REPORT OF THE

DEPARTMENT OF COMMERCE

ON THE

FEASIBILITY AND DESIRABILITY OF

LICENSURE OF AUDIO STRESS EXAMINERS

TO

THE GOVERNOR

AND

THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 5

COMMONWEALTH OF VIRGINIA
Richmond, Virginia
1981

AUDIO STRESS STUDY COMMITTEE

REPORT

COMMONWEALTH of VIRGINIA

RUTH J. HERRINK
Director

Department of Commerce
2 SOUTH NINTH STREET, RICHMOND, VIRGINIA 23219

December 1, 1980

TO: The Honorable John N. Dalton
Governor of Virginia

and

The General Assembly of Virginia

I herein transmit to you the report of the Department of Commerce and the Board of Commerce on the feasibility and desirability of licensure of audio stress examiners. This study was authorized by House Resolution Number 45 of the 1979 session of the General Assembly.

The report concludes that based on the study no action be taken to license audio stress examiners under Chapter 27, Title 54 of the Code of Virginia.

Sincerely,

Ruth J. Herrink

HOUSE RESOLUTION NO. 45

Requesting the Department of Commerce to conduct a study of the desirability and feasibility of licensure of audio stress examiners.

Agreed to by the House of Delegates, February 7, 1979

WHEREAS, the practice of certain professions and occupations is regulated by State law for the protection of the health, safety, and welfare of the public; and

WHEREAS, current State law, and regulation promulgated under such law, regulates the activities of polygraph examiners; and

WHEREAS, through the operation of an audio stress evaluator it has been alleged that an audio stress examiner can perform much the same tasks as are presently being carried out by polygraph examiners; and

WHEREAS, it is highly desirable that an unbiased and informed study of audio stress examiners be conducted prior to a decision as to the need for State regulation of their profession; now, therefore, be it

RESOLVED by the House of Delegates, That the Department of Commerce is requested to study the desirability and feasibility of State licensure, certification or regulation of audio stress examiners. The Department is requested to lay its findings, together with any legislative recommendations, before the nineteen hundred eighty Session of the General Assembly.

EXECUTIVE SUMMARY AND RECOMMENDATION

In its study of voice stress analysis, the Board of Commerce did not find the Audio Stress Evaluator an effective method for the determination of deception.

The validation study, conducted by the Department, established no relationship between results obtained from PSE examination of criminal suspects and those obtained from polygraph examination.

Based upon the above findings, the Department of Commerce recommends to the 1981 Virginia General Assembly that no action be taken to regulate Audio Stress Examiners under Chapter 27, Title 54 of the Code of Virginia.

BACKGROUND INFORMATION

This issue of audio stress examiners revolves around two problems: (1) The ability of the devices to indeed record voice characteristics that result in detection of deception (2) The needed training and/or examination of individuals to operate devices, assuming such are valid.

At the present time audio stress machines are not permitted for use in Virginia. Such activities are restricted to polygraph examiners who may only use a machine measuring at least two physiological reactions which relate to deception. An individual cannot be examined without his knowledge by use of the polygraph.

Unlike the polygraph, however, audio stress devices purport to detect deception by measurement of the presence or absence of "microtremors" which are reflected in the voice. Responses to questions may be tape recorded and then charted or converted by the actual devices to a pattern. Patterns are then "read" by trained individuals. Some devices bypass the taping procedure and produce an indication of truth or deception immediately. The devices could be used without the subject of the examination being aware that such examination is being conducted.

Pursuant to House Resolution 45, the Department of Commerce, through the Board of Commerce, spent the last year in study of an audio stress device manufactured in Virginia, has surveyed the literature and is conducting an evaluation in conjunction with the State Police to compare this device to the polygraph.

The issues involved are substantial. If the device is approved for use, it will be used for criminal investigations, employment purposes, and may, upon stipulation, be introduced as evidence in legal proceedings. Since a review of the literature offers no conclusive evidence as to its validity, completion of the formal evaluation should be a prerequisite to its licensure.

In March of 1979 a subcommittee of the Board of Commerce was appointed to conduct the study. The apointees to the study are Mrs. Polly Y. Campbell, Mr. Zack T. Perdue, and Mr. Alan McCullough, Jr., as Chairman.

The staff began the study by gathering all available information and literature on the subject of audio stress analysis. Those persons recognized in the field of detection of deception were notified of the study and were requested to make all information available. The studies and reports received were reviewed for all pertinent information concerning the use of the audio stress machines.

