5" and "8" suggest, the examinee



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might have been more disturbed about drug use and arrests than about a previous theft which resulted in her loss of employment. This conclusion is not without basis since she did use drug countermeasures on the first specific examination.

Table 1 summarizes the measured physiological response data from the four examinations just reviewed.

Table 1

Mean Heart and Respiratory Rates and

Numerical Evaluations for

Four Polygraph Examinations *

	Test No. & Type	Mean Heart Rate	Mean Respiration Rate	Numerical Evaluation
1.	Specific	72 bpm	22 bpm	- 3
2.	Specific	86 bpm	24 bpm	_1 4
3.	Specific	92 bpm	26 bpm	_1 6
4.	Pre-Emp.	64 bpm	19 bpm	

* Chart evaluation Criteria:

-6 or greater = Deception +6 or greater = Truthful +5 or less = Inconclusive

Several salient points should be made concerning the data. First, it should be noted that although drug countermeasures produced an inconclusive test result on the initial examination, subsequent tests accurately diagnosed the examinee as deceptive. Secondly, note that her mean heart rate, respiration, and numerical chart evaluations all increased on each specific examination. Mean heart rate increased from 72 bpm on Exam. #1 to 86 bpm on Exam. #2, and finally to 92 beats per minute on the third examination. Of course, as her apprehension increased on each succeeding test, so did her heart and respiration rates and the consequent numerical evaluation.

There was no obvious difference between her overall level of autonomic arousal on the specific and pre-employment tests. Her heart rate of 64 beats per minute and respiratory rate of 19 breaths per minute on the pre-employment test was considerably slower than the preceding examinations (even the one on which she was tranquilized). This final test was probably more near her physiological norm than the other tests because of the less stressful nature of the situation. Loss of an existing job, repayment of stolen money, and possible prosecution are much more psychologically threatening than merely attempting to secure initial employment. At least one may presume so in this case, as the data seem to indicate.

Summary and Conclusions

A 25-year-old female was suspected of an employee theft. She was polygraphed on three separate occasions concerning the cash loss. Her first examination was inconclusive, but the læst two indicate deception. At the conclusion of the last examination she agreed to return the money. She lost her job because of the theft, but was not prosecuted because she returned the missing cash.

A careful review of her polygraph charts reveals numerous attempts to defeat the polygraph's accuracy. As she progressed from test to test and examiner to examiner she tried out a variety of polygraph countermeasures worthy of a professional criminal or enemy espionage agent. She ingested tranquilizers, moved during the test, used selective muscle tension, and engaged in mental gymnastics in an attempt to distrot her charts.

The examinee's failure to "beat" the test in this case illustrates several crucial points about the current state of the art in polygraph science. While her drug countermeasures did produce an inconclusive result on the first test, the inclusion of control questions prevented the polygraphist from diagnosing her charts as truthful. While there was a general lack of reaction to the relevant questions, there was also a lack of reaction to the control questions. The net result was an inconclusive diagnosis (and subsequent retest) rather than an erroneous conclusion of truthfulness.

The senior author made one glaring error in his failure to include symptomatic questions in the specific tests. As her pre-employment test amply demonstrates, the examinee had several misdeeds on her mind besides the employee theft—and might have reacted significantly to the question: "Is there something else you are afraid I will ask you a question about?"

Finally, a discussion of professional ethics is in order. Three experienced polygraph examiners devoted numerous hours administering tests, interpreting charts, and discussing the results in order to arrive at an accurate determination of truth. Quite a few man-hours were expended for a relatively small fee. Considering business overhead and expenses, this series of tests was a financial loss, but, the essential point is that the primary consideration was the welfare of the examinee and not a business profit. This is a cardinal principle of the American Polygraph Association and one to which we wholeheartedly subscribe.

Not every company theft case requires this degree of effort, but the professional examiner should be ever-alert to the use of increasingly so-phisticated countermeasure techniques by even the most unlikely test sub-jects.

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THE VALIDITY OF THE GUILTY KNOWLEDGE TECHNIQUE: THE EFFECTS OF FAKING¹

By

David T. Lykken²

Contrary to what many psychologists believe, most professional lie detector operators really assume that they are in the business of lie detection. Although various techniques are employed, all are predicated on the belief that there is a distinctive pattern of physiological response which accompanies lying and which can be distinguished from that which accompanies truth-telling. Thus, "Whatever the measuring instrument used, the underlying psychological principle is identical, namely, that the tension occurring with deception is different from the tension occurring in response to the similar stimuli to which the subject answers truthfully" (Block, Salpeter, Tobach, Kubis & Welch, 1952, p. 55). There have been many reports of validity about .90 for conventional lie detector procedures in actual criminal investigations (e.g., Lee, 1953; Marston, 1938; Summers, 1939). However, I can find no published accounts of properly conducted studies which corroborate such claims. Nor have experiments conducted under artifical or laboratory conditions produced validities nearly so high (e.g., Ellson, 1952). The work of Lacey (1950) and others, demonstrating that physiological response patterns show great variation from one individual to another, allows little credence for the notion that all persons can be expected to show the same characteristic pattern when lying and some different patterns when telling the truth. The fact that most lie detector enthusiasts have been specialists in criminal investigation rather than in psychological measurement is perhaps sufficient to account for these optimistic claims.

One basis for confusion in the existing literature is the failure to distinguish between lie detection on the one hand and guilt detection on the other. The method of guilt detection has been described in a previous paper (Lykken, 1959a).

¹Richard Rose, George Skaff, and Joe Ylitalo conducted this experiment.

²This study was reported during the author's tenure as a Fellow of the Center for Advanced Study in the Behavioral Sciences, Stanford, California.

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Use of physiological measurements to detect. not lying, but the presence of "guilty knowledge," requires only the more reasonable assumption that a guilty person will show some involuntary physiological response (e.g., GSR) to stimuli related to remembered details of his crime. If the crime is such that the investigator can discover a number of factual details with which only the guilty person should be familiar, then the guilty knowledge method can be used. The guilty knowledge items are interspersed with other similar but irrelevant items in a stimulus list. The S is told that E is going to mention a number of items and that, if he is guilty, he will recognize some of these items as being related to the crime in question. The items may be stated in question form, in which case the S may or may not be required to answer. A guilty S, knowing which items are relevant and which are not, would be expected to respond differently to the relevant than to the irrelevant items. Usually, he would be expected to give larger responses to the relevant items, although it should be pointed out that any consistent difference in the responses to the two classes of stimuli is evidence of guilt.

In an earlier study (Lykken, 1959a), 49 male college students, after random assortment into four groups, were required to enact one, both, or neither of two mock crimes. All were then given a "guilty knowledge" test, employing the GSR, which used six standard questions relating to each of the two crimes. A simple, objective, and a priori scoring system was used to determine "guilt." Forty-four or 89.8% of the Ss were assigned to their correct group, against a chance expectancy of 25%. Considering the crimes separately, all Innocent Ss were correctly classified, while 44 of 50 interrogations of Guilty Ss gave "guilty" classifications, a total of 93.9% correct classification against the chance expectancy of 50%. The present experiment was designed to test the hypothesis that with a more comprehensive interrogation and a more subtle, although still objective, scoring system being employed, the guilty knowledge method can give nearly perfect validity even with sophisticated Ss who are motivated to attempt to subvert the test.

