# Polygraph

VOLUME 19 1990 NUMBER 3


CONTENTS




PUBLISHED QUARTERLY



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# THE VALIDITY AND RELIABILITY OF POLYGRAPH DECISIONS IN REAL CASES

By

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Abstract

A report on validity from all studies of real cases, conducted since 1980 is presented. Examiner decisions in these studies were compared to other results such as confessions, evidence, and judicial disposition. The ten studies reviewed considered the outcome of 2,042 cases, and the results, assuming that every disagreement was a polygraph error, indicate a validity of 98%. For deceptive cases, the validity was also 98%, and for non-deceptive cases, 97%. The studies were from police and private cases, using a variety of polygraph techniques, conducted in the United States, Canada, Israel, Japan and Poland.

A report on all the studies of the reliability of blind chart analyses from real cases conducted since 1980 is also presented. Blind analyses of polygraph charts is not a complete measure of reliability, despite frequent misrepresentations. It is, however, related to reliability and validity. True reliability studies involve retesting, and there are no such studies involving real cases. The eleven studies of blind chart analyses included 922 cases, of which 828 were correctly decided, being 90%. The confirmed deceptive cases were correctly decided at 94%, the non-deceptive at 89%. The charts were from police and private cases, with numerical and global scoring and a variety of polygraph techniques.

Four of the studies involved analyses of the examiners' decisions and the decisions of blind evaluators. Based on 320 police and private cases, examiners were correct in 313, being 98%, blind evaluators in 277 of 293 for 95%. Examiners and evaluators were both at 98% accuracy with deceptive cases, but differed considerably in truthful cases. Examiners were correct in 97% of the non-deceptive cases while blind evaluators were correct in 89%.

These studies, which represent all that are available in the last decade, suggest that polygraph testing is highly accurate but an imperfect technique for detecting deception and verifying truth.

The following analyses are based on the results of research studies involving field polygraph tests. Ground truth was established in these studies by either confession of the subject or of another person in the same case, or was based on court decisions. Sometime the follow-up was based on both, and may have also evaluated physical evidence. There are two weaknesses in this form of ground truth. One is that court decisions and physical evidence are themselves unreliable. Confessions are probably a good



Polygraph 19(3):169-190, 1990.

measure, when you have them, as false confessions are rare. However, some critics have suggested that the personality of those who confess is somehow different from those who don't, and that our accuracy in detecting deception in the confession group is not representative of the accuracy of detecting deception in the non-confession group. Also, when police examiners err by calling a deceptive person truthful, a false negative, the error is not often discovered because the subject is not interrogated, and the test result affects the subsequent investigation. These and other problems inherent in validity and reliability studies involving real cases create data that must be used with a caution somewhat different from the limitations imposed on the use of laboratory results. The combination of field and laboratory research results probably creates the best approximation of validity. The laboratory studies are most valuable when the control subjects are evaluated and the tests simulate field conditions with standard instruments, standard test formats, and trained examiners.

In this paper, the studies and tables are limited to studies published in the last ten years. They are of two types. In one, the testing examiner's numerical scores or his decision is compared with the ground truth derived from confession, judicial outcome, evidence, or a combination. These are studies of validity. The second group represents an estimate of reliability. In most of the reliability studies the evaluator sees only the sets of charts, and does not see the question lists, information about the subject, or case facts. Because of this restriction, the research only tells us the value of what is on the charts, with the evaluator not knowing the other information that was available to the examiner. It is not a full measure of total examination reliability. There is research that suggests that evaluators are more accurate in their decisions from the charts when they also have information about the case and subject (Holmes, 1958; Wicklander & Hunter, 1975). A different test of reliability might be to give the evaluators the case materials, a briefing on the case by the investigators, a video of the pretest and test, and the charts. That has not been done. Another approach to a field test measure of validity is to test after the fact, persons whose cases have been adjudicated or are confirmed by confession, evidence, and court adjudication. Marston came close to that in 1921 when he conducted twenty cases referred by the court or probation office and selected by a physician who believed their guilt or innocence was already well established by physical or medical evidence, testimony, or by judicial disposition. Two studies have assessed validity by comparing the decision of polygraph examiners who conducted criminal cases with the decisions of a panel of attorneys, assuming the attorneys were unfailingly correct when they all agreed after reading the evidence (Bersh, 1969; Barland & Raskin, 1976). That research would have been better if some confirmed cases were given to the panel mixed in with the other cases to determine how accurate they were at making decisions.

Because there are numerous studies of validity or reliability involving real cases, it seemed appropriate to confine this review to studies published in the past ten years because they are more apt to represent what is happening in the field now.

## Results

Table 1
Validity of Examiners' Decisions
(inconclusives excluded)

| Authors/Date | NDI # | NDI Correct | NDI % | DI # | DI Correct | DI % | Total # | Total Correct | Total % | Technique |
|---|---|---|---|---|---|---|---|---|---|---|
| Arellano (1990) | 18 | 18 | 100% | 22 | 22 | 100% | 40 | 40 | 100% | Backster Zone |
| Edwards (1981) | 363 | 356 | 98% | 596 | 587 | 98% | 959 | 943 | 98% | variety |
| Elaad & Schahar (1985) | 100 | 95 | 95% | 74 | 73 | 99% | 174 | 168 | 97% | Reid CQT & Backster Zone |
| Matte & Reuss (1989) | 54 | 54 | 100% | 60 | 60 | 100% | 114 | 114 | 100% | Quadri-zone |
| Murray (1989) | 21 | 18 | 86% | 150 | 150 | 100% | 171 | 168 | 98% | Arther CQT |
| Patrick & Iacono (1987) | 30 | 27 | 90% | 51 | 51 | 100% | 81 | 78 | 96% | CQT |
| Putnam (1983) | 65 | 62 | 95% | 220 | 219 | 99% | 285 | 281 | 99% | Backster Zone & MGQT |
| Raskin et al (1988) | 28 | 27 | 96% | 57 | 54 | 95% | 85 | 81 | 95% | CQT |
| Widacki (1982) * | -- | -- | -- | -- | -- | -- | 38 | 35 | 92% | Backster Zone |
| Yamamura & Miyake (1980) | 65 | 61 | 94% | 30 | 24 | 80% | 95 | 85 | 89% | POT |
| TOTALS | 744 | 718 | 97% | 1260 | 1240 | 98% | 2042 | 1993 | 98% | |
| TOTALS (less Edwards and Yamamura & Miyake) | 316 | 301 | 95% | 634 | 629 | 99% | 988 | 965 | 98% | |

* Only the totals reported.

Not all of the results are about control question tests. In regard to the largest study, the Edwards study, we do not know what kind of tests were given by the various police agencies in Virginia, some were probably Relevant-Irrelevant Technique (RI) and others were Control Question Tests (CQT), and perhaps a few were Peak of Tension tests (POT) alone or as supplements. Edwards also differs from the other studies in that the methods of follow-up are unknown, and it appears to be more of a survey than the other studies. Yamamura, reporting on a Japanese riot in which 95 were polygraphed, was able to use all POT tests. Like Edwards, his research needs special consideration. The other studies involve CQT test formats. Inconclusive decisions have been excluded from these tables.

Of the CQTs (excluding Edwards and Yamamura), examiners were correct in 301 of 316 NDI (No Deception Indicated) calls for 95%. They were correct in 629 of 634 DI (Deception Indicated) calls, for 99%. Unlike the peak of tension tests, control question tests were more accurate with guilty subjects. If you include Edwards' study there is minimal difference in the total results. The total NDI decisions were correct in 657 of 679 cases, for 96%, and correct in 1,216 of 1,230 DI cases, for 99%. The overall accuracy for all cases (except POT) was 1,873 correct out of 1,909 cases, for 98%. When you include Yamamura and Edwards, the data is similar: 718 of 744 NDI decisions were correct for 97%; 1,240 of 1,260 DI decisions were correct for 98%; and total figures were 1,993 decisions in 2,042 tests were correct for 98%.

The only research on field use of the peak of tension tests in the past ten years is by Yamamura. The accuracy for the 95 subjects averaged 89%, and was more accurate with the nondeceptive than with the deceptive. When they polygraphed the guilty subjects to learn which of five riot acts they had committed, they were only 79% accurate, but chance was also lower, at 20%. Also, many subjects were guilty of more than one act. Verifying the acts was also more difficult, but they did verify 179 of 226 DI decisions.

## Reliability of Blind Chart Analysis

Blind analysis of charts, where the evaluator knows no facts of the case is only a measure of reliability. This approach is often misrepresented as a measure of validity, but it is not so for several reasons. First, we assume in these studies that the blind evaluators are as competent as the examiner, are as experienced as the examiner, and are trained and experienced in the technique used by the examiner. The last point is vital. When there is a gathering of examiners where they have been trained at different schools in different test methods, and employ different scoring methods, the examiners will have difficulty scoring each other's charts (Weaver 1980, Koll 1979). Many studies do not cite the qualifications, training, and experience of the evaluators. It is not always safe to assume in these studies that the evaluators had experience with the technique, or had adequate training in the appropriate scoring method for the technique. Another variable is the quality of the polygraph charts and the details of marking. The evaluator may have made assumptions about some markings, or the lack of markings, assumptions that were not correct.

Excluded from this study are those research projects in which the reviewers saw only one chart of a set, or chart segments (Kirby, 1981; Kleinmuntz & Szucko, 1984; Rafky & Sussman, 1985; and Yankee, Powell & Newland, 1985). That all of these studies showed decisions above chance is interesting and instructive, but no one of those studies represent a measure of the reliability of blind chart interpretation. Also deleted is the study by Edel and Moore (1984) because it is only a study of interrater reliability at judging reactions, not truth and deception. Included in the tables are three studies that do not separate data by DI and NDI status (Honts & Driscoll, 1988; Jayne, 1990; Widacki, 1982), but do have total figures.

Results

When we total of the CQT studies in Table 2, the evaluation of confirmed NDI charts was correct in 193 of 218 cases, for 89%; the DI chart decisions were correct in 279 of 297, for 94%; and the total decisions were correct in 828 of 922, for 90%. Three studies give only totals, no data no NDI and DI decisions. One study, Elaad (1985), was included twice, as he used numerical scoring in one, global in the other. Global was superior.

The blind numerical analysis of charts was less accurate than the decisions by the initial examiners. The difference in examiner decisions compared to the blind evaluators for standard field CQTs are: for NDI, Examiners 95%, Blind Evaluators 89%; for DI, Examiners 99%, Blind Evaluators 94%; and overall, Examiners 98%, Blind Evaluators 90%.

Table 3 displays the results of four novel scoring methods applied to the analysis of confirmed polygraph charts from real cases. Two involve computer assisted scoring methods, methods that are quite different. In the work by Jayne, his numerical analysis of the charts was correct in 92 of 100 cases, for 92% while his computer analysis was correct in 90 of 100 cases, for 90%. Franz, however, was more accurate with his computer analysis, correctly deciding 89 of 100 examinations for 89%, while his numerical scoring correctly called 83 of 99 cases (one inconclusive) for 84%. In the Honts & Raskin research they added a directed lie control question to 23 cases. When they scored the charts without the directed lie they were correct in 19 of 21 decisions (two inconclusives), for 90%; while they were correct in 22 of 23 decisions when they included the directed lie, for 96%. Matte and Reuss decided to score their Quadri-zone charts with the Backster scoring system applied to all but the fourth zone, which provides additional control data. Because they were correct in the analysis of all tests in the original cases, the application of Backster's method could not improve the record. In fact, there were more inconclusive results, and the accuracy was 93 of 97 decisions, for 96%. While this may tell us how important the fourth zone is to the success of the quadri-zone test, it is not an indication of the accuracy of the Backster Zone Comparison Test.

When we compared those few studies that included the original examiners' accuracy and the blind evaluators' accuracy we had the results shown in Table 4.

Table 2
Reliability of Blind Chart Analysis
(inconclusives excluded)

| Authors/Date | NDI # | NDI Correct | NDI % | DI # | DI Correct | DI % | Total # | Total Correct | Total % | Technique |
|---|---|---|---|---|---|---|---|---|---|---|
| Arellano (1990) | 18 | 18 | 100% | 22 | 22 | 100% | 40 | 40 | 100% | Backster Zone (numerical scoring) |
| Elaad (1985) | 30 | 23 | 77% | 30 | 23 | 77% | 60 | 46 | 77% | CQT (numerical scoring) |
| Elaad (1985) | 30 | 27 | 90% | 30 | 23 | 77% | 60 | 50 | 83% | CQT (global scoring) |
| Franz (1989) | 34 | 33 | 97% | 47 | 47 | 100% | 81 | 80 | 99% | Reid CQT (numerical scoring) |
| Honts & Driscoll (1988) * | -- | -- | -- | -- | -- | -- | 52 | 46 | 88% | CQT (numerical scoring) |
| Honts & Raskin (1988) | 10 | 8 | 80% | 11 | 11 | 100% | 21 | 19 | 90% | Utah zone, less one control (DL) (numerical scoring) |
| Jayne (1990) * | -- | -- | -- | -- | -- | -- | 100 | 92 | 92% | Reid CQT (numerical scoring) |
| Matte & Reuss (1989) | 54 | 54 | 100% | 60 | 60 | 100% | 114 | 114 | 100% | Quadri-zone (numerical scoring) |
| Patrick & Iacono (1987) | 20 | 11 | 55% | 49 | 48 | 98% | 69 | 59 | 86% | Canadian CQT (numerical scoring) |
| Raskin et al (1988) | 22 | 19 | 86% | 48 | 45 | 94% | 70 | 64 | 91% | CQT (numerical scoring) |
| Ryan (1989) * | -- | -- | -- | -- | -- | -- | 255 | 218 | 85% | Reid CQT (numerical scoring) |
| TOTALS | 218 | 193 | 89% | 297 | 279 | 94% | 920 | 828 | 90% | |

* Only the totals reported.