Voice stress analyzers are widely used in the private sector, and by law enforcement agencies; however, their use remains controversial. Investigation of research literature indicates conflicting opinions of the reliability and validity of voice stress analyzers. The accuracy rate of the machines and the operators to detect deception range from 32 percent to one of 100 percent.

From the literature available on the subject of voice stress analysis, it is reasonable to conclude that the effectiveness of the method in accurately detecting deception has not been resolved. (See Appendix C).

At the present time, of the twenty-five states that license polygraph examiners, only one, North Carolina, issues licenses to voice stress operators. Four states, Alabama, Mississippi, Oklahoma and Oregon, have opinions from their Attorneys General to the effect that the PSE and similar devices may not be used. In Illinois a circuit court has issued an injunction against their use. New York has passed a statute specifically prohibiting the use of the PSE and similar devices in the employment context. In Pennsylvania it is illegal to use these devices surreptitiously. In Texas voice stress operators have been jailed and fined for using their equipment within the state. In Virginia recently a voice stress operator was fined for illegal use of the machine within the state. The state of Florida held public hearings in 1974 concerning the Psychological Stress Evaluator. The hearing officer concluded that the PSE in the hands of a competently trained operator is equally as credible as the polygraph. At this time, however, audio stress examiners are not required to be licensed.

The Department of Commerce conducted a field study to assess the reliability of voice stress analysis. This evaluation was conducted in conjunction and cooperation with the Virginia State Police and Dektor Counterintelligence and Security, Inc. Dektor Counterintelligence and Security, Inc. agreed to allow department investigators to attend an 80-hour course in the use of the PSE. The Virginia State Police agreed to tape record actual polygraph examinations for the purpose of charting through the PSE instrument.

A meeting was held at the Department of Commerce to formally establish the field study and to delineate the areas of responsibility to those participating in the field evaluation. Representatives of the Department of Commerce, the Virginia State Police and Dektor Counterintelligence and Security, Inc. were present and agreed substantially to the design of the evaluation.

In accordance with the study, two assumptions were made by the Department: (1) that the General Assembly licensed polygraph examiners and the use of the polygraph machine in Virginia; therefore, the polygraph process is assumed to be reliable in detecting deception; (2) that both the PSE operator from Dektor and the State Police polygraphers were competent in their field.

It was decided that the Virginia State Police polygraph examiners, using their equipment, would tape record polygraph examinations. The results of the examinations and the tapes would be sent to the Department. The tapes would then be distributed to a PSE examiner of Dektor Counterintelligence and Security, Inc. and the investigators of the Department to be charted through the PSE process. The results obtained by the PSE examiners and the polygraph examiners would then be correlated by an independent statistician from Psychological Consultants, Inc. for comparisons of the voice stress analysis method for the polygraph.

It was decided that a total of at least forty tapes would be charted through the PSE process, as this would provide a significant data base.

FINDINGS

The study established no significant relationship between results obtained from the PSE examination of criminal suspects and those obtained from polygraph examination of the same subjects. In addition, there is no significant evidence that different PSE examiners will reach similar conclusions when examining the same data tapes.

When the results of the voice analysis #1 was compared with voice analysis #2, they agreed 31.7% of the time and disagreed 24.4% of the time. Voice analysis #1 vs Voice analysis #3 agreed 38.1% of the time and disagreed 26.1% of the time. Voice analysis #2 agreed with voice analysis #3 41.8% and disagreed 34.9% of the time. See Table 10, Appendix B.

The most damning fact concerning the accuracy of the machine is that there is no consistent comparison in any aspect of the tests with any operator. They all have different results in all aspects of the test. Hence, the guilt or innocence of an individual is determined by the operator of the machine at any given time and not by any absolute that can be consistently read by interchargeable operators of the machine. As Dr. Filer says, "Thus, by all conventional standards of proof, we have to regard the validity and reliability of the Psychological Stress Evaluator as unproven. Indeed, it appears that by and large its validity and reliability are not only unproven, but rather are disproven". See Appendix B, Psychological Consultants, Inc.