Method

The 20 Ss used included a number of medical students, several staff psychologists and psychiatrists, and a number of female members of the secretarial staff. Each of the Ss had been required earlier to fill out a questionnaire containing 25 items such as "What is your father's first name?", "What was the name of the street that you lived on when you were a child?", "What was the name of your high school?". The answer to this questionnaire then constituted the set of guilty knowledge items characteristic of the S. The questionnaire responses of the first five Ss, all medical students, were put together to make up the original interrogation list. The first question on the list was "What was your mother's first name?" and there followed a set of six women's names, five of them being the names of the mothers of the first five Ss, and the first alternative being a name taken at random. The next question, "What was your father's

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first name?" had these Ss' fathers' names, in scrambled order, as Alternatives 2 through 6, with a man's name taken at random as the first alternative. All of the questions followed the same pattern, with the first alternative in each set always being random. This procedure, which made it possible to ignore for scoring purposes the response to the first alternative, eliminated the difficulty caused by the tendency of many Ss to give a larger GSR, other things equal, to the first item in any series.

The object of the interrogation was to correctly identify by an objective analysis of the GSR protocol, who S was, i.e., which set of questionnaire responses was his. Since he "might have been" any one of the five persons whose questionnaire responses went into the interrogation list, the scoring method matched his protocol against each of these five possibilities and defined a criterion to decide which of the five he must be. For all Ss after these first five, the interrogation list was constructed merely by substituting the 25 questionnaire responses of the new S in place of those belonging to one of the first five Ss. Thus, the last 15 Ss were all scored against the same four individuals.

Scoring Procedure.

The first step in scoring a record was to rank the GSRs to the five alternatives for each question (ignoring the first) in order of amplitude. Then a distribution was made of the ranks of the GSRs to the 25 alternatives from one of the five questionnaires used in the list. If the questionnaire did not belong to the S in question, then he should have no way of responding consistently the same to these 25 items, and one would expect the distribution of ranks to be roughly rectangular, i.e., about as many ranks of one, as of two, as of three, etc. But, if the items did come from that Ss' questionnaire, then some peculiarity would be expected in the distribution. If he had not been successful in producing false responses, for example, he should have mostly ranks of one (this was the most common result). Or, if he had produced many large GSRs to the Innocent alternatives, he should have mostly ranks of four or five. Even if he had been clever enough to consistently produce large GSRs to just two of each four Innocent alternatives, the distribution of ranks would still betray him in showing mostly ranks of three, with few ones or fives.

The expectation was that each distrubion of 25 ranks would be rectangular, i.e., five ranks of one, five of two, etc. Each such distribution was given a score by awarding a point for each entry over five in any of the five rank positions. Thus, a perfectly rectangular distribution would have a score of zero, indicating minimum likelihood that the S "belonged" to the given set of items, while a distribution in which all 25 responses had the same rank would get a score of 20. When no measurable GSR occurred to a given item, no rank was assigned to that item and the distribution of ranks for that list therefore totaled less than 25. In such cases, the expected frequency of ranks in each position was figured at one-fifth of the total and the distribution scored in the usual way.

Conditions and Instructions.

While being questioned, S was seated in the interrogation room with

a blindfold over his eyes and a pair of headphones adjusted to his ears. E was located with the apparatus in an adjoining room and spoke to S over a microphone. The GSR electrodes were the two-element lead type (Lykken, 1959b) fixed over the fingerprint area of the first and third fingers of the dominant hand. The electrolyte was Sanborn Redux, and the effective electrode area was a circle of 3/8-in. diameter. A constant dc current of 50 µ a. was employed, and total skin resistance and skin resistance changes (GSRs) were written out independently on rectilinear coordinates and at better than 5% accuracy, using a "recti-riter" recording milliammeter.

Each S was given a 15-min. lecture on the nature of the GSR, the lie detector in general, and the principle of the guilty knowledge method in particular. After being attached to the GSR electrodes, each S was allowed to sit before the recording instrument and practice producing voluntary GSRs by various methods. Each S was told what the format of the questioning would be, was cautioned against attempting to defeat the test merely by inhibiting responses, and was advised (correctly) that the best way to confuse the scoring system would be to produce GSRs of various amplitudes to the innocent alternatives in as random a pattern as possible. Each S was then offered a prize of \$10.00 if he could by any such means manage to defeat the objective scoring system being used.

		Question Lists			
S	l	2	3	4	S's
$ \begin{array}{c} 1\\ 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	29 47 42 310 55 8 7 10 6 42 40 43 7 6 66 5 5 46 5 5	5273135365120422608555906	52 47 231 397 731 730 96 230 218 522 52 52 52 52 52 52 52 52 52 52 52	61 40 58 46 66 42 73 63 43 20 38 27 50 43 27 50 43 27 50 43 27 50 43 27 50 43 27 50 43 27 50 43 27 50 55	$ \begin{array}{c} 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100$

Table .

Scores on Each of the Five Question Lists, Expressed as Percentage of S's Score on His Own List

Mean percentage = 43.67

Range = 18=86

Results

The scoring system employed here had two minor defects, both of which operated to work against the power of the test. First, since a number of the Ss were acquainted, there were some cases in which a S did recognize several of the innocent (for him) alternatives as belonging to the same individual. Secondly, since each S was "guilty" with respect to one set of 25 alternatives, his tendency to get an asymmetrical distribution of ranks for his responses to these items necessarily prevented the distribution of ranks for responses to the other sets from being truly rectangular. This decreased the discriminating power of the scoring but, although a statistical correction could have been made in each case, this was not done since the simpler method still gave 100% correct identification. The results of the experiment, that is, were that the Ss were correctly matched with their own sets of questionnaire responses in all 20 cases, with no ambiguities and by a completely objective a priori scoring system (see Table 1). Assuming a chance probability of a correct match being 0.20 in each case and these probabilities being independent (this scoring could have matched all 20 Ss with the same questionnaire), this result is obviously significant ($p < 10^{-13}$).

Discussion

The guilty knowledge technique, of course, is not new. Every psychology student has seen it demonstrated using the GSR and "a number between one and five." In one form or another it also appears repeatedly in the lie detection literature. Thus, the "peak of tension" test as described by Keeler (1933) originally involved presenting to the suspect a list of related items of which one was a "significant" item and looking to the response record for signs of increased physiological "tension" up to the significant item, decreasing thereafter. When only the guilty suspect knows which is the significant item, this is a crude form of the guilty knowledge test and is, potentially, an objective and accurate method of guilt detection. But many operators now make a practice of showing the list beforehand to the suspect, in order to enhance his apprehension of the critical item, and often this item is merely a direct question of guilt. Thus, the "peak of tension" test has become essentially just another fallible lie detector procedure. The "indirect" or "association" method described by Lee (1953) is even more similar to what is here called the guilty knowledge technique but is classified by that author as a lie detection procedure. A clear recognition that guilt detection is a more different procedure, inherently much more dependable than lie detection, and that it is based on the diagnosis of guilty knowledge, specifically, should contribute to the development of instrumental interrogation in several ways. One result should be the adoption of a standard format and objective scoring system which would eliminate the vagaries of subjective "expert" judgment. Such a development, which would put the operator in a position analogous to the fingerprint expert, should increase the willingness of police detectives to make use of these facilities early in the case at the time when a successful application of the method is most likely.

A common attitude in the lie detection field (e.g., Lee, 1953) is that the GSR is not a useful physiological datum because, paradoxically, it is "too sensitive." Again, the difficulty seems to stem from the use of lie detection rather than guilt detection methods. Undoubtedly cases will be found in which the guilty S will experience a strong enough reaction to a direct accusation of guilt to show a marked cardiac and respiratory reaction not shown to irrelevant questions. Such a clearly differentiated "Lie response" will seldom be seen in a GSR record, where responses to all questions will tend to be the rule. But for guilt detection, the extraordinary sensitivity of the GSR is a clear virtue, as is the relative simplicity of the GSR curve where basal level, latency, and amplitude of the response are easily measured and have a clear significance. As long as the S responds at all (and I have never observed a failure to respond when proper measuring techniques were used) there is no reason to suppose that blood pressure or pneumographic records add any useful information to that provided by the GSR, appropriately used in the guilt detection paradigm.