Table 3
Reliability of Blind Chart Analysis, Novel Scoring Methods
(inconclusives excluded)

| Authors/Date | NDI # / # Correct / % | | | DI # / # Correct / % | | | Total # / # Correct / % | | | Novel Technique |
|---|---|---|---|---|---|---|---|---|---|---|
| Franz (1989) | 50 | 43 | 86% | 50 | 46 | 92% | 100 | 89 | 89% | Computer analysis of CQT charts |
| Honts & Raskin (1988) | 11 | 11 | 100% | 12 | 11 | 92% | 23 | 22 | 96% | Directed Lie Control scored with CQT charts |
| Jayne (1990) * | -- | -- | -- | -- | -- | -- | 100 | 90 | 90% | Computer analysis of Reid CQT charts |
| Matte & Reuss (1989) | 38 | 35 | 92% | 59 | 58 | 98% | 97 | 93 | 96% | Backster numerical applied to Quadri-zone charts, fourth zone deleted |

* Only the totals reported.

Table 4
Validity of Examiner and Blind Scorers
(inconclusives excluded)

| Authors/Date | NDI # | NDI # Correct | NDI % | DI # | DI # Correct | DI % | Total # | Total # Correct | Total % | Scorer |
|---|---|---|---|---|---|---|---|---|---|---|
| Arellano (1990) | 18 | 18 | 100% | 22 | 22 | 100% | 40 | 40 | 100% | Examiner |
| | 18 | 18 | 100% | 22 | 22 | 100% | 40 | 40 | 100% | Blind Evaluator |
| Matte & Reuss (1989) | 54 | 54 | 100% | 60 | 60 | 100% | 114 | 114 | 100% | Examiner |
| | 54 | 54 | 100% | 60 | 60 | 100% | 114 | 114 | 100% | Blind Evaluator |
| Patrick & Iacono (1987) | 30 | 27 | 90% | 51 | 51 | 100% | 81 | 78 | 96% | Examiner |
| | 20 | 11 | 55% | 49 | 48 | 98% | 69 | 59 | 86% | Blind Evaluator |
| Raskin et al (1988) | 28 | 27 | 96% | 57 | 54 | 95% | 85 | 81 | 95% | Examiner |
| | 22 | 19 | 86% | 48 | 45 | 94% | 70 | 64 | 91% | Blind Evaluator |
| TOTALS | 130 | 126 | 97% | 190 | 187 | 98% | 320 | 313 | 98% | Examiner |
| | 114 | 102 | 89% | 179 | 175 | 98% | 293 | 277 | 95% | Blind Evaluator |

All four of these studies were CQTs and all were numerically scored. The examiners were correct in NDI charts in 126 of 130, for 97%, and the blind evaluators were correct on 102 of 114 for 89%. The differences disappeared with DI charts where examiners were correct on 187 of 190 charts and the blind evaluators were correct 175 of 179, both at 98%. The total examiners' decisions were correct in 313 of 320 cases, for 98%, and the total blind evaluators' decisions were correct in 277 of 293 cases, for 95%. The blind evaluators were not better than the original examiners in any phase of these four studies, but they were similar in their accuracy at judging deceptive charts. The blind evaluators were considerably less accurate in judging truthful charts. When the results are from separate studies, the trend remains, but the accuracy with DI charts is not alike. See Tables 2 and 3.

Discussion

Based on these studies involving real cases and excluding inconclusive decisions, it appears that field examiners are about 98% accurate in their overall decisions. When they employ control question tests they are more accurate with deceptive (DI) subjects at 99% than they are with truthful (NDI) subjects at 95%.

The blind reliability studies of control question tests also showed the same trend for accuracy comparing results from deceptive subjects with results from truthful subjects. Blind evaluators were correct in 93% of the DI charts and 83% of the NDI charts.

In the one field study of peak of tension tests, the examiners' truthful decisions, at 94%, were more accurate than their deceptive decisions, at 80%. In the one study of blind analysis of GKT charts, the truthful decisions, at 90%, were more accurate than the deceptive decisions, at 65%. Suggesting that these studies show a trend is questionable because one study is from Japan, the other is from Israel. The techniques are somewhat related, but not alike, and in the Elaad study, the GKT charts were run after Reid CQT charts. Also, in Elaad, the results were from blind evaluators while in Yamamura & Miyake the results are based on the examiners' decisions.

There is a recent tendency to treat the class of control question test (CQTs) as a generic test, something specific, rather than a category of tests with important differences among the members. While I have grouped CQTs in this study, there are several different CQT formats, with one appearing in four studies: Arther CQT (Murray 1989), Backster Zone (Arellano, 1990; Elaad & Schahar, 1987; Putnam, 1983; Widacki, 1982), Canadian CQT (Patrick & Iacono, 1987), Directed Lie Control Question Test (Honts & Raskin, 1988), Matte Quadri-zone (Matte & Reuss, 1989), Modified General Question Test (Putnam, 1983), and Reid CQTs (Elaad et al., 1988; Jayne, 1990; Ryan, 1989). See Table 5. There is no evidence to show that differences in pretest and format are important in determining validity of CQTs. It is logical to think they probably do make some difference but it may be a difficult task to separate pretest and format from other variables in field research. For example, the studies here include significant population differences in terms of culture. There is probably a diverse population

Table 5
Test Formats and Subject Populations

| Authors/Date | Test Format | #/Subjects | Population Tested |
|---|---|---|---|
| Arellano (1990) | Backster Zone | 40 | Hispanic. Illegal aliens in U.S. suspected of theft by employer. Tested in Spanish. |
| Edwards (1981). | variety | 959 | Criminal suspects in Virginia. |
| Elaad & Schahar (1984) | Backster Zone | 174 | Criminal suspects in Israel. |
| Elaad et al (1988) | Guilty Knowledge Test (after Reid CQT) | 40 | Criminal suspects in Israel. All but one GKT test followed a Reid CQT. |
| Franz (1989) | CQT (not described) | 100 | Criminal suspects in U.S. |
| Honts & Driscoll (1988) | CQT (not described) | 52 | Criminal suspects in U.S. (federal cases). ROSS (novel) scoring used. |
| Honts & Raskin (1988) | Directed lie incorporated | 21 | Criminal suspects in U.S. (private cases). |
| Matte & Reuss (1989) | Quadri-Zone | 114 | Criminal suspects in Buffalo, NY (police and private cases). |
| Murray (1989) | Arther CQT | 171 | Police screening and criminal cases in Colorado. |
| Patrick & Iacono (1987) | Canadian CQT | 81 | Criminal suspects in British Columbia. |
| Putnam (1983) | Modified General Question Test & Backster Zone | 285 | Criminal suspects in Reno, Nevada. |
| Raskin et al (1988) | CQT (not described) | 85 | Criminal suspects in U.S. (federal cases). |
| Ryan (1989) | Reid CQT | 255 | Criminal suspects in Chicago, IL. |
| Widacki (1982) | Backster Zone | 38 | Criminal suspects in Poland. |
| Yamamura & Miyake (1980) | Peak of Tension | 95 | Criminal suspects in riot case in Japan. |

represented among the subjects tested in Israel. Arellano tested Hispanics who were in the United States illegally, and tested only in the Spanish language. Yamamura & Miyake tested the riot suspects in Japanese. However, the Canadian and American subjects may have much in common. Variations in technique and populations must be recognized as a limiting factor in generalizing from these studies.

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# WELCOMING REMARKS OF DR. WILLIAM J. YANKEE AT THE 1990 FEDERAL INTERAGENCY POLYGRAPH SEMINAR FBI Academy, Quantico, Virginia

Good morning and welcome to the 1990 Federal Interagency Conference. On behalf of all of us I want to thank the FBI for providing these fine facilities and their hospitality. Also, thanks to Frank Morgovnick of the FBI and Don Weinstein of DoDPI for all the work they did in putting this program together. The logistics for such an undertaking are extensive and they have accomplished the task with their usual competence.

The DoD Directive 5210.78 sets forth, among other things, a requirement regarding the curriculum as it relates to user agencies. That requirement is that the Director will assure that all agencies that send students to DoDPI will be kept current as to program content of the Basic Polygraph Course.

Consequently, Don Weinstein and Frank Morgovnick oriented this conference to "Back to Basics" to allow DoDPI to fulfill that requirement and hopefully bring everyone up-to-date regarding the basic curriculum. In future years, we will provide new information as it is developed and becomes part of the curriculum. Those who attend this conference each year will be current as regards what is being taught in the basic program.

At the risk of absorbing more time than I am allowed, I would like to do three things: (1) Briefly describe what is going on at the Institute now -- some of you are already aware of a few of these things; (2) project future directions and developments; and (3) discuss our (by "our" I mean all polygraph examiners) responsibilities for advancing the scientific and applied aspects of our profession.

Currently the schedule of classes involve classroom instruction in the morning and clinical exercises in the afternoon. Thus the students begin using the instruments the first day and continue with operations each day during the entire session. The students take four courses: Forensic Science 501, Basic Polygraph Operations; Forensic Science 502, Advanced and Specialized Polygraph Operations; Forensic Psychophysiology 565, Physiology; and Forensic Psychophysiology 566, Psychology. Each of these are three credit hours, master level courses, for a total of 12 credit hours.

The content of 501 and 502 has not changed from previous years. How, and when, the content is taught "in the sequence" has changed to accommodate a variety of learning strategies. However, material has been added to 501 and 502, such as Post Test Interrogation - from 10 to 30 hours; Sex Crimes - from 0 to 8 hours; Pretest - from 9 to 30 hours; and Chart Interpretation - from 21 to 30 hours. In addition, students now conduct 60 to 65 examinations as compared to 50, previously. We have also added a number of continuing education courses. All of the substantive changes and additions have been reviewed by the Oversight Committee and approved by ODUSD(SP).

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Dr. Yankee is Director of the Department of Defense Polygraph Institute.

Regarding Physiology 565 and Psychology 566, the hours of instruction have been extended from 18 to 42 hours each. Physiology is now nearly integrated into the total curriculum and students and faculty now find the course relevant. Psychology 566 has not made the transition from rejection to relevance. Recently, faculty and research staff reviewed the content and organization of the course. We will also work on improving the delivery. It is expected that within a year this course will also be considered relevant and fully integrated into the other courses.

We have a Master Degree Program in Forensic Psychophysiology completed with Jacksonville State University. Four of our faculty members have completed the program. Several other faculty are pursuing this work as well. We are developing a plan to seek Congressional authorization to issue our own degree. This action was prompted by: (1) The desire to have complete control of the curriculum and not be directed by another institution; (2) because of the problems and expense associated with tuition payments; and (3) to retain the degree capability should we have to leave Fort McClellan.

It is always risky to project the future. However, we cannot plan for the future without projecting the changes we expect will take place. We have worked in an occupation that has not changed much in forty years. This is not only an assessment made by our critics but, as I look at the limited changes over the 36 years I've been involved in polygraph, I would have to admit the statement has some justification. With the exception of a modification in defining a control question, some comparative minor instrument changes, and a more objective way of scoring charts, not much change has occurred. The curriculum, as it relates to pretest phase, question formulation, intest phase and post test, again with the exception of minor variations, has been basically the same since Keeler revised his original curriculum in 1948.

One thing I feel confident about predicting is change. Change will take place. We need to evaluate the changes taking place now, predict the changes that will come, and prepare ourselves for the future. We need to evaluate how the projected changes will impact our profession and the Institute. The projected changes will require a long range view of our occupation and this, in turn, will undoubtedly change the way we look at the subject matter content of our curriculum.

In the past we have excused ourselves from using the more electronically advanced polygraphs used in medicine, physiology and psychology laboratories because they were not portable, they were expensive, and they couldn't provide better data than the instruments we were using. the portable and expensive aspects were true. We'll never know about the "better data" part.

In 1966 it took a 30 x 40 room, especially designed and air conditioned to hold a computer with 32K capacity. Today a lap top weighing 8.5 pounds can have a 400K memory. Right now, the Axitron Polygraph is the size of a telephone base and almost noise free. Why should we doubt that within a few years computerized polygraphs will not weigh more than ten pounds and can be carried in a briefcase. With the certain changes to come in respect to instruments, computers and analysis capabilities, we can no longer ignore the ramifications.

What will happen to our curriculum -- better yet, what must happen -- if within a year or two our instruments will record noise free, twenty different critical physiological activities at one time? When the data will be analyzed immediately by computer because the amount and nature of the data is beyond human analysis capability? When the number and types of questions used in an examination will be a function of the case facts, rather than the discomfort threshold of a blood pressure cuff; when test methods are varied according to personality types; or by individual autonomic responsibility patterns; or by cultural differences; or by intelligence levels; or by ethnic differences; or by gender? If even one or two of these things happen -- and some are very likely to happen -- how would such changes affect our curriculum? Affect the requirements to be a faculty member? Affect the requirements to be an examiner?

Change will affect every one of us. Change has and is affecting every profession and occupation. Medicine, law, agriculture, business and industry have all experienced significant changes over the years and will continue to do so in the future. We would be naive to think that change will not affect us. As Tommie Adkins put it, "Even our adversaries are changing." As changes occur there are always periods of ambiguity. For many people, ambiguity and change are threatening. As John Naisbitt said in his insightful book, Megatrends, "We have one foot in the past in our thoughts, beliefs, knowledge and actions and we are fearful of putting the other foot to the future. We cling to the known past in fear of the unknown future." We are frustrated that Congress, through its mandate to us to conduct research, has, in essence, told us to fix something we believe is not broken. Yet from buggies to cars, from kerosene lamps to electric bulbs, from silent movies to video discs, all were efforts to fix things that were not broken and had for long periods of time served everyone well.

Change is a difficult thing for some people to accept. Consequently, it is even more difficult to prepare people for change. How do we educate future examiners for change? There are only two ways which have been proposed, that I know of, to educate for change: (1) Provide the student with basic material that will have transfer value and (2) develop in students the ability and desire to learn independently outside the classroom. Teaching students how to learn independently is a vital ingredient for any curriculum. We are not doing this. We are teaching them for today. It has been said that vocational education narrows or closes a person's mind because it trains for the present and that any educator that trains for the present is actually training for the past.