APPENDIX A

AUDIO STRESS STUDY

BOARD OF COMMERCE COMMITTEE MEMBERS

Alan McCullough, Jr., Chairman
Polly Y. Campbell
Zack T. Perdue

PARTICIPANTS

Larry W. Barden	Virginia State Police
S. Suzanne Falls	Department of Commerce
Randall K. Filer	Psychological Consultants, Inc.
Gilbert W. Gray	Dektor Counterintelligence & Security, Inc.
Rodney D. Grimes	Virginia State Police
Patrick B. Gurganus	Virginia State Police
Robert L. Harp	Department of Commerce
Edward W. Kupec	Dektor Counterintelligence & Security, Inc.
David Purdy	Psychological Consultants, Inc.
Thomas A. Snead	Virginia State Police
Barbara L. Woodson	Department of Commerce

APPENDIX B

PSYCHOLOGICAL CONSULTANTS, INC.
6724 PATTERSON AVENUE
RICHMOND, VIRGINIA 23226

TELEPHONE 288-4125
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REPORT ON THE INVESTIGATION OF THE VALIDITY OF THE PSYCHOLOGICAL STRESS EVALUATOR

for

THE VIRGINIA STATE DEPARTMENT OF COMMERCE

September, 1980

The following report summarizes the results of a study performed by Psychological Consultants, Inc. (PCI) to determine the potential use validity of a Psychological Stress Evaluator (PSE) for the Virginia State Department of Commerce. The PSE is a vocal stress analysis technique which purports to be able to measure whether or not an individual's responses to a set of structured questions exhibit an attempt to present a deceptive pattern. Advocates of the PSE have proposed that it would be of significant value in a number of situations. Among these are criminal investigations and pre-employment screening. Clearly, usages with such inherent potential for significantly affecting the lives of individuals require that the PSE exhibit a consistently high level of performance validity and reliability in order for its use to be sanctioned. It is important to bear in mind that while academic researchers couch their findings in terms of "statistical significance" (results different from chance), American Jurisprudence requires a far tougher standard of proof, that of "beyond reasonable doubt." While this level of accuracy is not constitutionally required of any input into the judicial process, it is clear that before sanctioning any device or technique, those in a position of responsibility must demand proven levels of value concomitant with that device's potential influence over individuals.

SECTION I - SUMMARY OF RELEVANT LITERATURE FINDINGS

The literature with respect to vocal stress analysis techniques (in particular the PSE) can best be described as mixed. Discounting wild claims on the part of the manufacturer, there do appear to be a number of studies which indicate a potential for obtaining accurate information from the PSE. Three of these (Kradz, Kriete and Stanley, and Heisse) claim accuracies for the PSE in excess of ninety-five percent when compared with either polygraph findings or known results of criminal investigations. A fourth study (Barland, 1975) finds a significantly lower, although still statistically significant, correlation between PSE results and polygraph analyses.

On the other hand, a number of studies have failed to confirm these findings Among these are studies by Brenner and Branscomb, Kubis, Horvath, Nacheshon, Suzuki et al., Link, Older and Jenney, and Barland (1973). It is recognized that the Kubis study was negatively received by Dektor Corporation (the manufacturers of the PSE) and that a number of potentially valid criticisms of its research design have been raised. No study, whether it reaches favorable or unfavorable conclusions

with regard to validity of the PSE, can be regarded as the definitive word on the issue. Rather, each study must be evaluated in the context of other available information and the overall pattern emerging from the sum total of available research.

In this light, there appear to be two disturbing questions that are continually raised in the analysis of the PSE. First of all, a number of studies have found that the PSE fails to correlate at a better-than-chance level with results from traditional polygraph analysis. While the Kubis study was perhaps the first and most widely quoted of these, it by no means stands alone. Similar results were found by Horvath, Nacheshon, Suzuki et al., and Barland (1973). Further questions are raised concerning the PSE by the relatively low level of interrater reliability reported in several studies. (See, for example, Brenner and Branscomb, Horvath, and Nacheshon). It is clear that if independent judges cannot reach significant agreement on the amount of deception indicated by the PSE, then the results of this process cannot be regarded as valid for use.