The experiment reported here seems to testify, as conclusively as such laboratory studies can, that the guilty knowledge method can yield extremely high validities, even with sophisticated defensive Ss, under conditions appropriate to its use; i.e., when enough "guilty knowledge" is available to the operator to enable him to construct an adequate interrogation list. Since this guilty knowledge material can involve completely inconsequential matters and need not refer to the more dramatic and publicized aspects of the crime in question (e.g., what the weapon was, what was stolen, etc.), it would seem that competent investigation should be able to provide enough appropriate material in a large number of criminal cases, even when there has been considerable publicity or even prior questioning of suspects. Since lie detection, in contrast with the guilty knowledge method, can be used in all cases (e.g., whenever there is a suspect willing to be questioned), an appropriate comparative field study might show that the overall validity of the conventional method is higher. However, the advantages of having available a guilt detection method of nearly perfect validity where it can be used are obvious.

The fact that the guilty knowledge technique, unlike the lie detector, does not require that the S answer any questions or, indeed, say anything at all, may have helpful legal implications. Since the S is not required to speak it is clear that he is not "testifying against himself" except in the same trivial sense as when he is made to show his face to a witness, and unlike the blood test situation no pain or violation of his physical integrity is involved.

Summary

A distinction is made between instrumental methods of lie detection and of guilt detection. In the absence of adequate data supporting claims of high validity for lie detection procedures in criminal investigation, and since present knowledge of physiological response patterns argues against the assumption that all persons respond one way when lying and another when not, these claims are considered unacceptable.

A method of guilt detection using the GSR is described, which involves presenting the S with a set of questions concerning matters which could be known only by a guilty individual. Each question is followed by four or five alternatives, of which one is "correct". Scoring the response record for "guilt" involves identifying any pattern of nonrandom reactivity to the set of "guilty" alternatives. Each S is used as his own control and the scoring is entirely objective.

An experiment is reported in which 20 sophisticated Ss were given training in the theory of the GSR and of the guilty knowledge method, were allowed to practice inhibiting or producing false GSRs, and instructed concerning the interrogation procedure and scoring system to be used. These Ss were then offered \$10.00 if they could "beat" the test. Correct classification was obtained in 100% of these cases without ambiguity, using objective scoring of the GSR protocol alone.

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Answers to Polygraph Review:

1.	b.	6.	False
2.	с.	7.	True
3.	a.	8.	True
4.	d.	9.	True
5.	b.	10.	True

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REPORT ON POLYGRAPH USAGE

IN CHAIN DRUG STORES

By

The Research Department

National Association of Chain Drug Stores, Inc. (NACDS)

Preface

The use and continued use of the polygraph is an issue of vital importance to the chain drug industry. Based on the 39th Annual Nielsen Review of retail drug store trends, the chain drug industry loses approximately 2.1 percent of sales, an estimated 315 million dollars or retail drug sales, through pilferage. The use of routine or pre-employment polygraph examinations as an investigative tool allows companies to monitor pilferage by their own employees. The results of this survey indicate that the polygraph is widely utilized by chain drug corporations for these purposes. Eighty-one percent of those companies which responded to the survey use the polygraph. In questioning NACDS member chain drug companies regarding a congressional bill which might ban the use of polygraphs, 97 percent of the chain drug companies were opposed to such a bill indicating the importance of continued use of the polygraph examination.

Over fifty percent of the chain drug members of NACDS responded to this survey on polygraph testing, making the responses quite representative of the industry as a whole. NACDS represents the management of over 230 chain drug corporations operating over 10,000 stores throughout the United States, Canada and Mexico.

Class I Companies

Use of the Polygraph

In the Class I category, representing companies with 4 to 10 stores, there were forty responses. Of the forty responding chain drug companies in the class, seventy-five percent use the polygraph. The percentage of companies using the polygraph for various reasons is as follows:

- 60% of the companies use the polygraph when necessary for investigative purposes.
- 53% use the polygraph for pre-employment testing.
- 27% use the polygraph routinely on all employees.
- 10% use the polygraph for "other reasons, such as when shortages are discovered.

The twenty-five percent of the companies which do not use the polygraph listed the following reasons:

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- 40% of the companies feel that it is not necessary to use the polygraph.
- 30% do not use the polygraph for "other" reasons, such as anticipated employee reaction, unavailability.
- 20% do not use the polygraph because its use is illegal under state law.

Experiences of Polygraph Users

Only thirteen percent of those compnaies that do use the polygraph have had a significant number of employees refuse to take a polygraph test.

Sixty percent of the polygraph users felt that their losses decreased when they initiated use of the polygraph. Accordingly, ninety-seven percent of the companies felt that it was essential for their company to continue use of polygraph screening procedures.

It should also be noted in discussing polygraph screening procedures that one hundred percent of the polygraph examiners are licensed or certified. In fact, most chain drug companies contract certified or licensed polygraph examining companies to do this work for them.

Class II Companies

Use of the Polygraph

In the Class II category, which includes 11 to 50 store chains, there were forty-five responses. Sixty-two percent of those chains which responded use the polygraph. However, five percent of the responding chains in this class use a relatively new device, the Psychological Stress Evaluator (PSE). The reasons given for the use of the polygraph by the percentage of companies is as follows:

- 87% of the companies use the polygraph when necessary for investigative purposes.
- 33% use the polygraph for pre-employment testing.
- 20% use the polygraph for "other" reasons, such as when shortages occur.
- 17% use the polygraph routinely on all employees.

The reasons for thirty-three percent of the companies not using the polygraph are as follows:

- 33% do not use the polygraph because it is illegal due to union contracts.
- 27% do not use the polygraph because its use is illegal under state law.

- 13% do not use the polygraph because they feel it is not necessary.
- 13% do not use the polygraph for "other" reasons, such as anticipated employee reaction.

Experiences of Polygraph Users

In this class, only 10 percent of those companies that do use the polygraph have had a significant number of employees refuse to take a polygraph test.

Seventy percent of the companies felt that their losses decreased when they initiated use of the polygraph. Ninety percent of the companies believe that it is essential for their company to continue use of polygraph screening procedures.

As in Class I, one hundred percent of the polygraph examiners utilized by the chain drug companies are licensed or certified.

Class III Companies

Use of the Polygraph

Class III, consisting of chains with 51 or more stores, had seventeen responses. Ninety-four percent of those responding utilize the polygraph, while the remaining six percent utilize the PSE. The percentage of companies utilizing the polygraph and PSE for various reasons are as follows:

- 82% of the companies use the polygraph when necessary for investigative purposes.
- 65% use the polygraph for pre-employment testing.
- 24% use the polygraph routinely on all employees.

It should be noted that there are no companies within this class that do not use either the polygraph or the PSE.

Experiences of Polygraph Users

Eighteen percent of those companies that do use the polygraph have had a significant number of employees refuse to take a polygraph test.

Fifty-three percent of the companies useing the polygraph found that their losses decreased after they initiated use of the polygraph. 94 percent of the companies felt that is was essential for their company to continue use of polygraph screening procedures.

Again, in this class, all polygraph examiners utilized by the companies were either certified or license.

Summary

In examining the overall spectrum of polygraph users, it is found that &l percent of all chain drug companies responding to the survey utilize the polygraph. As would be expected, 100 percent of the companies in the largest chain category utilize either the polygraph or PSE. Furthermore, the main reason for utilization of the polygraph was the same in all three classes: 1) for investigative purposes when necessary, and 2) for preemployment testing.