The polygraph instructor who teaches his students, or another examiner, how to use a computerized polygraph is not sharing knowledge he acquired when he went through the polygraph school. He learned what was new yesterday and his students must learn it today. In recent years knowledge has escalated and has become more and more based upon scholarship and research. In most institutions of higher education, research, learning and teaching are interrelated. At the Institute we are developing in that direction. What the educational practices at the Institute will be tomorrow will probably have little resemblance to the educational practices as we know them today.

The curriculum of the future must be flexible; it must be constantly changed and augmented and it must prepare the learner for change. We, as in other professions, must recognize that if we are to keep abreast of our discipline, we will need an imaginative continuing education program. Only a strong commitment to life-long education will enable the examiner to change as new developments come along.

As examiners we all carry the responsibilities for assisting in the development and promotion of what we often refer to as "Our Profession." Seldom, however, do we ask ourselves how we compare to other professions in terms of a definition or the major characteristics of a profession.

According to Boyles, there is no generally accepted definition of a profession. However, there are three features that have been repeatedly identified by most authorities. First, a rather extensive education and training background is required to practice a profession. Many, if not most, professionals have, or are required to have, advanced degrees. Second, the education and training required involves a significant intellectual component. Bricklayers, barbers, breathalyzer operators and so on are primarily trained in physical skills whereas accountants, lawyers and physicians are educated in intellectual aspects as well as skills. Third, the special intellectual and skill abilities obtained provide an important service to society.

Recent changes in our curriculum in establishing a master degree program puts us narrowly within the characteristic of extensive education and training and advanced degree requirements. Also, the masters degree puts us narrowly within the second characteristic of a significant intellectual component. But in both instances, and even fluffing it a bit, at best we could be envisioned at the minimal end of the professional continuum.

Unfortunately, we like to bask in the glories associated with the professions but often resist the changes that are necessary to solidify and legitimize our professional role. Right now there is no doubt that Congress, and a vast majority of the established professions, do not recognize us as a profession. Professional status will not be given to us because we say we are professionals. We will have to earn our acceptance the hard way.

But being called professionals is only part of the concern. We need to establish our role in such a way that we are accepted by the scientific community, by the legal profession, by the public and by the Congress. We would be deluding ourselves if we assumed that Congress will, without question, continue to support the federal use of polygraph. The mandate to do research should be perceived as a warning -- not as a right -- to develop an acceptable scientific foundation.

If we are to measure up to what is expected of us we must recognize that an examiner is more than a skilled operator, more than a cop. We must realize that a polygraph examination is one of the most complex psychophysiological examinations ever developed. We cannot continue to neglect, or even at times reject, our parent disciplines -- physiology and psychology. These are the disciplines that fostered psychophysiology and it

is within this discipline that the scientific foundation for polygraph science, if it is to be, will be established.

To progress as a profession we need every examiner's support and involvement. Responsibility for research falls upon all of us. Not everyone is interested in conducting research and not everyone needs to. However, professionals not actively involved in research have an obligation to promote and support the members of the profession who do. In addition, if we are true professionals, we will make the effort to learn what we must learn so that we can critically understand what is being developed in research and have the depth of knowledge to apply the results to our everyday work.

Our faculty and research members have been working hard to identify the knowledge that is available now that can be applied to our curriculum. There is a lot of applicable knowledge that we are discovering already exists. Many of our faculty members will attest to this. The research has been done and has been published, yet we didn't know it existed. As one CEO put it when asked what he most worried about regarding the development of his corporation, he said, "I worry about what we don't know. I don't worry so much about what we know we don't know because we can learn that." It's what we don't know, we don't know, that is the problem.

I feel sometimes that we refuse to look at and learn the knowledge we know we don't know, because we assume we don't need to know, and, because we feel we already know all we need to know. Or worse yet, as Gordon Barland put it in quoting an unknown sage, "It's not what we don't know as much as what we think we know that is not so." Fortunately, most of our faculty members have acknowledged this dilemma and are pursuing the trail of knowledge. And more importantly, they are conveying this message to our students.

Often students question why they have to learn material that doesn't have direct and obvious relevance. It's much like the student in law school who says, "All I want to know is 'criminal' law because all I intend to do is be a prosecutor and put bad guys in jail. Why should I have to learn about researching the law, writing briefs, and constitutional law?" How can we expect students to have an accepting view of what they should learn if our attitude is, "Who needs that?" Learning about bout psychometrics may not have relevance to conducting a polygraph test and getting a confession, but it is basic material that will have transfer value when it comes to learning independently on a continuing basis. As I mentioned earlier, if we are to teach students for change and for learning independently, it is the transfer value material that will ultimately be the most relevant.

There is little doubt in my mind, and I'm sure yours, that there will be many changes taking place in the next few years. We can get frustrated about it, or we can realize the excitement that change can sometimes bring. Polygraph examiners are accustomed to facing the unknown. They do this in every examination they conduct. They are flexible and capable of 180 degree adjustments. They will be able to make the changes. I have no doubt that we will survive, that the scientific foundation for our discipline will be developed, and that eventually we will be members of a truly recognized profession.

I hope this conference will serve as a reacquaintance with the current bases of our occupation. In capsule form, you will review where we are in our development as of 1990. Let the content of this conference serve as the base line against which to gauge the changes that will surely come.

Thank you and best wishes for a productive conference.

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# Changes of Respiration Pattern to the Critical Question on Guilty Knowledge Technique

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## Abstract

A computer processing technique for digitization of the component analysis of thoracic respiration responses was used with 17 male and 3 female polygraph subjects in field detection of deception. All of the decisions involved Guilty Knowledge Techniques, and all decisions regarding whether or not the subjects were deceptive were verified. In each situation the deceptive admitted to the knowledge of the critical information in the test.

Respiration amplitude during deception, compared to the pre-stimulus level is suppressed. There was a significant increase of expiratory time demonstrated with the critical question, while changes of inspiration time were not significant. The rate of curve linear length (CLL) of respiratory tracing (CLL by cycle time) decreased significantly during critical question onset relating to noncritical questions. The rate of CLL to the noncritical question after the critical question was significantly more enhanced than the rate before the critical question.

In conclusion, the increased cycle time during critical question onset depends on changes of the expiratory function of respiration, and the increasing rate of CLL after the critical question associates with rebound components of suppression following deception.

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# Respiration Changes During Guilty Knowledge Tests

## Introduction

Although many investigators have emphasized that constructs such as anxiety and fear can not be defined entirely in physiological terms, some theorists whose primary focuses are the reduction of fear continue to emphasize the central importance of autonomic nervous system response modulation as the key to subjective fear reduction. A paced respiration procedure has significant facilitative effects on reducing autonomic responsiveness to a stressful stimulus (Harris et al., 1976).

Many results in investigations dealing with the effects of unpleasant, mentally taxing and threatening stimuli upon respiratory behavior in clinically normal populations, are generally consistent in showing that the typical respiratory pattern characteristic of stressful situations is one of rapid rate, altered tidal volume, relative hypocapnia, and predominantly of thoracic mode (Grossman, 1983).

Respiratory inhibition may also modify the cardiac response during sustained attention. The simple mechanical change in respiration has a powerful influence on the cardiac response pattern (Cheung and Porges, 1977). The control of heart rate is very closely related to respiratory and other somatic activity (Vandercar et al., 1977).

Thus, respiration has received much attention as an index of psychophysiological detection of deception which might be easily associated with fear and/or stressful situation (Reid & Inbau, 1977). Respiration seemed to yield some evidence of discrimination between truth and deception. An increase in the inspiration-expiration (I/E) ratios produced more than chance accuracy as the criterion of deception (Benussi, 1914). Several experimental studies concluded decrease of respiration amplitude, longer respiration cycle time, and irregular respiration patterns occur during deception. (Cutrow et al., 1972; Ellson et al. 1952; Kubis, 1973; Podlesny & Raskin, 1977).

Field apparatus usually consists of a bellows pneumograph around the chest to measure respiratory activity and display respiration curve through ink writing pens onto charts. An analysis of respiration pattern was conducted by hand-scoring procedures for field polygraph records in detecting deception with the Guilty Knowledge Technique (GKT: Lykken, 1960) or the Concealed Information Technique (CIT: Raskin, 1982), showing that a decrease in amplitude and increase in cycle time of respiration occurred during deception (Kizaki et al., 1979).

Although some field polygraph examiners have been vigorously maintaining that changes of respiration pattern were the most valid physiological indicator to detect deception, behavioral scientists who have neglected the significance of respiratory influences upon cardiovascular functions or other somatic activity consider the respiration only as monitorial index to measure other physiological indices, which suggests that effectiveness of respiratory activity has not yet been definitely confirmed in experimental detection of deception.

A major reason why debate over usefulness of respiration yields complicating conclusions, is that few systematic studies concerning respiratory responses associated with deception have been conducted. When the typical hand-scoring procedures are used, component analysis of the respiratory measure is not undertaken due to the problem of definition and unreliability. In addition to the lack of generally accepted methods for evaluating respiratory responses, the validity of a diagnostic technique that relies on human interpretations of test data may be adversely affected by bias, drift, inexperience, and incompetence (Kircher and Raskin, 1988).

These issues, however, can be more readily handled through the use of modern computer processing techniques which applies digitization with measuring of length tracing and of bending point. Cohen et al. (1975) demonstrated the relationship between stress and components of the respiratory cycle using computer processing technique. They found that expiration time was longer and pause time shorter during the stress than during the neutral films. Timm (1982) reported that a curve-linear length (CLL) of respiratory tracing by using an electric digitizer to the polygraph records obtained from the Control Question Technique (CQT: Barland and Raskin, 1975) was measured and concluded that the CLL to a relevant question suppressed during deception. These results suggest that respiratory measure would produce a good index for detecting deception.

Since the CLL depends upon both components of amplitude and rate on respiration, attenuation of amplitude made the CLL short and the cycle time of respiration enhances the CLL. If employing the CLL to respiration tracing may be contingent on other respiratory components, then the use of CLL measures may produce misleading information. Furthermore, the CLL is dependent on the mechanical transducing which field polygraph instruments employ, a situation which requires that the CLL measure be regarded as the relative numerical value compared to the prestimulus control level. Expiration time (amplitude by time) might be a good index to discriminate deception and truthfulness, because suppression of amplitude and increase in cycle time occurs simultaneously during deception.

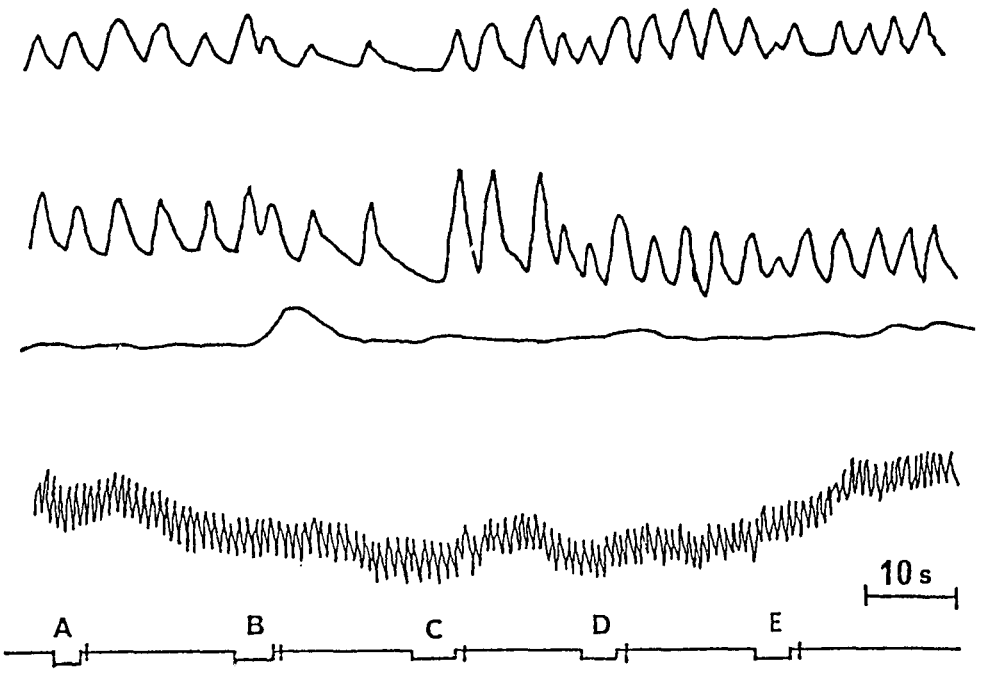
The present report concerns estimation of usefulness of some components of respiratory responses in field detection of deception using computerizing analysis of respiratory measures.

## Method

Material: In this study, the thoracic respiration responses recorded by a four channel polygraph (manufactured by Lafayette Instrument Co. Ltd.) were employed, while subjects were examined to detection deception in actual cases with the standard procedure for Guilty Knowledge Techniques by Shizuoka Prefecture Police Headquarters (Figure 1).

Records of seventeen male and three female subjects were investigated. Polygraph decisions were confirmed by confessions. Furthermore, they admitted to the knowledge of the critical information listed in test formats.