We do not need to go as far as David Raskin (professor of psychology at the University of Utah) who concluded in Congressional testimony that "there is not a single respectable, scientific study, and one that would meet the standards of publication in a scientific journal, which has shown the voice stress analysis technique to be any better than flipping a coin", in order to have serious reservations concerning its use. For example, it is recognized that some studies (see Kratz) have reported high levels of interrater reliability. It is not necessary, however, to question the results of this study, although such might be possible. It is sufficient to indicate that in numerous occasions, interrater reliability was not significant. Thus, simply because two raters in one situation did agree with each other, the result cannot be extrapolated to an assumption that the technique is consistent. There is sufficient evidence from numerous studies to conclude, rather, that in general, raters exhibit a low level of consistency when evaluating the same information. Similarly, it is not necessary to disprove all studies which indicate a high degree of accuracy or correlation with polygraph results in order to disapprove of the use of the PSE. The conclusion that in some contexts or some situations the PSE may be accurate, while in others it exhibits results no better than chance, is strong enough to justify withholding blanket approval of the device. Rather, the existence of a large number of studies which raise significant questions with regard to the PSE's accuracy and consistency throws the "burden of proof" back to its advocates. At the moment, the literature does not appear to indicate a sufficient degree of reliability or predictive accuracy to warrant the usage of the PSE.

However, there remain sufficient questions to indicate the desirability of further research. In this light, another study regarding the accuracy and reliability of the PSE was conducted by Psychological Consultants, Inc. for the Department of Commerce of the State of Virginia.

SECTION II - METHODOLOGY

The current study focuses on three questions: (1) To what extent do results obtained by professionally trained PSE examiners correlate with those obtained by conventional use of the polygraph? (2) How consistent are results obtained when different examiners analyze PSE data? and (3) To what extent does tape quality affect the validity of the PSE analyses?

Data for the study were provided by the Virginia State Police. Tape recordings were made of actual polygraph examination sessions. Charts of these tape recordings were made using the Psychological Stress Evaluator and these charts were independently analyzed by three PSE examiners. One of these examiners was a professional in the employ of Dektor Corporation, the device's manufacturer, while the other two were employees of the Virginia State Department of Commerce who had been trained in the usage of the PSE and certified as competent PSE analysts by Dektor Corporation. After eliminating unusable sessions from the sample, there remained a set of fifty observations. Each observation consisted on one polygraph examination result and three associated PSE examination results. A number of comparisons and analyses were performed and will be reported in detail below.

In theory, it was possible to compare results on individual questions or charts as well as overall examination conclusions. In light of the poor overall performance of the PSE to be reported below, however, it was judged unnecessary to focus on specific components. The data at this level performs even less well than overall conclusions, and its reportage would make the final report unnecessarily burdensome. Results to be reported include the relationships between PSE results (averaged across the three examiners) with polygraph results, the relationship between individual PSE results and polygraph results, the relationship between PSE results and polygraph results for each of the three examiners, and the interrelationship of PSE results for each pair of examiners.

The data provided by State Police was generated in the course of actual investigations. The vast preponderance of the subjects were suspects in criminal investigations, although some were being questioned as either witnesses or victims.

SECTION III - RESULTS

At the end of each PSE or polygraph examination session, the examiner placed his or her conclusions into one of three categories. It was concluded that either the subject was definitely being truthful, was definitely attempting to deceive the examiner, or else that no conclusion could be reached and the session should be regarded as inconclusive. With three categories, an individual attempting to guess the results of a polygraph examination on the basis of no information at all would be expected to be correct approximately one-third (33%) of the time. Results obtained from the PSE should always be examined in this light.

Three-way contingency tables comparing vocal stress analyzer results with those from polygraph examinations or the results obtained by two individual vocal stress analysts have been generated. There are a number of statistics which might be used to evaluate the degree of association between these variables. The most common such statistic, and the one most frequently used in previous studies regarding the PSE, is the Chi square statistic. This statistic measures whether the distribution of observation into cells of the contingency table is essentially random or whether there exists an association between observations on one variable and those on the other variable. There is, however, another statistic which utilizes more of the available information. The results of the polygraph and PSE examinations possess what are known as ordinal properties. That is, although there is no uniform spacing between the categories, there is an appropriate ordering of the categories. Essentially, this says that if a polygraph examination concludes that the subject was being definitely truthful, a vocal stress analysis which concludes that the subject was attempting to deceive is in less agreement than one which finds an inconclusive pattern. While the commonly used correlation coefficient (Pearson r) is not appropriate with ordinal data, a form of rank order correlation coefficient (Kendall Tau) is appropriate and can make use of this ranking property of the observations. For each of the analyses reported below, both Chi square statistics and Kendall Tau coefficients will be reported. Conventionally, levels of statistical significance of .10 or less are required in order for a researcher to regard an hypothesis as being substantiated. Essentially, this says that there is less than ten percent chance that any associations observed in the data could have arisen by chance. Any result with a significance level that indicates a greater than ten percent probability of chance occurrence must be dismissed as inconclusive. It should be emphasized that this ten percent significance level is extremely liberal, and that many

researchers require a much lower probability of chance occurrence before regarding an hypothesis as being established.