Polygraph Users (by class)	Percent of Companies
Class I Class II Class III	75% 67% 100%
Overall	81%

For those companies which do not utilize the polygraph there does not seem to be one predominant reason. As might be expected, the main reason for Class I companies, the smallest sized chains for not using the polygraph is that they feel it is not necessary. The main reason constraining use of the polygraph by Class II companies are the restrictions of union contracts and state laws.

Overall, 14 percent of the responding chain drug companies experienced a significant number of employees refusing to submit to a polygraph examination.

Refusals to Submit to Polygraph Exam	Percent of Companies
Class I	13%
Class II	10%
Class III	18%
Overall	14%

Sixty-one percent of all chain drug companies experienced decreases in pilferage after initiation of polygraph examinations. As might be expected, ninety-four percent of all the responding companies feel that it is essential to continue use of polygraph testing.

graph Percent of Companies	
	3
Class I 97% Class II 90% Class III 94% Overall 94%	_

* * * * * *

GEORGIA ADMITS POLYGRAPH EVIDENCE

State v. Chambers 239 S.E.2d 324 (1977)

Hall, Justice.

"We granted certiorari in this statutory rape case to consider whether the results of lie detector tests of the defendant and the prosecutrix were properly admitted at trial when it was stipulated between the state and the defendant before the tests that the results would be admissible.

"Chambers was convicted of the statutory rape of a young girl and sentenced to 20 years. Polygraph tests were administered to him and to the prosecutrix pursuant to an agreement between the state and the defendant that the results would be admissible whatever they showed. The results were admitted, and the examiner testified that he interpreted the results to mean that Chambers was lying in denying the crime, and the victim was truthful in accusing him. The Court of Appeals reversed the conviction on the ground that under <u>Famber v. State</u>, 134 Ga.App. 112 (213 S.E.2d 525)(1975), polygraph results are inadmissible and without probative value, and thus the victim's charge failed for lack of corroboration. The Court of Appeals correctly noted that doubt has been cast on the continued viability of <u>Famber</u>, see <u>Scott v. State</u>, 238 Ga. 30 (230 S.E.2d 857) (1976) (and dissenting opinion), but it has not heretofore been overruled.

"We rule today that upon an express stipulation of the parties that they shall be admissible, the results of a lie detector test shall be admissible as evidence for the jury to attach to them whatever probative value they may find them to have. <u>Famber v. State</u>, supra, is hereby overruled.

"The Court of Appeals a few years ago stated the law correctly in <u>Cagle v. State</u>, 132 Ga.App. 227, 229 (207 S.E.2d 703)(1974): 'Neither an agreement to take a polygraph, nor the taking of one, constitutes a waiver of a right to object to the admission of its results into evidence, absent an express stipulation of the parties as to its admissibility.⁴ (Emphasis supplied.) See also <u>Scott</u> v. <u>State</u>, supra (dissenting opinion).

"Numerous other jurisdictions have now arrived at the conclusion that these results may be admitted by agreement. E.g., <u>Herman v. Eagle Star Ins.</u> <u>Co.</u>, 396 F.2d 427 (9th Cir. 1968), affirming 283 F.Supp. 33 (C.D., Cal. 1966); <u>Commonwealth v. A Juvenile</u>, 365 Mass. 421 (313 N.E.2d 120)(1974); <u>State v. Woo</u>, 84 Wash. 2d 472 (527 P.2d. 271)(1974)(rule recognized); <u>State v. Alderete</u>, 86 N.M. 176 (521 P.2d 138)(1974); <u>State v. McDavitt</u>, 62 N.J. 36 (297 A.2d 849)(1972); <u>State v. Williams</u>, 108 Ariz. 382 (499 P.2d 97) (1972); <u>State v. Rowley</u>, 15 Utah2d 4 (386 P.2d 126); <u>People v. Houser</u>, 85 Cal.App. 2d 686 (193 P.2d 937)(1948); <u>State v. Lowry</u>, 163 Kan. 622 (185 P.2d 147) (1947)(rule recognized). See Annot., Admissibility of Lie Detector Test Taken upon Stipulation that the Result will be Admissible in Evidence, 53 ALR3d 1005 (1973).

"We acknowledge that doubt exists as to the complete reliability of

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Lie detector tests, and we share at least a modicum of that doubt. Operators may be unskilled, and results may be ambiguous and subject to arbitrary characterization. Of course, by cross examination counsel may show any vagueness of the electronic indications or any subjectiveness of the examiner's interpretations, as well as exploring conditions other than the subject's untruthfulness which could have produced such responses.

"However, despite some problems posed by polygraphs, McCormick warned more than 20 years ago that 'We cannot in our hearts be so confident of the reliability of the present system of resolving conflicts in testimony by impeachment, cross examination and inferences from demeanor, that we can afford to reject scientific aid in the task,' McCormick, Evidence 369-370, sec. 174 (1954 Ed.). A more recent writer has phrased this thought in more urgent language: 'If the judicial system is to fulfill its duty of searching for truth and maintaining integrity, it must commence a war against perjury. The war cannot be won with weapons restricted to cross examination, inferences from demeanor, and other relics from the crossbow era of Henry II.... [T]here is no tenable reason why qualified polygraphers should not be welcomed by courts confronting credibility questions; clearly, polygraphy "appears to have something valuable to add to the administration of justice."' Tarlow, Admissibility of Polygraph Evidence in 1975, 26 Hastings L.J. 917, 920-921 (1975), (Footnotes omitted.)

"Once it has been decided to admit polygraph evidence, it becomes necessary to decide what kind of evidence it is. As was true at Chamber's trial, such evidence usually has two parts. One part is the actual graphs made by the machine showing the subject's physical responses to questions. The other part is the opinion of the examiner as to what those responses indicate.

"Authorities are in some disagreement in characterizing this evidence. In <u>Schmerber</u> v. <u>California</u>, 384 U.S.757, 764 (88 S.C. 1826, 16 LE.2d 908)(1966), the United States Supreme Court found it difficult to say whether it was more like testimonial evidence (that is, "testimony" by the one subjected to the test), or physical evidence. A Massachusetts court in Commonwealth v. A Juvenile, 365 Mass. 421, supra, said it was testimonial evidence and that "the trial judge, ... may ... admit the results, not as binding or conclusive evidence, but to be considered with all other evidence as to innocence or guilt." P. 426. It is sometimes said, for example, that "Polygraph evidence is introduced as expert opinion testimony." Note, Pinocchio's New Nose, 48 N.Y.U.L.Rev. 339, 361 (1973). McCormick treats it as scientific evidence. McCormick, Evidence 421, sec. 207 (1972 Ed.). Accord, Tarlow, Polygraph, 26 Hastings L.J. 917 (1975). One federal court concluded that it was generally opinion evidence, but could sometimes be direct evidence on the point of the examinee's belief in his answer. "Since this is a perjury case, the issue is-was the defendant lying? The opinion of the polygraph examiner based on a properly conducted examination is more than character evidence, it is <u>direct</u> evidence on this point and may be offered by either side regardless of whether the accused takes the stand or puts his character is issue." United States v. Ridling, 350 F.Supp. 90, 98 (E.D.Mich. 1972). (Emphasis supplied.) "Whether the polygraph test results are admitted in a criminal or civil case, the judge should instruct the jury that they should consider the test results along with the other

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evidence, but that the opinion of the examiner as to whether the subject gave truthful or deceptive responses is not conclusive and should be only given whatever weight they think it deserves." Note, The Role of the Polygraph in Our Judicial System, 20 S.C.L.Rev. 804, 824 (1968).