Figure 1

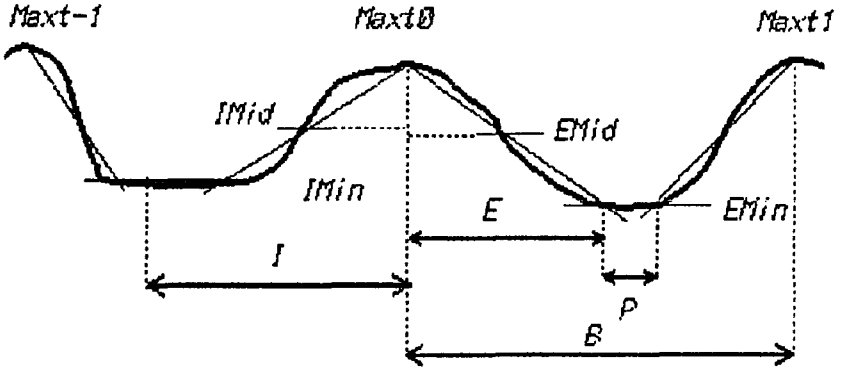



A polygraph of the Guilty Knowledge Technique for a 34-year-old male suspected of committing an arson. Prior to the test, no investigator had disclosed to the subject what had been burned. The subject was asked whether the lighted material was (A): a coinbox phone, (B): a signboard, (C): a placard, (D): a shed, and (E): a board fence. Each record from the upper to the bottom shows the marker line, respiration curves (Re, thoracic and abdominal), skin resistance response (SRR), blood pressure (BP). Note particularly the greater response containing suppression of Respiration, and the largest amplitude of SRR at the critical question (B) which was indicative of deception regarding the knowledge of the material that was burned.

Procedure: Photocopy of respiratory tracing for three cycles of the respiration curve preceding and during presentation of the critical and noncritical questions were the material used for analysis. Conversion to digital form for computer processing to 20ms was done using the digitizer (manufactured by Kanto Densi Co. Ltd., MYPAD3) with elimination of the time lag caused by arc deviation while measuring respiration amplitude, expiration and inspiration time, and pause time.

The details of respiration analysis program followed the design by Cohen et al. (1975). Briefly, five points on the data channel for each breath were located (Figure 2). The inspiratory minimum (IMin) is for the point of minimum circumference between the maximum amplitude circumference of the breath at issue (Maxt0) and the preceding breath maximum (Maxt-1). The expiratory minimum (EMin) is for the point of minimum circumference between Maxt0 and the following breath maximum (Maxt1).

Figure 2




Breath analysis by computer derivation. See text for details.

From these points, the following statistics were computed for each breath. The vertical intersected point with the inspiratory or expiratory circumference from the midway point of amplitude between IMin or EMin, and Maxt0 is for the mid-inspiration (IMid) or for the mid-expiration (EMid) respectively. The time difference between the point of Maxt1 and of Maxt0 shows the breath time (B). The inspiration time (I) is twice as long as IMid time, the expiration time (E) is twice of EMid and the pause time (P) represents as (B-E-I). Thus, the inspiration or expiration rate shows through the amplitude difference between IMin or EMin, and Maxt0 divided by I or E. The curvilinear length (CLL) for respiration tracing is a tracing distance from the point of Maxt0 to Maxt1 and the CLL rate is the quotient by B.

Treatment: Statistical treatment was done by an ANOVA test for significance in respiratory components.

## Results

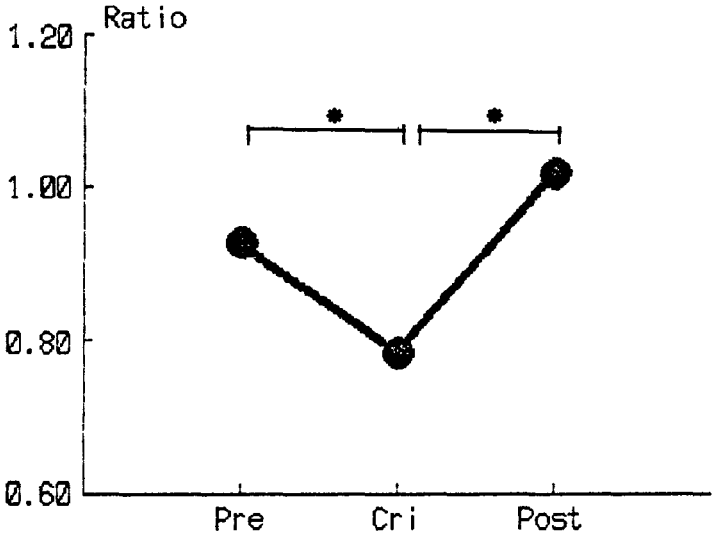
Figure 3 represents the relative mean expiration amplitude on the preceding (Pre), following (Post) and during (Cri) the critical question onset in comparison with prestimulus level. The respiration amplitude suppressed significantly during deception.

Figure 4 shows the mean expiration (E), inspiration (I) and pause (P) time at the preceding (Pre), following (Post), during (Cri) critical question onset, and the prestimulus control period. During presentation of critical question, significant increase of expiration time occurred, while

changes of inspiration time was not significant. The pause time was indefinite according to each subject. Six of 20 subjects showed the maximum pause time, four of them was the minimum and the remaining was the middle.

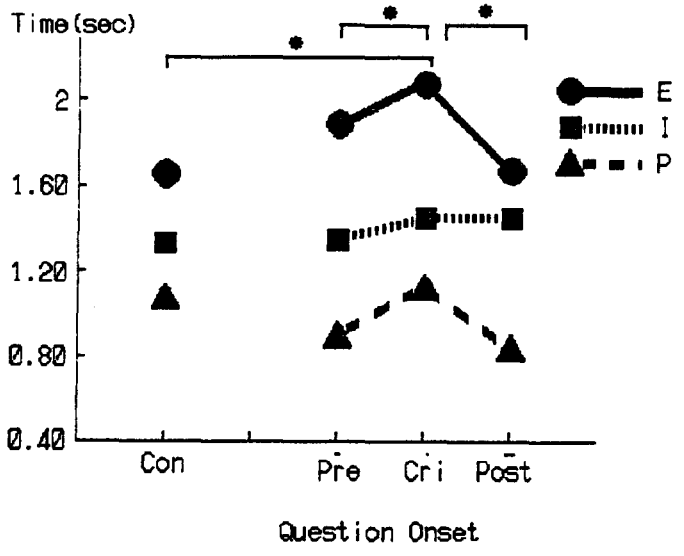
## RESULTS

Figure 3




The relative mean expiration amplitude with prestimulus level at the preceding (Pre), following (Post), and during (Cri) critical question inset. The * sign represents a significant difference ($P<0.05$).

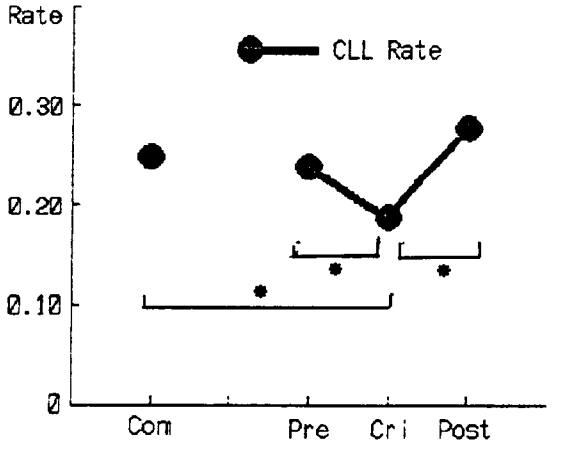
Figure 4




The mean expiration (E), inspiration (I), and pause (P) time at the preceding (Pre), following (Post), during (Cri) critical question onset, and the prestimulus control period. The * sign represents a significant difference ($P<0.05$).

Figure 5 represents the rate of CLL (CLL by breath time). The rate of CLL decreased significantly during the critical question onset, contrasting with the noncritical questions.

Figure 5




The mean rate of curvelinear length (CLL) divided by breath time at the preceding (Pre), following (Post), during (Cri) critical question onset, and prestimulus control period (Con). The * sign represents a significant difference ($P<0.05$).

Figure 6 shows the mean rate of expiration, which is a relative expiration amplitude divided by expiration time, at the preceding, following, during critical question onset, and pre-stimulus control period. Significant decrease of expiration rate occurred during critical question onset.

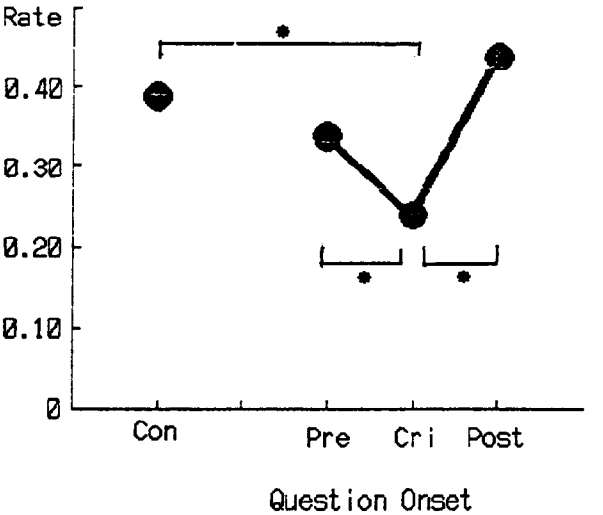



Figure 6. The mean rate of expiration (relative expiration amplitude divided by expiration time) at the preceding (Pre), following (Post), during (Cri) critical question onset, and prestimulus control period (Con). The * sign represents a significant difference ($P<0.05$).

## Discussion

The results in this study supports the context that it is important to examine the feasibility of developing computer treatment to quantify physiological reactions to minimize the risk of errors in the interpretation of polygraph protocols and to promote standardization of practice. The present investigation of respiratory variations confirms the previous field findings that respiration is the most valid index in detecting deception. The component analysis of respiratory responses described in this paper yielded highly useful indices to diagnose deception in field situation. When the respiratory changes accompanying deception became sufficiently great, they obtruded on the attention of the subject and he became aware of symptoms, and thereby deception has much affected his own concept on respiration. This preceding field observation in detection deception (Dudley, 1969; Reid and Inbau, 1977) should be reestablished.

Table 1 summarizes the detection efficiency of each respiratory component. Considering the correct detection rate based on respiratory component, the measure of mean expiration rate (ER) was the best index in detecting deception with 75% of accuracy rate. The deception has a significant effect on ER, expiration time (ET) and amplitude (EA).

All subjects were readily detected by employing several expiration components, namely ER, ET, and EA. Applying the computer method for quantifying respiration patterns, the battery of respiration components significantly discriminates between truth and deception. This finding, better than either measure separately, suggests an advantage in treating respiration as a combined index and support that computerizing analysis of respiration pattern produces the high detection efficiency level associated respiration responses.

The presentation of critical question on Guilty Knowledge Technique accompanies with decrease of respiration amplitude and with enhancement of respiration time, which fact is that the tidal air is diminished by critical question onset. The critical question prolongs the respiration amplitude more than does the prior question of the critical question. To the critical question, the change of EA is more prominent than the inspiration amplitude (IA). In this study, the respiration time consists of ET, inspiratory (IT) and pause time (PT). Changes of respiration time for one cycle primarily represent the prolongation of ET, which change seems to be independent of IT and PT accordingly. Consequently, the respiratory response to the critical question, in comparison with control level, is characteristic of prolongation of ET, distinctive reduction of PT and no change of IT among questions.

The relatively clear prolongation of ET depends on the comparatively strong reduction of PT to the critical question. The reduction of PT is the natural physiological compensatory activity for respiration. An interdependency exists between ET and PT. The ET may be hence representative of response in being deceptive.

Comparisons of respiratory responses among the non-critical questions presented before and after the critical question indicated that the rate of CLL (CR) to the non-critical question after the critical question was

significantly more enhanced than the CR before the critical question. The CR affected the respiratory cycle and strongly associated with decrease of respiration amplitude. Since the increased breath time during the critical question onset depends on changes of the ET and the decreasing rate of CLL after the presentation of the critical question related with rebound components of suppression following deception. From this we conclude that the ET or ER depending on expiratory activity, as well as the ET, produces a high rate of detection.

Table 1

Outcomes of polygraph records obtained from field detection of deception to every subject based on each component of respiratory responses. Decision was evaluated by the criterion with existence of increase of expiration time (ET), prolongation or disappearance of pause time (PT), and reduction of expiration amplitude (EA), rate of curvelinear length (CR) and of expiration (ER). ( ○ ; correct decision, ↑ ; prolongation of PT, ↓ ; disappearance of PT).

| Ss | EA | ET | PT | | CR | ER |
|---|---|---|---|---|---|---|
| 1 | | ○ | | | | |
| 2 | ○ | | ↑ | | ○ | ○ |
| 3 | | ○ | | | | |
| 4 | | ○ | ↑ | | | ○ |
| 5 | ○ | ○ | | ↓ | ○ | ○ |
| 6 | | ○ | | | | ○ |
| 7 | ○ | ○ | | | ○ | ○ |
| 8 | | ○ | | | | ○ |
| 9 | | ○ | | | ○ | ○ |
| 10 | ○ | ○ | | ↓ | ○ | ○ |
| 11 | ○ | | ↑ | | ○ | ○ |
| 12 | ○ | | | ↓ | ○ | ○ |
| 13 | | ○ | | | ○ | |
| 14 | | ○ | | | | ○ |
| 15 | ○ | | | | ○ | ○ |
| 16 | | ○ | | ↓ | | |
| 17 | ○ | ○ | | ↓ | ○ | ○ |
| 18 | ○ | | | | ○ | ○ |
| 19 | | | ↑ | | | ○ |
| 20 | | ○ | | ↓ | | |
| | 9 | 14 | 4 | 6 | 11 | 15 |
| (%) | 45 | 70 | 20 | 30 | 55 | 75 |

In summary, our findings indicate that respiration patterns, in detecting field deception are consistent with increases in expiration time and decreases in expiration amplitude. This component analysis clearly assures clearly that measurement of the fine structure of the respiratory cycle is a potentially effective tool for detection of deception, which supports advocacy of the proposition that the respiration is the most valid indicator in detecting deception in field. In conclusion, expiration phase has, in particular, a great role during deception.