With three PSE examiners for each polygraph session, there are a total of 150 possible pairs of observations. In fact, analyses are based on somewhat smaller sample sizes. In ten of the fifty cases, at least one of the PSE examiners was unable to evaluate the tape. Thus, there are forty cases for which complete results are available. In most of the other ten cases, however, at least one of the PSE examiners was able to evaluate the session and reach a conclusion. Therefore, there are a total of 138 pairs of polygraph/PSE results. Of these, the PSE examiners raised some question as to the tape quality in twenty cases, leaving a total of 118 pairs of results where no question as to the ability of the vocal stress analyzer tapes to be rated was raised.

Table 1 reports the results when polygraph results were compared with the average ranking obtained by the three PSE examiners. It is obvious that the distribution of results across the various cells of the table is relatively close to random, and that there is no significant association between the conclusions reached by the two methods. Neither the Chi square statistic nor the Kendall Tau approached anything close to a level of statistical significance. There is, however, one reservation which must be raised in conjunction with this table. The averaging of the PSE results contains an implicit assumption of at least some cardinal rather than ordinal properties in the data. That is, it assumes that an inconclusive result lies exactly half-way between a definitely truthful result and a definitely deceptive result. This concept of "distance" is somewhat strange with regard to the current type of data. Therefore, more satisfactory results may be obtained by comparing the polygraph result with each individual PSE result. This generates the above-mentioned 138 pairs of observation. The fact that each polygraph result is paired with more than one PSE result does not in any way affect the statistical properties of the analysis.

Table 2 shows the results of such a comparison. As can be seen in the table, once again there is an overall impression of randomness in the two sets of results. For example, of the sixty-one cases where the polygraph examination indicated that the subject was definitely being truthful, the PSE indicated definite truth in twenty-four and definite deception in twenty-seven, with ten tapes being regarded as inconclusive. Overall, results of the PSE exams agreed with results of the polygraph exam in 39% of the cases, compared with the 33% that would be expected simply by clipping coins. This result is not statistically significantly different from chance. In fact, to extend

the analysis even further, in 30% of the cases, the PSE results were diametrically opposed to the polygraph results. That is, one device gave a reading of definitely truthful while the other was indicating definite deception. This is somewhat higher than might be expected as a result of chance. Therefore, one is left with the conclusion that there is no discernable or measureable relationship between results from a professionally conducted vocal stress analysis examination and results from a professionally conducted polygraph examination.

This finding is not dependent upon the inclusion of questionable tapes in the PSE sample. Table 3 shows results when only those tapes with regard to which no question at all was raised by the PSE examiner are included in the study. Based on these 118 "good" pairs of observations, the above-stated results must be resubstantiated. Once again, there is no statistically significant correlation between results obtained by the two processes. Indeed, in a statistical sense, the PSE performs somewhat closer to the polygraph when the questionable tapes are included than when they are omitted.

It is also clear that no individual PSE analyst is able to satisfactorily correlate his or her results with those obtained from the polygraph, although some analysts do better at this than others. Tables 4 through 6 show the results when each analyst's conclusions are related individually to those resulting from the polygraph session. Table 4 represents the performance of the professional employee of Dektor Corporation while tables 5 and 6 represent the performance of the employees of the Virginia State Department of Commerce. It is interesting to note that substantially the worst performance was recorded by the Dektor employee. However, once again, it should be emphasized that no individual analyst was able to predict significantly the results obtained from the polygraph.

Finally, we turn to the interrater reliability of the PSE conclusions. Once again, the results are not statistically significant. Table 7 through 9 report the results obtained for the three possible pairs of ratings. It can be seen that in no case did the raters agree on even 50% of the possible conclusions. Rater 1 (the professional Dektor employee) agreed with the two Department of Commerce employees 38% and 42% of the time, while the two Department of Commerce employees agreed only 32% of the time. It must be emphasized that not only did the PSE results not correlate significantly with the polygraph results in any possible experimental configuration, but that there was, in addition, no significant relationship between results obtained by three professionally trained PSE examiners using the same tapes.