"In a context different from the instant case, a Washington court has admitted polygraph evidence for corroboration: "While all courts are not in complete agreement, we are persuaded that the better rule is that the results of a polygraph test are admissible for the purpose of corroboration under [certain circumstances]" <u>State v. Ross</u>, 7 Wash. App. 62 (497 P.2d 1343, 1347)(1972).

"It is a question of corroboration which is presently before us, and it has long been the law in Georgia that only slight circumstances can suffice to corroborate the accusation of a rape victim.

"In a prosecution for rape, corroborating evidence need not be of itself sufficient to convict the accused. Slight circumstances may be sufficient corroboration. [Cits] ... "Therefore, if there be any corroborative evidence at all, this court will not pass upon its probative value, since the verdict of the jury under proper instructions has resolved that issue.' [Cits.]" Johnson v. State, 239 Ga. 116, 117 (236 S.E.2d 65)(1977).

"It is not necessary in this opinion to answer all questions which future cases may present. It suffices to decide this case that the polygraph results were at least some evidence, though not direct evidence, of Chamber's guilt. The Court of Appeals erred in ruling that polygraph results are always inadmissible and without probative value. Accord, <u>Cullin</u> <u>v. State</u>, (Wyo)., 565 P.2d 445, 449 (1977); <u>State v. Sims</u>, 21 Crim. L. Rptr. 2190 (April 25, 1977) (Cuyahoga, Ohio, Common Pleas Court). The polygraph results were adequate to provide the corroboration of the victim's testimony required by Code Ann. para. 26-2018.

"We note that in a different case in which the only evidence of guilt is defendant's performance on a lie detector test, the state's case would not meet the strongent test which is applied by Code Ann. para 38-109 to circumstantial evidence: "To warrant a conviction on circumstantial evidence, the proved facts shall not only be consistent with the hypothesis of guilt, but shall exclude every other reasonable hypothesis save that of the guilt of the accused." Today's decision to allow these results into evidence is limited by our concurrent conclusion that the results of the lie detector tests are insufficiently reliable to exclude very other reasonable hypothesis in conflict with their conclusion. This means that when the only evidence of guilt is defendant's performance on a lie detector test, a conviction may not stand.

"When polygraph results are admitted at trial, either party is entitled, upon request, to have the jury charged concerning the meaning of this evidence. In giving the charge the judge should state that the examiner's opinions may only be used to indicate whether at the time of the polygraph examination the person examined believed that he was telling the whole truth; that the jury are not bound by the polygraph examiner's conclusions and his (or her) testimony is not controlling on the issues and may even be entirely disregarded; and that it is for the jury to decide what weight should be given this evidence.

"In reversing on the ground that, absent corroboration, the evidence was inadequately to convict, the Court of Appeals did not consider the other enumerations of error. Accordingly, we must remand the case to the Court of Appeals for their consideration of the remaining issues.

"Judgement reversed and remanded. All the Justices concur, except Jordan and Bowles, JJ., who dissent."

"Submitted April 22, 1977-Decided October 18, 1977-Rehearing denied November 1, 1977.

"Certiorari to the Court of Appeals of Georgia—141 Ga.App. 438 (233 S.E.2d 818)(1977).

"Charles Crawford, District Attorney, for appellant. "Ben Lancaster, for appellee.

Jordan, Justice, dissenting.

"The law has been settled for years in Georgia that results of polygraph tests are inadmissible and without probative value. This is based on the lack of scientific proof of the accuracy and reliability of such tests. Now, without any scientific authority or other rational basis, this court would open the door for the admissibility of such tests. While some jurisdictions have arrived at the same result, the rule in most jurisdictions comports with the Georgia view. See <u>Stack v. State</u>, 234 Ga. 19, 21 (213 S.E.2d 514).

"There is simply no "lie detector" machine or human. The first recorded lie detector test was in ancient India where a suspect was required to enter a darkened room and touch the tail of a donkey. If the donkey brayed when his tail was touched the suspect was declared guilty, otherwise he was released. Modern science has substituted a metal electronic box for the donkey but the results remain just as haphazard and inconclusive.

"The state should not be able to convict nor the defendant to gain acquittal on the basis of such tests, even though both are willing to stipulate its admissibility.

"I respectfully dissent."

Bowles, Justice, dissenting.

"I cannot agree with the majority opinion in this case. An express stipulation of the parties that the results of a polygraph test shall be admissible in evidence does not in my opinion make the results competent evidence. The majority opinion suggests that these scientific devices may have improved in recent years sufficiently to now aid in the search for truth. Certainly there may have been improvements both in the machines themselves and in the abilities of various examiners. I note, however, that the decisions cited in the majority opinion deal with the result being admitted

by agreement only and there is practically no authority. statutory or otherwise permitting such evidence to be introduced by a party as a matter of right. My personal experience from many long years at the bar leads me to appreciate many many faults with polygraph results and procedures. and little or no tangible benefits. I cannot agree that evidence of any kind has probative value merely because counsel for both parties stipulate as to its admissibility. The courts of many states agree. State v. Corbin, 285 S.2d 234 (La. 1973); Lewis v. State, 500 S.W.2d 167 (Tex. 1973); Romero v. State, 493 S.W.2d 206 (Tex. 1973); Pulakis v. State, 476 P.2d 474 (Alaska 1970); Conley v. Commonwealth, 382 S.W.2d 865 (Ky. 1964); People v. Zazzetta, 27 III. 2d 302 (189 N.E.2d 260)(1963); Stone v. Earp, 331 Mich. 606 (50 N.W. 2d 172)(1951); LeFevre v. State, 242 Wis. 416 (9 N.W.2d 288)(1943). Courts are usually reluctant to exclude any matter consented to by both parties. This is based on the basic principles of fair play. However, polygraph results have not been demonstrated as reliable. I cannot feel comfortable leaving the guilt or innocence of an individual based on "evidence" which almost every court in America has concluded is lacking as competent evidence because of insufficient scientific reliability. Defendants do not know or understand the truthworthiness. Jurors are not experts and usually have had little or no experience along these lines. On the other hand, juries could be greatly persuaded in one direction or the other by such unreliable scientific evidence. To approve its use, in my opinion, is a step backward in the judicial process.

"Therefore, I respectfully dissent."

* * * * * *

<u>RESEARCH</u> <u>NOTE</u>

By

C. Muses

Computerisation Feasibility of Psychophysiological Parameters*

Polygraphy, including voice stress supplement, is the field of applied psychophysiology chosen for this research report, as it is widely un use and has multilevel practical and social implications for biomedical computing in forensic medicine.

In the late 1970s sensors are sufficiently developed to be able, without great difficulty or cumbersomeness, to digitise parameters such as

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C. Muses, Center for Research in Mathematics and Morphology, 844 San Ysidro Lane, Santa Barbara, California 93108 breathing rate and depth, pulse rate and pressure, and the changes in skin resistance with emotional concern that are so helpful in polygraphy, especially in its highest state of the art today. The Backster Zone Comparison Technique was worked out in the years following 1959 by Mr. Cleve Backster, whose methods were incorporated by the official and thorough U.S. Army Criminal Investigation Command, with a jointly operated Army Polygraph Examiner School at Fort Gordon, Georgia.

The Backster Technique, aside from its precision and velocity, also provides the best possible insurance against obtaining a false positive result in the case of innocent subjects, later verified as such, who may simply and naturally be reacting to threatening questions with normal nervousness and emotional tension.

In the 1960s, Backster worked out his now widely used (with variants) numerical scoring method, based on objective criteria depending on the actual time-charting of the observable psychophysiological parameters, and not on any interrogator's bias, mere prejudice or whim.

Hence, if the polygraph is computer-feasible, such feasibility, it is wholly safe to say, can be arrived at only by using the Zone Comparison Technique and its numerical scoring as a starting point. The working out of computer feasibility and consequent implementation in software is now an international need in a rapidly shrinking global society.