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# A COMPARISON OF THE RELATIVE UTILITY OF SKIN CONDUCTANCE AND SKIN RESISTANCE COUPLERS FOR THE MEASUREMENT OF ELECTRODERMAL ACTIVITY

By

Charles R. Honts and Steven D. Barger

Abstract

The relative utility of constant voltage (Skin Conductance; GSG) and constant current (Skin Resistance; GSR) circuits used for the exosomatic measurement of electrodermal activity was examined by comparing simultaneous recordings from 65 subjects of a laboratory mock crime detection of deception experiment. The circuits were equally sensitive to changes in electrodermal activity. However, the constant voltage circuit required about half as much centering adjustment as did the constant current circuit. Advantages of the constant voltage circuit were discussed.

Background. There has been wide spread use of electrodermal activity in a number of scientific and applied settings. In particular, research has generally indicated that measures of electrodermal activity are the most predictive measures in the physiological detection of deception, (i.e., Kircher & Raskin, 1988; Podlesney & Raskin, 1978; Raskin, Kircher, Honts, & Horowitz, 1988). The most common methods of measurement are exosomatic. Exosomatic circuits measure the electrical conductivity of the skin as part of a circuit that includes an external current source. This paper will focus on two exosomatic circuits, a constant current circuit that is used for the direct measurement of skin resistance (SR) and a constant voltage

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The views expressed in this article are those of the authors and do not reflect the official policy or position of the Department of Defense, the Department of Defense Polygraph Institute, or the U.S. Government. The data used in this analysis were originally collected as part of a study designed by Gordon Barland and conducted by Edgar Stovall. The authors wish to thank Clinton Humphries for his assistance in making the physiological measurements for this analysis and Tommie E. Adkins, Samuel L. Braddock, Michael Chimarys, Robert F. Cole, Brian Cropper, Donnie W. Dutton, Ronald L. Farris, Robert M. Manners, James Mayo, Patricia Morris, Johnnie Rodgerson, Gary L. Stotler, and Donald A. Weinstein, for conducting the polygraph examinations. The authors wish to thank Gordon Barland, Barbara Carlton, Dan Killeen, Shiela Reed, David Renzelman, Brenda Smith, and William Yankee for their helpful comments on the draft of this manuscript. The authors also wish to express their appreciation to Lafayette Instrument Company for providing the GSG couplers used in this study.

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circuit that is used for the direct measurement of skin conductance (SC). Lykken and Venables (1971) have argued that the constant voltage circuit is superior to the constant current circuit, and psychophysiologists have adopted the constant voltage circuit as the standard for exosomatic measurement of electrodermal activity (Fowles, Christie, Edelberg, Grings, Lykken, & Venables, 1981). The reasons for this nearly universal change by psychophysiologists were based on the following theoretical understanding of the origins of electrodermal activity and the behavior of the sweat gland in an exosomatic circuit.

Physiological Models of Electrodermal Activity. Psychophysiologists generally agree that most of the electrodermal activity measured by exosomatic circuits is due to the filling of the sweat ducts and hydration of the epidermis. As the sweat ducts fill they offer relatively low resistance pathways to the flow of current from the instrumentation circuit and the sweat glands function electrically as variable resistors in parallel (Fowles, 1974).

It is also likely that some of the electrodermal activity measured by the exosomatic circuits comes from the electrostatic membranes in the sweat gland. Those membranes serve two functions. One set of membranes moves the fluid that comprises the sweat from the body into the duct. The second set of membranes selectively recovers sodium ions from the sweat. Thus, the sweat is relatively richer in potassium and poorer in sodium ions than are the bodily fluids. Detailed descriptions of this model of electrodermal activity can be found in Fowles (1974) and Venables and Christie (1980). Electrically, both membranes function as capacitances in parallel to an exosomatic measurement circuit, but their contribution to the measurements made by exosomatic circuits is likely to be small.

Lykken and Venables Argument for the Constant Voltage Circuit. Lykken and Venables argue for the superiority of a constant voltage circuit that measures skin conductance directly on three major points. First, they argue that skin conductance is more simply related to the physiological activity of interest. Since the physiology of interest is the secretory activity of the sweat gland, the problem of measurement is to evaluate quality and quantity of the activity of a number of parallel variable resistors. Lykken and Venables note that,

> ... the overall resistance of a parallel circuit is a complex function of the individual resistances and the change produced by a change in one branch depends upon the resistances of all the other branches. In contrast, the conductance of a parallel circuit is a simple sum of the conductances-in-parallel and a change in one of these produces simply an equivalent change in the total, independently of the values of the others (1971, p. 661).

Further, they argue that because of this more linear relationship, "the shape characteristics of the waveform are more meaningful than in the case of SR measurement." (Lykken & Venables, 1971, p. 661).

Second, they argue that the constant voltage circuit is less intrusive to the sweat glands noting:

> When SR is high only a few sweat glands may be active. With a constant-current circuit, these few pathways must still carry the load so that current densities in each may become very high. With a constant-voltage circuit, current flow in one pathway is independent of the number of pathways active at the time (Lykken and Venables, 1971, p. 661).

In effect, the sweat glands may be overcome by current density when skin resistance is high due to few sweat glands being active. It is possible that many of the "plunging tracings" seen on traditional lie detection polygraph instruments with constant current units are due to this phenomenon of current density overwhelming the active membranes in the sweat glands.

Lykken and Venables third argument states that because of the mathematical scaling differences between the measurements of resistance and conductance, the constant voltage circuit will require many fewer centering adjustments than will the constant current circuit. Lykken and Venables predict that about half as much adjustment will be required of the constant voltage circuit. If this is true, it would free the examiner to focus attention on other matters and should result in less data loss from out of range recordings.

Boucsein & Hoffman (1979) compared simultaneous recordings from the constant current and constant voltage circuits using laboratory equipment. They reported no differences between the circuits in the amplitude or area of the electrodermal responses elicited by white noise stimulation. They did find that the constant voltage circuit produced electrodermal responses of shorter recovery time, but they reported neither measurements of plunging tracings nor of the amount of centering required by each circuit.

Until recently no constant voltage circuit was available for field polygraph instruments. Lafayette instruments now markets a constant voltage unit which they refer to as a GSG. This is not the Lykken and Venables (1971) circuit that is now considered the standard in psychophysiology, but is a circuit that Lafayette developed. The Lafayette circuit uses a constant voltage of 2.2 volts as compared to the 0.5 volts of the Lykken and Venables circuit (Lafayette Instruments Engineering Department, personal communication, November, 1989). The physiological impact of this increased voltage is not readily apparent.

To date, there has been one written report comparing the Lafayette constant voltage and constant current circuits. Reid and Rowlands (1989) simultaneously collected data using both circuits. They concluded, "It is our opinion the GSG [constant voltage] is a superior component to the GSR [constant current] ... We found the GSG more manageable than GSR ..." Unfortunately, their paper does not provide sufficient detail to allow for a useful evaluation of their results. We were not told the number of subjects and no statistical evaluations were presented. In addition, Reid and Rowlands do not appear to understand the scaling differences between measuring conductance and resistance, and they misrepresent the functioning of the sweat glands. These factors make it very difficult to evaluate the Reid and Rowlands study.

However, despite the empirical data and the theoretical arguments for the use of the constant voltage circuit, the constant current circuit is still the circuit of choice in field polygraph applications. Clearly the polygraph profession has lagged behind the accepted state of scientific practice by retaining constant current technology for field polygraphy. However, the critical question for the polygraph community is: Would there be any important advantages for using the constant voltage circuit in the field? To examine that question, we performed a within subjects evaluation of the Lafayette constant voltage and constant current circuits in the context of a larger study that has been reported elsewhere (Barland, Honts, & Barger, 1989a; Barland, Honts, & Barger, 1989b).

## METHOD

Subjects. The Subjects were 100 basic trainees at Ft. McClellan, Alabama who volunteered for the study. No pay or inducements were given to the trainees for volunteering, nor were they offered any reward for passing their polygraph examination. They ranged in age from 18 to 32 with a mean of 20.2 years. Simultaneous measurements of skin conductance and skin resistance were available for 65 of those 100 subjects. The recordings from those 61 male and 4 female subjects were used as the data for this analysis.

Apparatus. Lafayette all-electronic field polygraph instruments were used. Although those instruments recorded respiration, relative blood pressure, and vasomotor activity, as well as electrodermal activity, only the electrodermal data were used in this analysis. Skin resistance was measured by stainless steel plate electrodes attached to the palmar surface of the subject's left index and ring fingers. Skin conductance was measured by stainless steel plate electrodes attached to the palmar surface of the subject's left middle and little fingers. No electrolyte medium was used for either the skin resistance or conductance measurement.

Procedure. Subjects were randomly assigned to one of four conditions of equal size. One condition was an innocent condition and the other three were guilty conditions. Subjects assigned to the first guilty condition enacted one of three possible acts of espionage or sabotage. Subjects assigned to the second guilty condition enacted two of the three possible acts, and the remaining guilty subjects enacted all three mock crimes.

Subjects were brought to the Polygraph Institute from their training area in groups of six to ten, and they were briefed on the purpose of the experiment. They were told that their participation was voluntary, and they were asked to sign the statement of informed consent. No subject refused to participate. After signing the consent form, guilty subjects enacted their mock crime(s) and innocent subjects waited. Crime 1 was the theft of a mock classified document. Crime 2 consisted of photographing mock classified equipment. Crime 3 was an act of mock sabotage.

The polygraph examinations were conducted by 13 instructors from the Defense Polygraph Institute. All were polygraph examiners trained at the Defense Polygraph Institute or its predecessor, all were certified by their parent organizations, and all were experienced in field polygraph work. The examiners were blind to the guilt or innocence of individual subjects, but

they were briefed on the details of the three mock crimes so that they could conduct the tests realistically.

During their polygraph examinations, subjects were treated as if they were criminal suspects. That is, the examiner informed them that three crimes had been committed, and that there was reason to believe that the subject may have committed one or more of them. The subjects were given a Miranda (Article 32) warning, and their control questions were tailored to the individual subject's personalities and the type of crime being covered. A stimulation (number) test (Raskin & Hare, 1978) was administered before the first chart.

Two different control question test polygraph examinations were administered. Half of the subjects were given three single issue control question tests, one after the other. Each test covered one crime with two relevant and three control questions that were repeated on three charts. Thus, there were nine charts for these subjects. The sequence in which the crimes were covered was systematically varied to control for possible sequence effects. The multiple issue test administered to the remaining subjects used the same six relevant questions in a single series with four control questions. That multiple issue series was repeated three times.

Following data collection, an assistant who was not aware of each subject's guilt status made objective measurements of the SC and SR waveforms. Two measurements were made. First, all examiner centering adjustments that occurred between the point where the examiner told the subject the test was about to begin and the point where the examiner told the subject the test was over were measured to the nearest millimeter. Then all of the phasic responses to the relevant and control questions were measured to the nearest millimeter. The following rules were used. Response magnitude was measured from the lowest point following question onset, but preceding electrodermal response onset, to the peak of the largest electrodermal response wave that began no later than 5 seconds following the subject's answer. Responses of 3 mm or less in magnitude were considered zero response.

## Results[1]

Centering Adjustments. The amount of adjustment for each of the three charts of the multiple issue test for each of the couplers is illustrated in Figure 1. On average, the skin conductance coupler required 78.56 mm of adjustment per chart while the skin resistance coupler required 134.82 mm of adjustment. The difference between those means was significant, $F$ (1, 31) = 7.0, $p < .05$.

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[1] The detection results of this study were described in detail in Barland, Honts, and Barger (1989a), and Barland, Honts, and Barger (1989b).

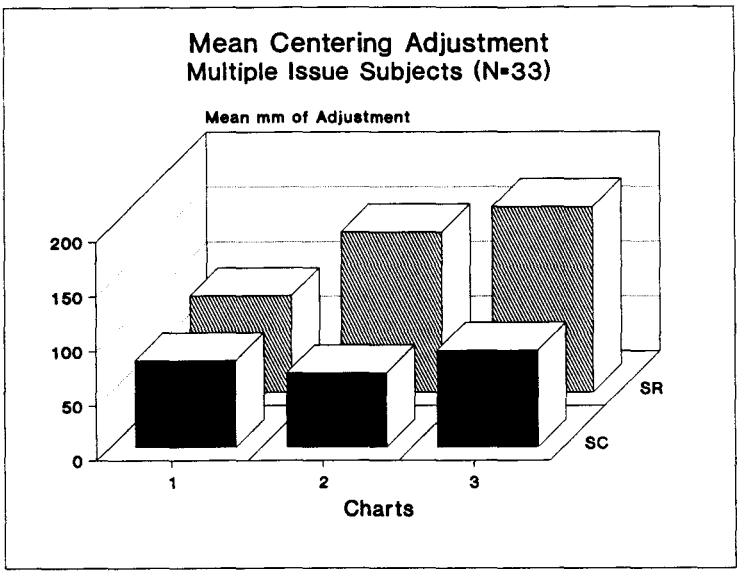


Figure 1. Mean millimeters of centering adjustment for the constant voltage circuit (skin conductance, SC) and the constant current circuit (skin resistance, SR) in the multiple issue test.

The amount of adjustment for each of the nine charts of the single issue test for each of the couplers is illustrated in Figure 2. On average the skin conductance coupler required 58.04 mm of adjustment per chart while the skin resistance coupler required 92.14 mm of adjustment. The difference between those means was also significant, $F$ (1, 30) = 10.08, $p < .01$.