SECTION IV - CONCLUSIONS AND RECOMMENDATIONS

The conclusions of the current study can be succinctly and powerfully stated. From this research, it cannot be established that there is any statistically significant relationship between results obtained from PSE examination of criminal suspects and those obtained from polygraph examination of the same subjects. In addition, there is no statistically significant evidence that multiple PSE examiners will reach similar conclusions when examining the same data tapes. The implication of this finding is that the results obtained from a PSE examination of an individual will vary depending upon who conducts the examination. To return to the three questions outlined for the current study, it is possible to reach the following conclusions.

1. We have no evidence that the PSE results are significantly related to those obtained from polygraph examinations. Thus, it is not possible to reject the hypothesis that PSE examination results are totally independent of those obtained by polygraph exams. It should be emphasized that this finding only enables us to conclude that the PSE is not equivalent to the polygraph. It can make no judgment as to the inherent validity of either methods. While it is unlikely, it is possible that the results of the PSE examinations were accurate and those of the polygraph were inaccurate in this study. Given the large volume of data available regarding the polygraph and the mixed performance of the PSE in other studies, as outlined above, we are inclined to doubt that such is the case, however. It is clear that both of the devices cannot possibly be accurate.

2. It does not appear that the poor performance of the Psychological Stress Evaluator is the result of the forced conclusions of less-than-adequate data. The device performs no better when analysts were allowed to exclude all tapes with regard to which they had any question about their suitability.

3. It is also abundantly clear from the data that we cannot accept the hypothesis that there is any relationship between PSE results obtained by one examiner and those obtained by another examiner from the same data. This is an especially disturbing conclusion because it implies that a subject's truthfulness or deception is not a function of what the subject himself says, but rather simply a function of which

particular examiner is conducting the analysis. This suggests very strongly that the PSE does not provide valid data for use in either employment or criminological investigations.

When the results of the current study are combined with those from other studies outlined above, the following conclusions and recommendations can be made. Although there is some evidence from some studies that the Psychological Stress Evaluator may have validity in some situations in assessing truthfulness or deceptive intent on the part of individuals, there remain significant questions as to its value. It appears that the preponderance of research, including the current study, strongly suggests that the Psychological Stress Evaluator can do no better than blind guessing in predicting the results obtained from more conventional methods of stress measurement (especially the polygraph). In addition, numerous studies, including the current one, have found that there is no significant interrater reliability between various individuals evaluating the same data using the PSE. Thus, by all conventional standards of proof, we have to regard the validity and reliability of the Psychological Stress Evaluator as unproven. Indeed, it appears that by and large its validity and reliability are not only unproven, but rather are disproven.

TABLE 1

AVERAGE RESULTS OF VOICE ANALYZER

RESULTS OF POLYGRAPH EXAM	Definitely Truthful		Inconclusive				Definitely Deceptive	Row Total
Definitely Truthful	0 0.0%	2 5.0%	4 10.0%	2 5.0%	7 17.5%	1 2.5%	2 5.0%	18 45.0%
Inconclusive	0 0.0%	2 5.0%	0 0.0%	4 10.0%	0 0.0%	1 2.5%	2 5.0%	9 22.5%
Definitely Deceptive	0 0.0%	2 5.0%	2 5.0%	2 5.0%	2 5.0%	2 5.0%	3 7.5%	13 32.5%
Column Total	0 0.0%	6 15.0%	6 15.0%	8 20.0%	9 22.5%	4 10.0%	7 17.5%	40 100.0%

Chi Square = 11.98684 with 10 Degrees of Freedom. Significance = 0.2859

Kendall's Tau = 0.05625. Significance = 0.3505

TABLE 2

RESULTS OF VOICE ANALYZER EXAM

RESULTS OF POLYGRAPH EXAM	Definitely Truthful	Inconclusive	Definitely Deceptive	Row Total
Definitely Truthful	24 17.4%	10 7.2%	27 19.6%	61 44.2%
Inconclusive	11 8.0%	8 5.8%	15 10.9%	34 24.6%
Definitely Deceptive	14 10.1%	7 5.1%	22 15.9%	43 31.2%
Column Total	49 35.5%	25 18.1%	64 46.4%	138 100.0%