A grant for such a much needed study is now being processed by this author in connection with the Backster Research Foundation. Readers will be advised as to progress. Voice microtremor will be included as a parameter in addition to the standard cardiovascular and galvanic skin response.

* * * * * *

Note to Readers: Included with this issue of Polygraph is a "Quick Reference Guide to Polygraph Admissibility" by Norman Ansley. This is a continued service of the American Polygraph Association to keep examiners up-to-date. Additional copies are available for \$3.95 postpaid by writing to APA Publications, 3 Kimberly Court, Severna Park, Maryland 21146.

* * * * * *

Incidentally, an early pulse recorder was invented by Dr. MacKenzie, a British cardiologist of Burnley and Later London and St. Andrews. [Note from Editor of Int. J. Bio-Medical Computing]. Article printed in Great Britain.

TECHNICAL NOTES

CALIBRATING THE 22500 STOELTING GSR AMPLIFIER AND RECORDING UNIT

By

Ronald E. Decker

- 1. Attach AC power cord to instrument and electrical outlet.
- 2. Attach finger electrode assembly to instrument and plug into checking fixture.
- 3. Install 7 inch GSR recording pen in GSR pen cradle.
- 4. Remove amplifier from instrument. Rest amplifier on top panel over the amplifier opening. Turn amplifier on and let it warm for 30 minutes.
- 5. Set auto/manual switch to manual position.
- 6. Set sensitivity control to "O".
- 7. Set pen centering control to full counterclockwise position.
- 8. Adjust R-23 (screwdriver adjustable variable resistor) to center GSR pen on GSR base line. Let set for 5 minutes before making any further adjustments. If necessary, readjust pen to base line. (Note: R-23 resistor is located back of the two 6AQ5 tubes.)
- 9. Turn sensitivity control (R-19) to 100 to maximum clockwise position.
- 10. Center GSR pen with centering control (R-1) to GSR base line.
- 11. Switch auto/manual switch to auto position.
- 12. Adjust chopper balance by using R-10 (screwdriver adjustable variable resistor, located near the auto/manual switch) until GSR pen will remain on base line. Let set for 5 minutes. Switch to manual position and center pen using center control (R-1). Switch back to auto position. Pen should remain on GSR base line. If pen does not remain on base line when switching from manual to auto position, make further adjustments with R-10.
- 13. It may be necessary to repeat the above procedure to obtain correct GSR amplifier calibration on an amplifier which is extremely out of adjustment.
- 14. Rotate sensitivity to control. If GSR pen moves in either direction more than one chart division, unbalance amplifier by turning R-23 and R-10 and repeat procedure. (However, you may not be able to correct this in all amplifiers; if you cannot the amplifier will operate satisfactory.)

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- 15. Check sensitivity with checking fixture. You should have $3\frac{1}{2}$ to 4 chart divisions of pen deflection in the manual position. If not (too much or not enough sensitivity) adjust R-18 (screwdriver adjustable variable resistor) until proper sensitivity is obtained.
- 16. On amplifiers where you cannot reduce the sensitivity down to $3\frac{1}{2}-4$ chart divisions of pen deflection, it will be necessary to have a signal repairman place a one (1) MEG resistor in series with R-18. When this is done, the amplifier will have to be re-calibrated.

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UNDERSTANDING HUMAN BEHAVIOR FOR EFFECTIVE POLICE WORK

A BOOK REVIEW

By

Norman Ansley

Russell, Harold E. and Beigel, Allan, <u>Understanding Human Behavior</u> for <u>Effective Police Work</u>. New York: Basic Books, 1976. 303 pp. (\$13.95).

This work is a basic textbook, suitable for classroom use or self study. Its primary value is the clarity of the text and fine organization of the material. Each chapter has a summary and bibliography. There is a very thorough index.

All polygraph examiners, psychologists, and law enforcement officers work constantly with a variety of human behavior, under conditions that are often stressful to the subject. The text is designed to provide the reader with a "practical understanding of both normal behavior and the deviant behavior he is apt to encounter on the street."

The book is forthright in giving advice on specific situations, and the situations are those which are typical. There are clear chapters describing psychopathic, drug dependent, sexually deviant, delinquent, paranoid, violent, suicidal and other forms of abnormal behavior. There are even chapters on behavior during disasters and riots.

The authors are qualified to write from practical experience, and they do. Dr. Russell is Director of the Pima County Superior Court Clinic and a staff psychologist for the Tucson Police Department. Dr. Beigel is Director of the Southern Arizona Mental Health Center in Tucson.

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HYPNOSIS: A NEW TOOL IN CRIME DETECTION

A REVIEW

By

Clarence H. A. Romig

Block, Eugene B. <u>Hypnosis: A New Tool in Crime Detection</u>. New York: McKay Company, 1976, 240 pages.

Polygraphists will find in this book more than a passing kinship between hypnosis and polygraphy. Recorded in use for more than five thousand years, hypnosis, like the modern polygraph technique, gains results by methods not totally understood by its practitioners. Despite this lack of knowledge why or how hypnosis works, or does not work with certain subjects, twenty years ago the American Medical Association purportedly recognized hypnosis as a valid tool for the medical field. Coupled with frequent mention of the use of modern lie detectors, how hypnosis has increasingly been accepted by courts throughout the country should provide interesting reading to the polygraphists who want to improve themselves and their profession.

Eugene Block is no newcomer to the field of crime detection. This is his thirteenth book dealing with his interests in criminology and penology, which originated from his days as a police reporter for various newspapers. Written from a neutral perspective, the book vividly depicts the intriguing history of hypnosis, including its quest for legal acceptance and the significant contributions the practice has made to the fields of law enforcement and justice. Hypnosis was utilized in some of the best known crimes of this century, including the Boston Strangler case, the Robert Kennedy assassination and the kidnapping of Jimmy Hoffa. <u>Hypnosis: A New Tool in</u> <u>Crime Detection</u> provides a very readable catalogue of many criminal cases and courtroom battles in which hypnosis played a prominent role.

The value of hypnosis in prodding the memory has been proved repeatedly in recent years. Witnesses and victims have been hypnotized to provide repressed details from the scenes of crimes or accurate descriptions of criminals. Forgotten alibis, motives, and sometimes confessions were obtained from suspects in hypnotic trances. (And as done often with the polygraph, hypnosis has cleared wrongfully convicted and imprisoned citizens.)

The obvious usefulness of hypnosis has won its gradual but increasing acceptance in the courts. In 1959 the California Supreme Court decreed that the use of hypnosis, recognized by medical authorities, was not legally different than the use of a psychiatrist to probe into the client's subconscious recollection. This ruling did not address the acceptance of evidence obtained by hypnosis, rather it outlined the right of the accused to learn facts that may be of assistance in the preparation of the defense of the crime charged. In another court case in California in 1964, the state Supreme Court held that expert opinion concerning hypnotic techniques as used in a psychiatric examination and the information gained are clearly admissible. In Ohio in 1962, a defendant was placed in a hypnotic trance

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and then examined in open court, in the presence of the judge and jury. Since then courts in Maryland, Michigan, New York, and Pennsylvania have allowed the use of hypnosis to provide testimony and evidence in cases at hand.

A question often asked of polygraphers is, "How accurate is the polygraph?" That same question was foremost in the mind of this reviewer while reading this book. The answer was clearly provided by the author. Although hypnosis can enable the subject to remember things that have been repressed from conscious memory, there is no guarantee that the subject has not lied, fantasized, or made mistakes while in the trance. The desire for self-protection may remain unaffected by hypnosis, and a guilty person is just as likely to resist the truth under hypnosis as when he is in a normal state. Information obtained by hypnosis still has to be verified.