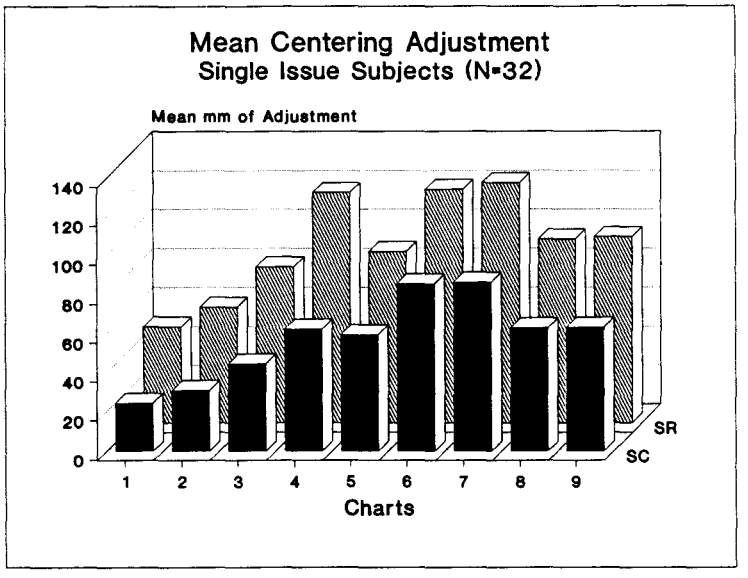


Figure 2. Mean millimeters of centering adjustment for the constant voltage circuit (skin conductance, SC) and the constant current circuit (skin resistance, SR) in the single issue test.

Response Amplitudes. The single and multiple issue tests were evaluated separately. Measurements were averaged across charts and within type to yield one relevant score and one control score for skin resistance and skin conductance for each subject. Those scores were then analyzed with a repeated measures analysis of variance. This analysis tested for effects of the following factors, Condition (Innocent or Guilty), a between subjects factor, Physiological Measure (SR or SC) and Question Type (Relevant or Control), both of which were repeated measures factors.

In the multiple issue tests, Innocent subjects produced larger electrodermal responses to control questions ($M$ = 19.98 mm) than to relevant questions ($M$ = 10.82 mm), and Guilty subjects produced larger electrodermal response to relevant questions ($M$ = 20.39 mm) than to control questions ($M$ - 18.14 mm). This expected interaction of Condition and Question Type was significant, $F$ (1, 31) = 12.95, $p < .001$. The average response to control questions ($M$ = 18.58 mm) was larger than the average response to relevant questions ($M$ - 18.07 mm) as was indicated by the significant main effect for Question Type, $F$ (1, 31) = 4.74, $p$ = .037. There were no significant effects involving the Physiological Measure factor, nor were there any other significant effects. The mean electrodermal responses for relevant and control questions by condition are shown in Table 1 collapsed across the measures factor.

Table 1. Mean Electrodermal Responses (mm) for Relevant and Control Questions by Condition with the Multiple Issue Test.

| Condition | Relevant | Control |
|---|---|---|
| Innocent (N = 8) | 10.82 | 19.98 |
| Guilty (N = 25) | 20.39 | 18.14 |

With the single issue tests, Innocent subjects also produced larger electrodermal responses to control ($M$ = 7.7 mm) than to relevant questions ($M$ = 5.6 mm), and Guilty subjects produced larger responses to relevant questions ($M$ = 15.7 mm) than to control questions ($M$ = 9.9 mm). This expected condition by question type interaction was significant, $F$ (1, 30) = 14.52, $p < .001$. However, with the single issue tests there was a significant main effect for Condition, $F$ (1, 30) = 4.48, $p$ = .043, indicating that Guilty subjects produced larger electrodermal responses ($M$ - 12.8 mm) than did Innocent subjects ($M$ - 6.6 mm). There were no significant effects involving the Physiological Measure factor, nor were there any other significant effects. The mean electrodermal responses for relevant and control questions by condition are shown in Table 2 collapsed across the measures factor.

Table 2. Mean Electrodermal Responses (mm) for Relevant and Control Questions by Condition with the Single Issue Test.

| Condition | Relevant | Control |
|---|---|---|
| Innocent (N = 8) | 5.60 | 7.70 |
| Guilty (N = 24) | 15.70 | 9.90 |

## Discussion

The results of this study support Lykken and Venables' assertions about centering adjustments and plunging tracings. As predicted, the constant voltage circuit (Skin Conductance) required only about half as much adjustment as did the constant current circuit (Skin Resistance). We were not able to analyze the number of adjustments required directly, because in lieu of instruction to do otherwise, examiners in this study tended to center both skin resistance and conductance tracings at the same time even if only one required recentering. However, the amount of adjustment results strongly suggest that examiners will make fewer centering adjustments when using skin conductance.

The finding that the amplitudes of electrodermal response for the two couplers were not different is consistent with the results reported by Boucsein and Hoffman (1979). The lack of difference in amplitudes also suggests that the difference between the couplers in amount of centering adjustment was not due to differences in the sensitivities of the two couplers to changes in electrodermal activity. The lack of significant interactions between condition and the couplers suggests that there was no difference in the discriminative power of the tracings produced by the two couplers. However, any differences in discriminative power of the two circuits are likely to be small and additional research with more statistical power is needed to provide a definitive answer the question of discriminative power.

Regardless of the issue of discriminative power, the reduction in required adjustment represents a considerable benefit in favor of the use of the constant voltage circuit. Without a loss of sensitivity to electrodermal responses, examiners could devote less time to maintaining centering of the electrodermal channel and could then devote more attention to the important factors in the examination. In addition, it would seem very reasonable to expect that the use of the constant voltage circuit would result in less loss of data due to off channel recordings, since it is likely that the recording will go off channel less often.

In summary, the constant voltage circuit offers conceptual and practical advantages over the more commonly used constant current circuit. Conceptually, the constant voltage circuit is more simply related to the physiological activity of interest and is more likely to present an accurate representation of the underlying physiological activity. From a practical standpoint, the constant voltage circuit required only about half as much centering adjustment as did the constant current circuit without a loss in sensitivity. These factors recommend the use of the constant voltage circuit in field applications.

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Education should be a conscious,
methodical application of the best means
in the wisdom of the ages to the end
that youth may know how to live
completely. -- Austin O'Malley.

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# LAW NOTES

By

Norman Ansley

In Lenea v. Lane, the Seventh U.S. Court of Appeals said polygraph results, alone, did not constitute in this case the "some evidence" requirement necessary to support a finding of guilt in a prison disciplinary hearing, but did not decide whether polygraph examinations in other cases might be sufficient by themselves to establish "some evidence."

On remand to the trial court, in U.S. v. Piccinonna, the trial court again barred the polygraph evidence saying that the questions and answers in the test were not relevant to the issues in this perjury trial. The trial court also took the opportunity to criticize the appellate decision.

In Illinois the Court of Appeals, 6th Division, said that Coronet Insurance Company's use of polygraph test results to deny an auto theft insurance claim was against public policy, and reversed the trial court's dismissal of the suit. However, the appellate court upheld dismissal of defendant's attempt to enter a class action suit.

The Minnesota Court of Appeals in Schaeffer departed from the usual rule and allowed defense counsel to profit (reversal of conviction) from an error he invited and then compounded. In a pretrial agreement the court agreed to let the defense counsel discuss the polygraph examination in order to set the scene for the confession, which was admitted; but there was to be no mention of the test results. Defense counsel did mention the test results then appealed the conviction. The Court of Appeals said the trial court had a duty to keep out all mention of the polygraph test, reversed and remanded. One justice dissented. Schaeffer has similarities to the reversal of the conviction for espionage in U.S. v. Miller. The Washington Post of August 23, 1990 reported that Richard W. Miller will be tried again.

In Warren v. City of Ashville, the North Carolina Court of Appeals considered the case of a police officer who refused a polygraph test during an internal affairs investigation about homosexual activity. The Chief fired him, the Civil Service Board affirmed, the Superior Court ordered reinstatement, and the City appealed. The Court of Appeals in affirming the Superior Court decision noted that the proposed polygraph questions went beyond the issue under investigation.

The Ohio Supreme Court in Jamison said that the defendant's constitutional rights to due process and equal protection were not violated by the trial court's refusal to order a polygraph test at state expense. The defendant did not offer to stipulate to admit the test results. Instead, he said his lawyers needed to know whether he was telling them the truth. The novel argument lacked merit, and the sentence to death for robbery and murder was affirmed.

A Nevada statute, printed in its entirety, is reported by APA Director Richard Putnam to be a state version of EPPA.

**SEVENTH CIRCUIT**

Lenea v. Lane, 882 F.2d 1171 (7th Cir. 1989)

An inmate of Joliet prison in Illinois was found guilty by a prison disciplinary committee of aiding and abetting an escape. The decision was confirmed by the Corrections Director. The inmate was placed in segregation for 360 days, had 360 days of good time credit revoked, and was demoted to "C" grade for 360 days. He sued the Department of Corrections, its Director, and others individually and in their official capacity claiming they had denied him due process by finding him guilty without sufficient evidence.

During the investigation of an escape, Lenea was asked to take a polygraph test and he agreed. The results showed he was deceptive to questions about helping or planning the escape and knowing of the escape plans beforehand. On the strength of those results plus some circumstantial evidence he was charged with aiding and abetting the escape, and with providing false information to prison officials. The Institutional Adjustment Committee (IAC) held a hearing at which Lenea testified. They found him guilty and concluded that, as the polygraph test indicated that the inmate answered the two questions untruthfully, they reasonably felt that the inmate was guilty as charged. The Department of Corrections Administrative Review Board reviewed the IAC decision, interviewed Lenea and others, reviewed his file, and a majority of the Board voted to overturn the report because of their belief that the results of a polygraph examination are insufficient evidence for finding of guilt. A minority of the Board disagreed and recommended the report be upheld. The Director of the Department of Corrections adopted the minority view without comment.

In Federal Court Lenea moved for summary judgment, contending that polygraph results were inadmissible in prison disciplinary hearings, and without the results there was not sufficient evidence to support the finding of guilt. The judge denied their motion, and the subsequent defense motion for summary judgment. The case was assigned to another judge who held Lenea was denied due process because there was not "some evidence" of his guilt. The judge said the circumstantial evidence was evidence of guilt, and the polygraph test results were relevant only to Lenea's credibility, but not relevant to the offense charged and did not constitute "some evidence." Both sides appealed. Defendants argued that the polygraph results and circumstantial evidence amounted to "some evidence" of his guilt. They also added that he had not exhausted state remedies. Lenea contended on appeal that polygraph tests are inadmissible in prison disciplinary proceedings, that the defendants, as individuals, were not entitled to immunity, and that if they were immune, it does not bar reinstatement or back pay.

The United States Court of Appeals, Seventh Circuit, noted that prison disciplinary hearings are not governed by the evidentiary rules of a civil or criminal trial, nor even that of an administrative hearing. The appellate court reviewed a number of federal precedents, and said that "In prison disciplinary hearings, polygraphs may corroborate vital testimony or other evidence ... they may even provide a prisoner with exculpatory evidence." The court noted that Lenea was a beneficiary of the polygraph results in connection with the investigation of another inmate's attempted escape. The court said "In light of the prison disciplinary hearing's unique setting and general acceptance of polygraph evidence in such cases, we decline to adopt a blanket prohibition on the admission of polygraph results, and now expressly hold that polygraph test results are admissible in disciplinary proceedings." In the case of Lenea, however, the court said that while the standard of "some evidence" is not much, ranking far below what would be sufficient in a criminal or civil trial, it still must point to the accused's guilt. The court considered the circumstantial evidence and agreed with the District Court that it was not sufficient, leaving only the polygraph evidence. The appellate court said the polygraph test results in this case were relevant only to the question of Lenea's credibility, and that was not enough to find him guilty of aiding and abetting the escape.

The court added: "We do not, however, decide whether polygraph exams in all cases are insufficient by themselves to establish "some evidence." The threshold question will be, when such a case is presented, the exam's reliability, which necessarily will entail a detailed inquiry into polygraph examinations.

The court agreed that the defendants were personally immune from damages and enjoyed protection of qualified immunity. The court said that expungement of Lenea's record ordered by the District Court was sufficient correction, and that no monetary relief could be granted. The District Court rulings were affirmed.

**ELEVENTH CIRCUIT**

United States v. Piccinonna, 885 F.2d 1529 (11th Cir. 1989), on remand to trial court

When the Eleventh Circuit Court of Appeals remanded Piccinonna to the trial court for further action, the trial court took the opportunity to criticize the appellate decision. In United States v. Piccinonna the District Court of Southern Florida, No. 85-6132-CR-JAG, 7 Feb 90 on remand said that despite the appellate ruling on polygraph evidence admissibility there were other reasons to bar polygraph evidence that were possibly insurmountable. In reinstating the conviction and sentence of Piccinonna the trial court said that the evidence could be excluded because in Piccinonna the questions and answers in the polygraph test were not relevant to the issues in his perjury trial. Excluding stipulated cases, the District Court was of the opinion that polygraph tests could not, in general, be used to impeach a witness because Fed. R. Ev. 608(a) requires that evidence for this purpose must refer to the witness' "character" for truthfulness, and it is doubtful

if a single polygraph session would ever be an adequate foundation on which an expert could base an opinion on a witness' "character" for truthfulness.

For details of United States v. Piccinonna, 885 F.2d 1529 (11th Cir. 1989) see Polygraph (1989) 18(3) 125-142.

**ILLINOIS**

Elder v. Coronet Insurance Co. and Elston Claim Service, Inc., (1990), Illinois Court of Appeal, Sixth Division, Nos. 1-89-0893 and 1-89-1116 consolidated

The case involved the propriety of an insurance company denying the claim of the insured based on the result of a polygraph examination. The plaintiff alleged unfair practices in violation of the consumer Fraud and Deceptive Business Act (Illinois Rev. State. 1987, Chapter 121 1/2, paragraphs 261 to 272)(Act or Consumer Fraud Act) and breach of contract. The Third Court included similar claims entitled "class action allegations."

At trial, the judge dismissed the first count on the ground that it did not allege an unfair practice under the Act; dismissed count two for the same reason; but certified for appeal the question of whether the plaintiff could maintain a class action under Illinois law. The appellate court granted leave to appeal on all three issues. On appeal, the factual allegations were taken as true.