Raw Chi Square =1.49213 With 4 Degrees of Freedom. Significance =0.8280

Kendall's Tau = 0.05875 Significance =0.2224

TABLE 3

RESULTS OF VOICE ANALYZER EXAM

RESULTS OF POLYGRAPH EXAM	Definitely Truthful	Inconclusive	Definitely Deceptive	Row Total
Definitely Truthful	22 18.6%	6 5.1%	23 19.5%	51 43.2%
Inconclusive	10 8.5%	7 5.9%	13 11.0%	30 25.4%
Definitely Deceptive	13 11.0%	7 5.9%	17 14.4%	37 31.4%
Column Total	45 38.1%	20 16.9%	53 44.9%	118 100.0%

Raw Chi Square = 2.24405 With 4 Degrees of Freedom. Significance = 0.6910

Kendall's Tau = 0.03765 Significance = 0.3255

TABLE 4

RESULTS OF VOICE ANALYZER EXAM

(Examiner = Dektor Professional)

RESULTS OF POLYGRAPH EXAM	Definitely Truthful	Inconclusive	Definitely Deceptive	Row Total
Definitely Truthful	7 14.6%	3 6.3%	10 20.8%	20 41.7%
Inconclusive	6 12.5%	1 2.1%	6 12.5%	13 27.1%
Definitely Deceptive	7 14.6%	1 2.1%	7 14.6%	15 31.3%
Column Total	20 41.7%	5 10.4%	23 47.9%	48 100.0%

Raw Chi Square =1.09605 With 4 Degrees of Freedom. Significance =0.8949

Kendall's Tau =-0.06304 Significance = 0.3176

TABLE 5

RESULTS OF VOICE ANALYZER EXAM

(Examiner = Department of Commerce Employee #1)

RESULTS OF POLYGRAPH EXAM	Definitely Truthful	Inconclusive	Definitely Deceptive	Row Total
Definitely Truthful	4 9.1%	5 11.4%	11 25.0%	20 45.5%
Inconclusive	1 2.3%	5 11.4%	4 9.1%	10 22.7%
Definitely Deceptive	0 0.0%	5 11.4%	9 20.5%	14 31.8%
Column Total	5 11.4%	15 34.1%	24 54.5%	44 100.0%

Raw Chi Square = 4.79024 With 4 Degrees of Freedom. Significance = 0.3095

Kendall's Tau = 0.11933 Significance = 0.1954

TABLE 6

RESULTS OF VOICE ANALYZER

(Examiner = Department of Commerce Employee #2)

RESULTS OF POLYGRAPH EXAM	Definitely Truthful	Inconclusive	Definitely Deceptive	Row Total
Definitely Truthful	13 28.3%	2 4.3%	6 13.0%	21 45.7%
Inconclusive	4 8.7%	2 4.3%	5 10.9%	11 23.9%
Definitely Deceptive	7 15.2%	1 2.2%	6 13.0%	14 30.4%
Column Total	24 52.2%	5 10.9%	17 37.0%	46 100.0%

Raw Chi Square = 2.42216 With 4 Degrees of Freedom. Significance = 0.6586

Kendall's Tau = 0.13020 Significance = 0.1691

TABLE 7

RESULTS OF VOICE ANALYZER

(Examiner = Department of Commerce Employee #1)

RESULTS OF VOICE ANALYZER (Examiner = Dektor Professional)	Definitely Truthful	Inconclusive	Definitely Deceptive	Row Total
Definitely Truthful	0	9	8	17
	0.0%	21.4%	19.0%	40.5%
Inconclusive	2	2	1	5
	4.8%	4.8%	2.4%	11.9%
Definitely Deceptive	3	3	14	20
	7.1%	7.1%	33.3%	47.6%
Column Total	5	14	23	42
	11.9%	33.3%	54.8%	100.0%

Raw Chi Square =11.67967 With 4 Degrees of Freedom. Significance =0.0199

Kendall's Tau = 0.11630 Significance = 0.2101

TABLE 8

RESULTS OF VOICE ANALYZER

(Examiner = Department of Commerce Employee #2)

RESULTS OF VOICE ANALYZER (Examiner = Dektor Professional)	Definitely Truthful	Inconclusive	Definitely Deceptive	Row Total
Definitely Truthful	9 20.9%	2 4.7%	6 14.0%	17 39.5%
Inconclusive	3 7.0%	0 0.0%	2 4.7%	5 11.6%
Definitely Deceptive	9 20.9%	3 7.0%	9 20.9%	21 48.8%
Column Total	21 48.8%	5 11.6%	17 39.5%	43 100.0%