One case where information revealed by hypnosis was verified instantly involved the simultaneous use of the polygraph and hypnosis. As pre-trial preparation, a defense counsel obtained a court order to allow the examination of the accused held in a penitentiary. One of the nation's foremost polygraphists assisted the psychiatrist-hypnotist in a joint effort to arrive at the truth by polygraphing the inmate as he answered questions posed by the hypnotist.

Not mentioned in the book is the fact that there are groups that object to the use of hypnosis by law enforcement. Some civil liberty groups have expressed concern that it could elicit confessions unfairly. Police say they use hypnosis only for investigations and that the subject's cooperation is necessarily voluntary. The Miranda requirements would apply in the case of hypnotizing a person actually suspected of an offense. Further research and continued controls of the practitioners by the several professional associations is expected to overcome such objections.

Polygraphists need not fear that hypnosis will supplant polygraphy. Rather they should read closely the prescription given for hypnosis to become acceptable to the courts. Further, they should become aware of the fact that in all the cited cases the hypnotists were armed with advanced academic degrees and had the acquiescence, if not the full support, of a scientific community. Polygraphists must transcend their parochialism and make a more concerted and professional contribution to their field if they would aspire to the burgeoning successes attained by hypnosis.

In sum, <u>Hypnosis: A New Tool for Crime Detection</u> should be required reading for all present and future polygraphists, not only because of its references to the polygraph, but because the increasing use of hypnosis by the police and its acceptance by the courts closely parallels the history of the polygraph. Closer relationships with hypnotists may be mutually beneficial. Serious reading of this book should be no less rewarding.

The reviewer is an Associate Professor of Criminology at Indiana State University, Terre Haute, Indiana.

TRUTH AND DECEPTION

A BOOK REVIEW

By

Norman Ansley

Reid, John E. and Inbau, Fred E. <u>Truth and Deception: The Polygraph</u> ("Lie <u>Detector</u>") <u>Technique</u>. 2nd Edition, Baltimore: Williams & Wilkins, 1977, 360 pages, illustrated, \$32.00 postpaid to Williams & Wilkins, P.O. Box 1496, Baltimore, Maryland 21203.

This second edition of Reid and Inbau is an excellent book. The additions, bringing it up-to-date, have been eagerly awaited by all examiners. In the preface, the authors note that the work is based upon professional experiences, in the testing of over 100,000 persons in actual case situations, over a span of 44 years.

The authors acknowledge the contributions of many others in preparation of the book, appendices, changes, research projects, charts, bibliographies, surveys and photographs: Philip Ash, Gordon H. Barland, Joseph P. Buckley, Robert C. Cummins, Frank S. Horvath, Fred L. Hunter, Alvin Meyer, Louis Okmin, Paul G. Simon, Stanley Slowik, and Douglas E. Wicklander.

It is not necessary to be a student of the Reid technique to find the text useful. Every examiner will benefit from reading the history; legal chapter; the appendices with research on validity, reliability, influence of auxiliary sources of information; use of an interpreter; suggestions to law enforcement officers on the use of the polygraph; and a selected bibliography.

The use of the superb chart illustrations for studying chart interpretation is of value to everyone. The reproduction of portions of charts in excellent, and so is the selection and variety.

The description of the Reid technique is clear, well written, and supported by excellent illustrations of cases and situations. The book is, however, strictly limited to the Reid technique. There is nothing here for those seeking information on other techniques. It is a textbook, and an excellent one, full of the collective wisdom, personal observations, and professional preferences of the authors. It is not a scientific treatise. Although research is mentioned at points and some is added in appendices, there was no intention to make it a scientific work. There are those who may find fault with the Reid technique, or more likely, some part of it, but the book accomplishes its objective, a thorough explanation of the entire technique from pretest through chart interpretation. The legal chapter is a fine discussion of every aspect of the law as it applies to the polygraph in both criminal and civil settings. This portion of the book is invaluable as a reference.

This book should be in every examiner's library.

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ABSTRACTS

Finger Pulse Volume (Plethysmography)

Bloom, Larry J. and Trautt, Gregory M. "Finger Pulse Volume as a Measure of Anxiety: Further Evaluation," <u>Psychophysiology</u> 14 (6)(November 1977): 517-521.

The investigation further explored the utility of Finger Pulse Volume (FPV) as a measure of anxiety. Male and female subjects were exposed to threatening and nonthreatening situations and measures of FPV, pulse rate (PR), and self-report of anxiety (AACL) were collected. Results indicate that: (a) FPV was sensitive to change in experimentally manipulated anxiety, and (b) FPV and PR were temporally, differentially responsive as measures of anxiety: FPV was more responsive initially and recovered more quickly than PR following the introduction of threat. Implications of these data to the often noted low intercorrelations among physiological measures and the relevance of these findings to anxiety management are discussed. [author abstract]

Pupillometry

Heilveil, Ira. "Deception and Pupil Size," <u>Journal of Clinical</u> Psychology 32 (3)(July 1976): 675-676.

An experiment with undergraduate students designed to test the hypothesis that pupil diameter is significantly larger when a subject is engaging in deceptive verbal responses than when a subject is responding honestly to interviewer's questions. Twelve subjects were asked five questions about themselves while their pupil sizes were being recorded by a Whittaker Corporation pupillometer. Deceptiveness was determined by a selfrating procedure, in which subjects rated their responses as completely true. partially deceptive, or completely deceptive. It was found that during the period of time in which subjects stated that they were responding deceptively their pupils were dilated significantly more than when they rated themselves as responding truthfully. Pupil size was measured during the response period at intervals of 2/10 second. The mean of these measurements was calculated for the response to each question, which yielded a mean pupil idameter (mpd). The mpd's of all answers were rated as nondeceptive. The mean mpd for all nondeceptive responses was 5.1515 mm., and the mean mpd for all responses rated as deceptive was 5.7444 mm. A t-test showed the difference to be significant, t(11) = -2.033, p < .05. An analysis of variance also showed a significant difference between pupil size in the deceptive and nondeceptive conditions, F(1,11) = 3/728, p = .0798.

Reliability

Edel, Eugene C., Moore, Lane A. and Jacoby, Jacob, "Examiner Reliability in Polygraph Chart Analysis: Identification of Physiological Responses," Journal of Applied Psychology 60 (5)(1975): 632-634. The degree of reliability displayed by polygraph examiners when identifying physiological responses was investigated. Judgments by 10 experienced examiners working independently on actual case material involving responses to 2,530 questions from 40 polygraph interview cases were examined. A high degree of consistency (p. .0001) was found in the ability of these examiners to identify (a) whether or not a physiological reaction occurred and, if so, (b) what type of physiological pattern occurred (cardio-vascular, respiratory, and/or galvanic skin response). The overall percentage of agreement across examiners, for all possible judgments, was 95%: 96% for cardiovascular responses. [author abstract.] (Note: when this article was originally published the name of Lane A. Moore was omitted through error. Bibliographies should be amended to include his name as second author. Ed.).

Horvath, Frank. "The Effect of Selected Variables on Interpretation of Polygraph Records," <u>Journal of Applied Psychology</u> 62 (2)(April 1977): 127-136.

Ten field-trained polygraph examiners (evaluators) made blind judgments of a stratified sample of the polygraph records of 112 criminal suspects. Correct calls averaged 63.1% (p. .001), 64/1% on records where ground truth was not known (unverified) but where the criterion measure was the øriginal testing examiner's judgment. Evaluators' hit rates in both situations were quite similar, averaging about 77% true positives and about 50% true negatives; the variable having the greatest effect on evaluators' errors was the type of investigation from which records were drawn. Reliability coefficients showed high interevaluator agreement on both verified and unverified records, .89 amd .85 respectively. [author abstract.]