Coronet's auto insurance included theft coverage. When plaintiff purchased the policy he was not told of the use of polygraph tests in processing claims. Plaintoff's car was stolen, and he reported it as stolen. It was later recovered by authorities, but it was stripped and damaged. A letter told plaintiff to take a polygraph test, or he would be required to give a statement to a court reporter under oath. He took the polygraph examination. Following the test, plaintiff was sent a letter denying his claim, and saying that based on their investigation the loss did not occur as reported. Plaintiff alleged there was no investigation and that the insurer showed no interest in interviewing plaintiff's witness.

The Court of Appeals accepted as fact a statement that "defendants have a policy and practice of requesting insureds to submit to polygraph tests and denying claims based on the results of such tests, without significant or other investigation. Polygraph tests, however, are not reliable."

The Court of Appeals said that Coronet's exclusive reliance on the results of a polygraph examination, "[although not] having been previously considered unlawful, offends public policy as it has been established by statutes, the common law, or both." In this case reference was made to Illinois Rev. Stat. 1987, ch. 38, para. 155-1 and ch. 110, para. 2-1104, prohibiting, requiring, requesting or suggesting submission to a polygraph test by a criminal defendant, or in a civil trial or a pretrial proceeding. Coronet argued that its test did not offend public policy, citing the state licensing law (Illinois Rev. State. 1987, ch. 111, para. 2401 et seq.). The

issue, said the Court was whether Coronet may use the results of the test, not at issue was whether they could request the test. The Court said the test was not, in itself, an unlawful or criminal act, and that the license statute did constitute an articulated public policy justifying the use of polygraph test results in any context not specifically prohibited by that statute. The Court of Appeals noted and cited Illinois cases barring polygraph evidence in court and administrative proceedings. Finally, the Court of Appeals also said reliance on polygraph test results to determine insurance claims was against the public policy, and reversed the trial court's decision.

On the issue of class action, the Court of Appeals noted that the denial of such status was proper because to provide such a case every member of the class would have to prove their car was stolen and the amount of damage, prove the refusal to pay was vexatious, and show that a common question predominates over other questions affecting individual members. The refusal of the trial court to certify the case for class action was based on its sound discretion and would not be reversed.

Judgment reversed in part, affirmed in part, and remanded.

Note: This case will probably be appealed to the Illinois Supreme Court. [Ed.]

**MINNESOTA**

State v. Schaeffer, 452 N.W.2d 719 (Minn.App. 1990)

The defendant was convicted of first degree criminal sexual conduct and he appealed.

Defendant claimed the trial court erred in admitting the results of his polygraph test and the confession that followed, which he claimed was coerced.

Following a complaint from a minor, defendant voluntarily took a polygraph test administered by Appleton Police Chief David Erickson, a trained examiner. Following the test defendant made incriminating admissions to the examiner, then more statements to an investigator. He had been warned of his rights before the polygraph examination and was given a Miranda warning before the interview by the other officer. At trial his attorney, in camera, asked the court for permission to elicit testimony from Erikson about circumstances surrounding the taking of the polygraph test, and the subsequent confession, saying he wanted to bring the fact of a polygraph test to the attention of the jury, on the theory that even though the confession had been ruled admissible, the circumstances under which it was obtained could be used to undermine its credibility. The trial judge agreed to the request but added that neither party could inquire about the results of the polygraph examination.

During cross examination defendant's attorney got the fact that a test was given into evidence. Question by counsel was, "And you informed Mr. Schaeff that, in your opinion, he had been lying on the polygraph, is that correct?" The answer was "That's correct." There was more along that line, emphasizing that the reason for the test was that he was trying to extract a confession. After conviction, defendant claimed error on the part of the court in admitting this testimony.

The Court of Appeals said that despite the broad discretion of a trial judge, a court cannot depart from the rules of evidence at the request of a party, and in Minnesota the results of a polygraph test and any reference to it are inadmissible. State v. Feeney, 448 N.W.2d 54 (Minn. 1989); State v. Anderson, 379 N.W.2d 70 (Minn. 1979), cert. denied 476 U.S. 1141, 106 S.Ct. 2248, 90 L.Ed. 694 (1986), State v. Litzau, 377 N.W.2d 53 (Minn.Ct.App. 1985).

While it is usually the practice of appellate courts to prevent a party from profiting from an error it invited or committed, the court of appeals in Schaeffer took the position that the trial court had a duty to keep the polygraph evidence out. The weight of the error they said was prejudicial and noncurable. The court ruled the confessions admissible. Reversed and remanded for a new trial.

Judge Schumacher dissented, noting that the defense counsel asked questions that were contrary to the court's instruction, and should not be allowed as a basis for complaint. His leading question to the examiner directly mentioned the polygraph results. Also, the trial court did give a cautionary instruction to the jury negating any misunderstanding.

**NORTH CAROLINA**

Warren v. City of Asheville, 328 S.E.2d 859 (N.C.App. 1985)

A former police officer sued the City of Asheville over his discharge. The Superior Court entered judgment in favor of the officer, and the city appealed.

The former officer let another officer stay at his house in exchange for work around the house and yard, plus splitting expenses. Warren, the former officer, offered to perform oral sex on the other officer, who said no, moved out, and reported the incident to his superior officer. Internal Affairs investigated. Warren said he made the statement to see if his fellow officer was a homosexual. When ordered by the Chief of Police to take a polygraph test, he refused. He refused on advice of counsel who had enquired about the proposed polygraph questions. Warren was terminated and appealed his dismissal to the City Civil Service Board, which affirmed. He then appealed to the Superior Court. The jury found that the Chief of Police acted without justification in finding that Warren violated the rules of conduct by refusing to submit to a polygraph test. The court ordered reinstatement with back pay and benefits, and the City appealed.

The Court of Appeals of North Carolina noted that the polygraph questions were beyond the immediate issue, and were questions that did not relate narrowly and specifically to his official duties and the charge that was being investigated. He was, therefore, as a matter of law justified in refusing to take a test including broad questions that inquired whether he was a homosexual and whether he had ever had a homosexual encounter in the Asheville area.

The City also appealed from the trial court's decision to allow the plaintiff's counsel to read part of a deposition to the jury which supported the plaintiff's contention that the tentative polygraph examination questions were too general and not relevant to the charges. The appellate court agreed it was error to admit a deposition when the parties could have testified, but the error was not so grievous as to have likely caused a different result if it had not occurred. It was harmless error. Affirmed.

**OHIO**

State v. Jamison, 49 Ohio 3d 182, 552 N.E.2d 180 (1990).

Defendant was convicted of aggravated robbery and felony murder, sentenced to death, and he appealed. The Court of Appeals affirmed. Defendant claimed the trial court erred in that the judge refused his pretrial motion for a polygraph examination, at state expense.

The Supreme Court of Ohio considered the Due Process and Equal Protection clauses of the Fourteenth Amendment and his claim for indigent assistance. The Court observed that the trial court could not have admitted the results of the test simply at the defendant's request. A stipulation was necessary in order to make the results admissible in Ohio. State v. Souel (1978) 53 Ohio St.2d 123, 372 N.E.2d 1318. Appellate did not claim he was going to stipulate to admissibility prior to taking the test, nor did he claim the state would consent to admission. Instead, defendant argued that his lawyers needed the information in order to tell whether he was telling them the truth. That, said the Court, was not of any tangible benefit to the defense of the case. The argument, they said, lacked merit.

Judgment affirmed.

**NEVADA**

NEVADA BILL LIMITING POLYGRAPH USE BY BUSINESS*

AN ACT relating to employment practices; prohibiting certain employers from requiring an employee or a prospective employee to submit to a lie detector test; prohibiting an employer from taking any adverse employment action based upon the results of a lie detector test or the refusal of an employee to take a lie detector test; authorizing the use of polygraphic examinations

*Contributed by Richard Putnam.

under certain circumstances; providing penalties; and providing other matters properly relating thereto.

THE PEOPLE OF THE STATE OF NEVADA, REPRESENTED IN SENATE AND ASSEMBLY, DO ENACT AS FOLLOWS:

Section 1. Chapter 613 of NRS is hereby amended by adding thereto the provisions set forth as sections 2 to 9, inclusive, of this act.

Sec. 2. As used in sections 2 to 9, inclusive, of this act, unless the context otherwise requires:

1. "Employer" includes any person acting directly or indirectly in the interest of an employer in relation to an employee or prospective employee.

2. "Lie detector" means a polygraph, voice stress analyzer, psychological stress evaluator or any other similar device, whether mechanical or electrical, that is used, or the results of which are used, for the purpose of rendering a diagnostic opinion regarding the honesty or dishonesty of an individual.

3. "Polygraph" means an instrument that:

(a) Visually, permanently and simultaneously records cardiovascular activity, respiratory activity and changes in skin resistance; and

(b) Is used, or the results of which are used, for the purpose of rendering a diagnostic opinion regarding the veracity of any statement made by the person examined.

4. "Polygraphic examination" means a test administered with a polygraph.

Sec. 3. Except as otherwise provided in section 9 of this act, it is unlawful for any employer in this state to:

1. Directly or indirectly, require, request, suggest or cause any employee or prospective employee to take or submit to any lie detector test;

2. Use, accept, refer to or inquire concerning the results of any lie detector test of any employee or prospective employee;

3. Discharge, discipline, discriminate against in any manner or deny employment or promotion to, or threaten to take any such action against any employee or prospective employee;

(a) Who refuses, declines or fails to take or submit to any lie detector test; or

(b) On the basis of the results of any lie detector test; or

4. Discharge, discipline, discriminate against in any manner, deny employment or promotion to or threaten to take any such action against any employee or prospective employee who has:

(a) Filed any complaint or instituted or caused to be instituted any legal proceeding pursuant to sections 2 to 9, inclusive, of this act;

(b) Testified or may testify in any legal proceeding instituted pursuant to sections 2 to 9, inclusive, of this act; or

(c) Exercised his rights, or has exercised on behalf of another person the rights afforded him pursuant to sections 2 to 9, inclusive, of this act.

Sec. 4. 1. The labor commissioner:

(a) May adopt any regulations necessary or appropriate to carry out the provisions of sections 2 to 9, inclusive, of this act; and

(b) Shall prepare and distribute to employers in this state, a notice setting forth a summary of the provisions of sections 2 to 9, inclusive, of this act.

2. Each employer shall post and maintain the notice in a conspicuous location at the place of employment where notices to employees and applicants for employment are customarily posted and read.

Sec. 5. 1. The labor commissioner may, after notice and an opportunity for a hearing, impose a civil penalty of not more than $9,000 for each violation of any provision of sections 2 to 9, inclusive, of this act. In determining the amount of any penalty, the labor commissioner shall consider the previous record of the person committing the violation in terms of compliance with sections 2 to 9, inclusive, of this act, and the gravity of the violation. The civil penalty imposed by this subsection is in addition to any other penalties provided pursuant to sections 2 to 9, inclusive, of this act.

2. The labor commissioner may bring an action pursuant to this section to restrain violations of sections 2 to 9, inclusive, of this act. A court of competent jurisdiction may issue, without bond, a temporary or permanent restraining order or injunction to require compliance with sections 2 to 9, inclusive, of this act, including any legal or equitable relief incident thereto as may be appropriate, such as employment of a prospective employee, reinstatement or promotion of an employee and the payment of lost wages and benefits.

Sec. 6. 1. An employer who violate the provisions of the sections 2 to 9, inclusive, of this act, is liable to the employee or prospective employee affected by the violation. The employer is liable for any legal or equitable relief as may be appropriate, including employment of a prospective employee, reinstatement or promotion of an employee and the payment of lost wages and benefits.

2. An action to recover the liability pursuant to subsection 1 may be maintained against the employer by an employee or prospective employee:

(a) For or on behalf of the employee or prospective employee; and

(b) On behalf of other employees or prospective employees similarly situated.

An action must not be commenced pursuant to this section more than 3 years after the date of the alleged violation.

3. In any action brought pursuant to this section, the court, in its discretion, may allow the prevailing party reasonable costs, including attorney's fees.

Sec. 7. Unless stipulated in a written statement agreement signed by all parties to a pending action or complaint filed pursuant to sections 2 to 9, inclusive, of this act, any waiver of the rights and procedures provided by sections 2 to 9, inclusive, of this act, is against public policy and is void.

Sec. 8. The provisions of sections 2 to 9, inclusive, of this act, do not apply to this state or any political subdivision of this state.

Sec. 9. 1. Except as otherwise provided in subsection 2, the following are exempt from the provisions of sections 2 to 8, inclusive, of this act:

(a) Any employer who requests an employee to submit to a polygraphic examination if:

(1) The examination is administered in connection with an ongoing investigation involving economic loss or injury to the employer's business, including theft, embezzlement, misappropriation or an act of unlawful industrial espionage or sabotage;

(2) The employee had access to the property that is the subject of the investigation;

(3) The employer has a reasonable suspicion that the employee was involved in the incident or activity under investigation; and

(4) The employer provides to the employee, before the examination, a written statement that:

(I) Sets forth with particularity the specific incident or activity being investigated;

(II) Is signed by the employer or an agent of the employer;

(III) Is retained by the employer for at least 3 years; and

(IV) Contains an identification of the specific economic loss or injury to the business, a statement indicating that the employee had access to the property and a statement describing the basis of the employer's reasonable suspicion that the employee was involved in the incident.

(b) The use of polygraphic examinations on prospective employees who would be employed to protect:

(1) Facilities, materials or operations having a significant impact on the health or safety of this state or any political subdivision of this state; or

(2) Currency, negotiable securities, precious commodities or instruments or proprietary information,

requested by the potential employer whose primary business is to provide armored car personnel, personnel engaged in the design, installation and maintenance of security alarm systems or other security personnel.

(c) The use of a polygraphic examination by any employer authorized to manufacture, distribute or dispense a controlled substance if:

(1) The examination is administered to a prospective employee who would have direct access to the manufacture, storage, distribution or sale of any controlled substance; or

(2) The examination is administered to a current employee in connection with an ongoing investigation of misconduct involving a controlled substance manufactured, distributed or dispensed by the employer if the employee had access to the property that is the subject of the investigation.