Raw Chi Square =1.18545 With 4 Degrees of Freedom. Significance =0.8805

Kendall's Tau =0.08410 Significance =0.2777

TABLE 9

RESULTS OF VOICE ANALYZER

(Examiner = Department of Commerce Employee #2)

RESULTS OF VOICE ANALYZER (Examiner = Department of Commerce Employee #1)	Definitely Truthful	Inconclusive	Definitely Deceptive	Row Total
Definitely Truthful	3 7.3%	1 2.4%	1 2.4%	5 12.2%
Inconclusive	8 19.5%	0 0.0%	5 12.2%	13 31.7%
Definitely Deceptive	9 22.0%	4 9.8%	10 24.4%	23 56.1%
Column Total	20 48.8%	5 12.2%	16 39.0%	41 100.0%

Raw Chi Square = 3.92791 With 4 Degrees of Freedom. Significance = 0.4159

Kendall's Tau = 0.16551 Significance = 0.1284

TABLE 10

INDIVIDUAL RESULTS

Case	Polygraph Results	Voice Analyst Number One	Voice Analyst Number Two	Voice Analyst Number Three
1	Inconclusive	Truthful	Inconclusive	Deceptive
2	Inconslusive	Deceptive	Deceptive	Inconslusive
3	Deceptive	Deceptive	Deceptive	Deceptive
4	Deceptive	Deceptive	Inconclusive	Truthful
5	Deceptive	Inconclusive	Deceptive	Deceptive
6	Truthful	Not Rated	Not Rated	Truthful
7	Deceptive	Truthful	Inconclusive	Not Rated
8	Truthful	Inconclusive	Truthful	Truthful
9	Inconclusive	Truthful	Inconclusive	Truthful
10	Inconclusive	Deceptive	Not Rated	Not Rated
11	Truthful	Truthful	Inconclusive	Deceptive
12	Truthful	Not Rated	Inconclusive	Truthful
13	Truthful	Truthful	Deceptive	Deceptive
14	Truthful	Deceptive	Deceptive	Truthful
15	Truthful	Truthful	Not Rated	Not Rated
16	Inconslusive	Deceptive	Inconclusive	Truthful
17	Truthful	Truthful	Not Rated	Truthful
18	Deceptive	Deceptive	Deceptive	Inconclusive
19	Truthful	Deceptive	Truthful	Deceptive
20	Inconclusive	Truthful	Inconclusive	Not Rated
21	Truthful	Deceptive	Deceptive	Deceptive
22	Truthful	Inconclusive	Inconclusive	Deceptive
23	Inconclusive	Deceptive	Deceptive	Deceptive
24	Deceptive	Truthful	Inconclusive	Truthful
25	Truthful	Deceptive	Truthful	Truthful
26	Deceptive	Truthful	Deceptive	Inconclusive
27	Deceptive	Deceptive	Deceptive	Deceptive
28	Inconclusive	Truthful	Inconclusive	Deceptive
29	Deceptive	Truthful	Inconclusive	Truthful
30	Truthful	Truthful	Inconclusive	Truthful
31	Truthful	Inconclusive	Inconclusive	Truthful
32	Truthful	Deceptive	Deceptive	Truthful
33	Truthful	Trughful	Deceptive	Truthful
34	Inconclusive	Truthful	Deceptive	Inconclusive
35	Truthful	Deceptive	Truthful	Inconclusive
36	Deceptive	Truthful	Deceptive	Truthful
37	Deceptive	Truthful	Deceptive	Truthful
38	Truthful	Deceptive	Deceptive	Truthful
39	Inconclusive	Truthful	Not Rated	Deceptive
40	Deceptive	Deceptive	Not Rated	Truthful

TABLE 10 (Continued)

Case	Polygraph Results	Voice Analyst Number One	Voice Analyst Number Two	Voice Analyst Number Three
41	Deceptive	Deceptive	Inconclusive	Deceptive
42	Deceptive	Deceptive	Deceptive	Truthful
43	Inconclusive	Inconclusive	Truthful	Truthful
44	Inconclusive	Deceptive	Not Rated	Not Rated
45	Deceptive	Truthful	Deceptive	Deceptive
46	Deceptive	Deceptive	Deceptive	Deceptive
47	Truthful	Deceptive	Deceptive	Truthful
48	Inconclusive	Deceptive	Deceptive	Deceptive
49	Truthful	Deceptive	Deceptive	Deceptive
50	Truthful	Truthful	Deceptive	Truthful

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APPENDIX C

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