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The Psychological Stress Evaluator: The Theory, Validity and Legal Status of an Innovative “Lie Detector”†

WILLIAM H. KENETY*

THE PSYCHOLOGICAL STRESS EVALUATOR: A NEW CONCEPT IN LIE DETECTION

The Psychological Stress Evaluator (PSE) has received increasing attention from the legal establishment. It has been the subject of two law review notes¹ and discussed in several cases.² It has also captured some of the public mind; journalists have seized upon it almost as a news-making gadget sure to provide copy on demand. The PSE has been used to “prove” Patty Hearst’s innocence,³ to demonstrate that Lee Harvey Oswald probably did not assassinate John F. Kennedy,⁴ to show that John Mitchell lied during the Watergate hearings while John Dean told the truth,⁵ and to indicate that Jimmy Carter didn’t believe his own words when he argued that the Panama Canal treaties were in the nation’s best interests.⁶ The PSE seems assured of headlines if not scientific or legal acceptance.

One student commentator⁷ discussed the controversy surrounding use of the PSE, noted the “frightening possibilities for its abuse,”⁸ and concluded that it “may well be that, in view of the questionable efficacy of the Psychological Stress Evaluator and the serious threat that its use poses to individual rights, the only legitimate course of action open to resolve this problem is the actual prohibition on the

† Copyright 1980 by William H. Kenety. All rights reserved.
³ The Daily Record (Baltimore), Apr. 28, 1976, at 1.
⁴ G. O'TOOLE, THE ASSASSINATION TAPES (1975); O'Toole, Lee Harvey Oswald was Innocent, PENTHOUSE, April 9, 1975, at 45.
⁵ PARADE MAGAZINE, October 10, 1976, at 12.
⁶ THE WASHINGTON POST MAGAZINE, April 9, 1978, at 5.
⁸ Id. at 301.
sale of the PSE."\(^9\)

Contrary to the above suggestion, the author of this article believes that the PSE does have a place in today's world. Problems arise not from the machine's existence but rather from its improper use. Even the strongest advocates of the PSE recommend restrictions on its use and those who would operate it. The solution to most problems lies in correcting the abuses rather than banning the PSE altogether.

The PSE is now routinely used in criminal investigations and employment screening. In certain limited situations it may be used in court. It may well have some value as a "truth tester." This article will explore why the PSE came to be, describe its theory and operation, judge its reliability and accuracy, relate its legal status, and finally make some judgments as to its place in the future.

**STRESS THEORY AND LIE DETECTION**

The Psychological Stress Evaluator, the polygraph or any "lie detection" device cannot detect deception *per se.*\(^{10}\) Rather, such machines record reactions to a given situation, most commonly a question and answer session. Those reactions may be charted, and the interpretation of those reactions may lead the examiner/expert to conclude that an individual is lying.

Lie detection relies on one basic principle: an individual undergoing stress will exhibit certain involuntary reactions caused by that stress.\(^{11}\) Stress may result from any number of factors; an individual confronted by a masked gunman, a student taking a difficult test or an attorney trying an important case will feel stress. So too will a person who is lying, particularly if the lie hides something of importance.

Most "normal" functions of the human body are controlled by the central nervous system. However, certain reactions are controlled by the autonomic nervous system. Stress will almost always "kick in" the autonomic nervous system, which then adjusts the body's metabolism to deal with the stress.

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\(^9\) *Id.* at 339.


The autonomic nervous system has two components; the sympathetic nervous system and the parasympathetic nervous system.\textsuperscript{12} Walter Cannon, a physiologist who first studied the autonomic nervous system in detail, described the sympathetic nervous system as a “fight or flight” system.\textsuperscript{13} The sympathetic nervous system is largely regulated by a part of the brain known as the hypothalamus. The hypothalamus receives input from the thought and emotional centers of the brain (the limbic system), and from various external stimuli.

The hypothalamus may then trigger the sympathetic nervous system. The system then sends chemical “messages” along the spinal cord and to various organs via connectors called ganglia. When the sympathetic nervous system “kicks in” it triggers both parts of the adrenal glands—the medulla in the center and the cortex on the outside. The medulla secretes adrenaline directly into the bloodstream, while the cortex releases cortisone much more slowly. Both adrenaline and cortisone serve to speed the body’s metabolism.

The second of the autonomic nervous system’s two “subsystems,” the parasympathetic nervous system, is a counterbalance to the sympathetic nervous system. A body simply cannot maintain the stepped up metabolism induced by the sympathetic nervous system for an extended time. Stress must eventually fade, adrenaline and cortisone secretion must slow down: the body must return to its “normal” state. By this process of “homeostasis,”\textsuperscript{14} the autonomic nervous system works to maintain the body’s stability. The stress passes and the body relaxes. These bodily changes can easily be measured. They can less easily be interpreted. The lie detection expert must determine whether deception has caused the measured stress.