Response to Stress

Barrell, James J. and Price, Donald D. "Two Experimental Orientations Toward a Stressful Situation and Their Related Somatic and Visceral Responses," <u>Psychophysiology</u> 14 (6)(November 1977): 517-521.

Experimental orientations toward a stressor, a threat of very painful electric shock, were found to be related to some visceral and somatic responses. Under such conditions, subjects either attempted to confront or avoid the stressor. Moreover, in the stress situation, a confronting orientation showed significantly higher trapezius electromyograms (EMGs) when compared to an avoiding orientation; and avoiding significantly higher heart rates (HRs) when compared to confronting. The existence of stress in this situation was based upon both physiological changes toward activation and subject feedback (i.e., self reports). Attention targets were suggested as another way of conceptualizing these two experiential orientations. The results indicated that these specific stress orientations expressed themselves in the body through specific physiological response profiles. [author abstract.]

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Validity

Barland, Gordon H. <u>Detection of Deception in Criminal Suspects</u>: <u>A</u> <u>Field Validation Study</u>. Ph.D. Dissertation, Salt Lake City: University of Utah, 1975.

This study examined the accuracy of the polygraph technique for the detection of deception by criminal suspects. Seventy-seven suspects involved in 67 different cases were examined by a private polygraph examiner using the federal modification of the zone comparison control question technique, Standard field polygraphs were used to record respiration, the skin conductance response (SRR), and cardiovascular activity by means of occlusion plethysmography. A minimum of three polygraph charts were obtained from each suspect. Additionally, the suspect's answers to the test questions were tape recorded for voice stress analysis with the Psychological Stress Evaluator, Model PSE-1. During the pretest interview, the MMPI L-scale, K-scale, Psychopathic Deviancy (Pd) scale, Depression (D) scale, and Hypocondriasis (Hs) scale were orally administered. The polygraph and PSE charts were numerically evaluated using standard field scoring practices. The significance level for all tests in the study was .05, twotailed.

The examiner concluded that 55 (71.4%) of the 77 suspects were deceptive (DI) when they denied having committed the act of which they were accused, 10 (13.0%) of the subjects had no deception indicated (NDI), and the remaining 12 examinations (15.6%) were inconclusive. Excluding the inconclusives, 84.6% of the decisions were DI. When the charts were rescored about six months later, the scores were significantly more conservative. Sixty-five (84.4%) of the decisions remained the same upon rescoring. In no case was a decision reversed; the main changes were from a decision to inconclusive. The mean absolute value of the scores of the NDI subjects (M=3.8) was significantly smaller than that of the DI subjects (M=-10.5).

In 17 of 19 cases (89.5%), the examiner correctly predicted the polygraph outcome by observing the suspect's pretest behavior. In 27 examinations confirmed by the confession or guilty plea of the suspect, the skin resistance response was the single most accurate physiological measure, being correct in 25 of 26 decisions (96.2%).

The sign of the PSE Mode III score agreed with the sign of the polygraph score in 34 of 52 cases, which was significant.

The accuracy of the examiner's decisions was assessed by comparing the decision to the consensus of a panel consisting of 5 attorneys and judges who had been presented with all available evidence concerning each case with the exception of the polygraph examination result. The examiner's decisions agreed with the direction of the panel's decision in 37 of 47 cases (78.7%), which was significant. When higher levels of agreement within the panel were required for a panel decision, the agreement between the panel and the polygraph examiner's decisions was generally about 85%. When unanimity of the panel was required for a panel decision, the rate of agreement between the panel and the polygraph outcome was 83.3%. The three disagreements occurred on suspects considered innocent by the panel. When the examiner's decisions were compared against the judicial outcome in those cases in which the judiciary was uninformed of the polygraph outcome, the rate of agreement was 26 out of 29 cases (89.7%). Again, the disagreements occurred on suspects acquitted by the judicial process.

None of the following biographical variables was related to autonomic responsivity as recorded by the polygraph: age, sex, education, number of previous arrests, number of previous polygraph examinations, dept of religious convictions, and type of crime committed. No practical effect upon autonomic responsivity of the suspects' scores on the MMPI scales was found, including the psychopathic deviancy scale.

It was concluded that, within the limitations inherent in any attempt to validate the polygraph technique outside of the laboratory setting, the results of this study support the proposition that carefully administered control question polygraph examinations are highly accurate in assessing the credibility of criminal suspects. [author abstract.]

Voice Stress Equipment

Cain, Stephen. "The Psychological Stress Evaluator: Forensic Applications and Limitations," <u>Identification News</u> (September 1977, pp. 3-7), biblio.

A general overview of the development of the Psychological Stress Evaluator and similar equipment, including a description of how they purport to work. In regard to validity, Cain quotes from all sources available. He notes the A.P.A. view and the response of those who do use voice equipment. Some of the PSE cases, including the article by George O'Toole who claims that Oswald did not kill anyone, are described; as is the uncertain position of voice equipment in states which license polygraph examiners. Cain notes that the Society of Stress Analysts is composed of 200 members led by John W. Heisse, M.D. who claims that the P.S.E. has a validity of 97%. Uses of voice equipment in other fields, particularly in psychology, is mentioned. In all, a balanced view, without critical analysis. [Ed.]

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POLYGRAPH REVIEW

By

Bobby J. Daily

How would you score on a licensing examination? Are you sufficiently up-to-date about such subjects as psychology, physiology, instrumentation, test question construction, chart interpretation, interview techniques, etc? Are you prepared to undergo direct and cross-examination on polygraph subjects in court? A score of 9 or 10 is excellent, 7 or 8 is good, and below 7 may indicate some review is warranted. (Answers on page 48.)

- 1. When the pneumograph chest tube expands in conjunction with examinee's breathing, the pressure within the pneumograph system:
 - a. increases
 - b. decreases
 - c. remains constant
 - d. Neither of the above. There is no pressure in the pneumo system.
- 2. During an examination, when the GSR is functioning properly, an upward movement of the GSR pen indicates that the examinee's body resistance has:
 - a. remained unchanged
 - b. increased
 - c. decreased
 - d. Neither of the above
- 3. When all components of a polygraph instrument are in operation and are functioning properly, the amount of pressure within the pneumo component is approximately:
 - a. 15 pounds per square inch
 - b. 30 millimeters of mercury
 - c. 60 pounds per square inch
 - d. Neither of the above. There is no pressure in the pneumo system.
- 4. After completing a polygraph examination, it is noted that the chart drive motor continues to operate when the chart drive switch is turned off. Which of the following is the most likely cause?
 - a. Defective chart drive motor
 - b. Defective roller spring adjustment
 - c. Defective friction drive wheel
 - d. Defective chart drive switch
- 5. As a polygraph examiner, you should know that the optimum pressure is reached within the cardio system when:
 - a. a two millimeter deviation is observed on the manometer
 - b. the dicrotic notch is centered on the diastolic stroke
 - c. a three-quarter inch pen excursion is obtained
 - d. the subject does not complain of cuff discomfort

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- 6. If the dicrotic notch is too low in the cardio tracing, corrective action would be to increase pressure in the system. (T) (F)
- 7. Massaging of the blood pressure cuff after inflation assists in maintaining constant pressure within the system. (T) (F)
- 8. The GSR sensitivity setting should not be changed between questions 4 and 7 in the Army version of the Zone Comparison test. (T) (F)
- 9. Sensitivity of the pneumo component may be increased or decreased by changing position of the pneumo chest assembly. (T) (F)
- 10. During an examination, if the GSR pen cannot be centered, application of electrode jelly is the first of several possible remedial actions.
 (T) (F)

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