2. The exemptions provided in subsection 1 are applicable only if:

(a) The polygraphic examination is administered by a person who holds a valid license as a polygraphic examiner or intern or is qualified as a polygraphic examiner and is exempt from the requirement of licensing pursuant to the provisions of chapter 648 of NRS; and

(b) The results of a polygraphic examination or the refusal to take a polygraphic examination is not used as the sole basis upon which an adverse employment action is taken against an employee or prospective employee.

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Errata Volume 19(2):

Page 100, Table D, the accurary for Electrodermal is listed at 85%. This should be **65%.**

Page 162, Line one, next to last word should read "word" and line three fifth word should read "changed".

Please make these corrections in your volume.

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TECHNICAL NOTE

# "ZONE COMPARISON IS THE PROPER NAME," A RESPONSE

By

William Yankee

In the Volume 19, No. 2, 1990 issue of Polygraph, Norman Ansley wrote an article entitled, "Zone Comparison is the Proper Name."

The major points addressed related to: (1) the Army school's (author's title) failure to recognize Keeler, Reid and Backster in naming the test methodologies taught at the school, which were based on methods developed by those individuals, and (2) changing the name of "zone comparison" to "zone of comparison."

The Department of Defense Polygraph Institute (DoDPI) is an outgrowth of the United States Army Military Police School (Polygraph Division) established in 1962, which, in turn, was an outgrowth of an operation within the Provost Marshal General School established in 1951. As the Director of this Institute since 1987, I cannot speak for the "Army school," but I can speak for the DoDPI.

Since 1987, DoDPI has taught the zone comparison, the general question test and the modified general question test as indicated in Ansley's article. Although Backster, Keeler and Reid's names are not included in the test type titles, extensive credit is given in the lectures and student outlines on all three individuals. As regards the "zone of comparison" versus the "zone comparison" issue, it is admitted that some of the program of instruction documents and lectures used in the past were titled "zone of comparison" while others were not.

On behalf of the faculty and staff at DoDPI, I publicly assure Mr. Cleve Backster and Mr. Norm Ansley that "zone comparison" will be the name of the test method taught at DoDPI that is based on Backster's original design. The offending "of" will be purged from all past, present and future visual material such as lectures, video, slides, documents, etc. used by DoDPI and henceforth from all oral utterances of the faculty and staff.

Although the Institute will not be changing the names of the test methods taught to include the developer's names, Keeler, Reid and Backster will, in the future, as in the past, be given full credit for their respective methods. In addition, they will maintain their respected positions for other contributions to the field of polygraphy in the "history" portion of the curriculum.

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TECHNICAL NOTE

# "ZONE COMPARISON IS THE PROPER NAME," A RESPONSE

By

Robert A. Brisentine, Jr.

On behalf of all past and present instructors, managers, graduates and students of the Army Polygraph School I feel compelled to respond to an article appearing in Polygraph, 19(2), (1990), pages 161-163 titled "Zone Comparison is the Proper Name" (Ansley, 1990). In this article the author commented about the Army Polygraph School mislabeling the Backster procedure, "Zone of Comparison", and made some other suggestions about the Army Polygraph program which deserve both clarification and comment.

During my 23 year tenure as the Senior Army Polygraph Examiner, I was never aware that Cleve Backster was unhappy about or objected to the Army sometimes referring to his technique and procedure as the "Zone of Comparison" or "ZOC". As of this date, I still have no knowledge that Mr. Backster ever complained to anyone associated with the Army Polygraph School about the Army's use of the term "Zone of Comparison" instead of "Zone Comparison" when referring to his technique and procedure.

Does it really made any difference if graduates of the Army School or anyone else places "of" between the words zone and comparison? Does Mr. Backster's technique and procedure allow for greater validity or reliability when it is called "Backster Zone Comparison" rather than "Backster's Zone of Comparison?" I do not think so.

The Backster Zone Comparison procedure was introduced to Army examiners in 1961, being first learned by Army Polygraph School instructor Tom Puckett at the Backster Institute in New York who, upon returning to the Army School, taught it to me. The first use of that procedure in an actual Army examination occurred shortly thereafter and I still have the original/test question sheet from that examination. This examination involved a larceny, the subject was deceptive during the examination and subsequently confessed, and the examination charts were noted as being extremely clear and of good quality. After the appearance of Mr. Ansley's article in Polygraph, I referred to this original test and question sheet and learned that I had labeled it "Zone of Comparison." To this day I do not know if Mr. Puckett misunderstood Mr. Backster during his initial training, or if I misunderstood Tom Puckett when he gave me the title. I later learned the correct title to be, "Zone Comparison"; however, the Army had and continues to refer to the Backster technique as either "Zone Comparison" or "Zone of Comparison (ZOC)".

Following this initial examination, several more closely controlled and regulated zone comparison examinations were conducted which led to the Department of Defense conducting research and closely evaluating this technique and procedure. The zone comparison procedure was found by the Department of Defense researchers to possess between 92 and 94 percent validity

when used in the manner taught to the United States Army, Marine Corps, and Air Force examiners. This research, which I was closely involved with, was subsequently published by Phil Bersh in the Journal of Applied Psychology.

Contrary to statements appearing in "Zone Comparison is the Proper Name," the Army has always credited the developer of any questioning technique taught at the Army Polygraph School. The Army was not in any way attempting to steal or do injustice to Cleve Backster's technique; and, was not attempting to take any credit for the development of the procedure.

During the period 1951 through 1960, three polygraph procedures were taught by the United States Army School: the General Question Test, the Peak of Tension Test, and the Control Test. The Control Test was a testing series used to assist the polygraph examiner in determining if the subject appeared to be a "guilt complex" reactor. From the suggestions made by Mr. Ansley in his article, this procedure could or should have been called the Reid technique in a similar fashion that the Peak of Tension examination could or should have been referred to as the Larson or Keeler techniques. Had this been done, however, the Reid technique "Control Test" may have been confused with other techniques or procedures developed by John Reid. The General Question Test was the title given the primary technique being taught by the Army School at that time. This technique developed from the Keeler or relevant/irrelevant technique, the first procedure taught by the Army Polygraph School. During the year 1954, this primary testing technique was changed to include one control question and later to include two control questions. Both modifications of this primary testing technique (Keeler or the relevant/irrelevant) continued to be referred to as the "General Question Test". In 1961, the Backster Zone Comparison was included as a General Question Technique taught by the Army and was referred to by the Army Polygraph School as the Backster Zone Comparison beginning at that time. At no time did the Army ever label the Backster Zone Comparison a "General Question Test." Regarding any techniques used or taught by the Army Polygraph School, the Army Polygraph Program has never been arrogant nor has it ever failed to give the developers of techniques the credit they deserved by identifying their names with their techniques. The Dick Arther technique, the Lynn Marcy technique, and any other procedures or techniques studied or taught by the Army Polygraph School have always been identified with the developer by name.

In response to Mr. Ansley's article, I do not believe that any graduate of the Army Polygraph School would state that they "were solemnly taught that 'Zone of Comparison' was the correct title and that the creator of the technique was wrong." Had anyone formerly or presently associated with the Army Polygraph School had the opportunity to review Mr. Ansley's article prior to publication, the information contained in this response would have been made available to him.

Between 1961 when that first Army actual examination was conducted utilizing the Backster Zone Comparison and July of 1990, I have conducted several thousand examinations using this procedure. I'm not sure how many of these examinations I have erroneously labeled the "Zone of Comparison." I am pleased that this procedure can now be properly identified.

By the way, in the article "Zone Comparison is the Proper Name", was there actually an error when the word "work" instead of "word" appeared in the first paragraph of the article? Oh well, what's in a "word"?

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Note: There was a typographical error with the word "work" instead of "word". The original manuscript had "word" and not "work". Sorry for the error. [jkp]

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# THE READING CORNER

By

Janet Kay Pumphrey

Keeping up-to-date on articles published both pro- and anti-polygraph becomes an ever-increasing problem with the lack of indexing for polygraph and detection of deception articles. Many items are not printed in journals which are selected for indexing purposes; others are printed in local, regional, and small journals which do not have a large readership. This issue of "The Reading Corner" offers articles found on the Dialog Information Services Database File 171: Criminal Justice Periodical Index. There were only twenty-one items listed for 1989 of which four were from Polygraph. The other seventeen titles are listed below for your information.

Testimony About Contents of defendant's Polygraph Exam Spoiled Trial. CA 9 Rules. The Criminal Law Reporter: Court Decisions 45:8. (5/24/89). p2141-2142, 1989.

Maryland Court Bars Use of Polygraphs in Administrative Hearings For Employees. Corrections Digest 20:14. (7/12/89). p.7, 1989.

Employee Selection: Alternatives to the Pre-Employment Polygraph. Enforcement Journal 28:1. (1-3/89). p.14, 1989.

The Employee Polygraph Protection Act: A Guide to Compliance. Security Management 33:5. (5/89). p.116, 1989.

EPPA: The Fine Print. Rea, Kelley V. Security Management 33:5. (5/89). p.49, 51+, 1989.

Can We Still Pick Out the Bad Apples? Capps, Michael H. Security Management 33:6. (6/89). p.126, 128, 1989.

Speaking Out On the Polygraph. Corporate Security (6/89). p.4, 1989.

Alarm Industry Supporters Challenge Implementation of New Polygraph Law. Corporate Security Digest 3:13. (4/3/89). p.5-6, 1989.

Polygraphers Losing Their Businesses As the Result of New National Law. Corporate Security Digest 3:6. (2/13/89). p.1-2, 1989.

Huge Settlement Reached in Polygraph Testing Case. Corporate Security Digest 3:26. (7389). p.7, 1989.

Washington Appeals Court Limits Polygraph Challenges. Corporate Security Digest 3:25. (6/26/89). p.8, 1989.

Polygraph Professionals: The Fight Has Just Begun. Corporate Security Digest 3:20. (5/22/89). p.2-4, 1989.

Summary of Polygraph Protection Act. Police & Security Bulletin 20:9. (1/89). p.5, 1989.

Federal Judge Dismisses Industry Challenge to Polygraph Test Restrictions. Corporate Security Digest 3:4. (1/30/89). p.1-2, 1989.

Polygraph Curbs Implemented. Corporate Security Digest. 3:1. (1/9/89). p.5-6, 1989.

Comment Invited on Employee Polygraph Protection Act. Corporate Security (1/89). p.7, 1989.

Employment Polygraph Protection Act Poster Out. Security Letter 19:1. (1/2/89). p.4, 1989.

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Note: Contributions of articles and/or citations are always welcomed by "The Reading Corner." Please send to P.O. Box 1061, Severna Park, MD 21146.

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## ABSTRACTS OF EARLY RESEARCH

Marston, William Moulton (1921). Psychological possibilities in deception test. Journal of Criminal Law and Criminology, 11(4), 551-570. Reprinted in Polygraph, 14(4)(1985), 321-339. (The research was performed for the Psychological Committee of the National Research Council in October 1917.)

### Procedure

Twenty tests, authorized by a court, were made of criminal defendants who were referred by the court or probation office for a medical or psychiatric evaluation. The 20 subjects were selected by the physician because, in his opinion, their guilty or innocence was established by physical and medical evidence, testimony, and judicial disposition. Because each case history is presented in detail, it is possible to say that much of the verifying evidence is weak. Nonetheless, there is no evidence in the case histories to suggest the physician was wrong in assigning the role of guilt or innocent. There were 16 women and 4 men. Two of the women were black, all other subjects were white. The average age of the women was 30, range 17 to 46. The average age of the men was 29, range 17 to 32. Two of the tests were of the same subject.

The subjects were seated at a table and the left arm thrust through a slit in a curtain so they would not see the blood pressure apparatus. The test was of systolic blood pressure taken intermittently while the subject was questioned by the physician.

The examiner had knowledge of case facts for each person prior to the test, but did not have access to the verifying evidence, testimony, or court disposition. Details of what he knew before the test are set forth in each case history.

### Results

The examiner's determinations were in agreement with the evidence in all 20 cases. In eight cases the examiner said the subject was truthful and in twelve cases he said some or all of the testimony was deceptive. In five of the deceptive cases the examiner identified specific issues about which they were truthful and other specific issues about which they were deceptive.

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Larson, John A. (1923). The cardio-pneumo-psychogram in deception. Journal of Experimental Psychology, 6(6), 420-454. See also Larson, John A. (1932), Lying and its detection: A study of deception and deception tests (pp. 333-334). Chicago, Il: University of Chicago Press.

Procedure

The Berkeley Police Department received information from a clerk that someone in a group of 38 college girls living in the same house was a shoplifter. All of the members of this group were tested at the police laboratory in a 16-hour period, and all were asked the same questions. The instrument was a cardio-pneumo-psychogram which recorded pulse rate, vascular volume and respiration on a smoked-drum kymograph.

Results

One of the subjects had deceptive records, and after another test given several days later in which the records were again deceptive, she was questioned and she confessed. She admitted having sold over $500 worth of stolen books, articles from stores, and clothing.

Larson, John A. (1932). Lying and its detection: A study of deception and deception tests (pp. 339-340). Chicago, IL: University of Chicago Press.

Procedure

Ninety college girls who lived in a college boarding house had been victimized by a series of thefts ranging from silk underwear, registered letters and a diamond ring. Police investigators had worked on the case for three or four months without success. All of the girls consented to be tested. All of the tests were conducted as nearly alike as possible. The instrument was a cardio-pneumo-psychogram which recorded pulse rate, vascular volume and respiration on a smoked-drum kymograph.

Results

With one exception the records of all the girls investigated showed a marked uniformity. The exceptional case showed very marked effects, both in the respiratory rate and the blood pressure. In one instance there seemed to be an involuntary holding of the breath and a marked drop in the height of the beats, following which there was a marked increase in rate, pressure and amplitude. The test was not completed because the subject "blew up." At the point at which the subject forced discontinuance of the experiment, the pressure rate, and force were steadily increasing. A few days later, while under investigation, she admitted the thefts and paid for the property stolen.

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