\section*{The Polygraph}

The polygraph, the most widely used and widely known “lie detector,” is the forerunner of the Psychological Stress Evaluator and other second generation deception detection devices.\textsuperscript{15} The

\textsuperscript{13} Discussion with Robert Crowell, Neurosurgeon, Massachusetts General Hospital, Boston, Mass. (Apr. 1978). The remainder of this section relies on Crowell and A. Guyton, supra note 12.
\textsuperscript{14} A. Guyton, supra note 12, at 4.
\textsuperscript{15} The polygraph measures four physiological reactions to stress. It records changes in blood pressure, pulse, respiration and electrodermal response. See J. Reid & F. Inbau, \textit{Truth and Deception} 5-6, 275-78 (2d ed. 1977). For a brief description of other second generation detection of deception devices, see note 95, infra.
physiological theories upon which the PSE is based first gained credibility when applied to the polygraph. The concept of using a scientific machine to measure stress and hence, ultimately, truth, first became popular with the development of the polygraph. Whatever legal difficulties the PSE runs into will, in large part, be decided in accordance with what has happened with the polygraph.

The polygraph has had a tangled legal existence since 1923. That year, in Frye v. United States, the District of Columbia Circuit first rejected the use of polygraph results in a criminal trial. The court reviewed the validity and reliability of such tests and concluded that the polygraph "has not yet gained such standing and scientific recognition among physiological and psychological authorities as would justify the courts in admitting expert testimony deduced from the discovery, development and experiments thus far made."

Since 1923 courts have generally adhered to the "Frye test" and for the most part prohibited the introduction of polygraph results at trial. On occasion, federal trial courts have allowed use of the polygraph. In United States v. Zeiger, the court noted that "the polygraph has been accepted by authorities in the field as being capable of producing highly probative evidence in a court of law.

Despite its widespread use, the polygraph has failed to win general acceptance in the courts. See notes 96-98 & accompanying text infra.

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See notes 10-14 & accompanying text supra.

17 The polygraph has gained widespread popularity. It is commonly used in criminal investigation, national security matters and employment application screening. It is estimated that between 300,000 and 500,000 polygraph tests are given every year to employees. 123 Cong. Rec. 11691 (1977). Employers using the polygraph to screen employees range from small department stores to the Central Intelligence Agency. Moorhead Hearings, supra note 11, at 643-63. However, use of lie detectors in employment screening has come under fire and is the subject of some recent legislation. Senator Bayh of Indiana introduced in 1977 a bill, S. 1845, which would establish significant restraints on the use of polygraphs in employment testing. Hearings on the bill were held before the Senate Judiciary Committee's Subcommittee on the Constitution in November, 1977, and September, 1978, but the bill never cleared committee after the sponsor of its companion bill in the House of Representatives, Representative Edward Koch, was elected Mayor of New York City in November, 1977, and resigned from the House. In February, 1979, the House version was reintroduced as H. 2349 by Representative Stewart McKinney of Connecticut. Former Senator Sam Ervin also introduced legislation to limit the use of the polygraph. See Moorhead Hearings, supra note 11, at 784-90.


when properly used by competent, experienced examiners.”22 The court in United States v. Ridling23 permitted the use of polygraph results only after the court chose the polygrapher to administer the test. Among the state courts, only New Mexico has explicitly authorized polygraph tests,24 although one lower Ohio court concluded that the sixth amendment right to compulsory process guaranteed a defendant the right to introduce favorable polygraph reports.25

These are, however, isolated decisions. The vast majority of courts do not permit the use of polygraphic testimony. In spite of figures that indicate an eighty-five to ninety-five percent accuracy rate,26 courts consistently refuse to allow in polygraph evidence.27 The PSE is a newer, less tested and less esteemed instrument; a fortiori it is difficult to believe that the PSE could gain rapid court approval.

THE PSYCHOLOGICAL STRESS EVALUATOR: THEORY AND OPERATION

The PSE and the polygraph operate similarly. Both rely on the fact that deception causes stress and that stress causes psychophysiological changes.28 The polygraph measures changes in the subject’s heartbeat, respiration and perspiration. The PSE measures changes in the subject’s voice.

The human voice has two basic components: Amplitude Modulation (AM) and Frequency Modulation (FM).29 AM sound is audible,
FM is not. Audible AM sounds begin with the "glottal tone." Glottal tone is caused by the vibration of the vocal cords during the passage of air through the throat to or from the lungs and chest. Hence, a person can speak only while breathing. The glottal tone, and the air affected by it, tends to vibrate in various cavities throughout the chest, throat and head. The vibrations are known as formant frequencies. The glottal tones and the formant frequencies combine to create the audible human voice.

Superimposed on the audible AM component is an inaudible FM component which is the basis for the PSE. Studies have shown that normal relaxed human muscles "vibrate" at a frequency of eight to twelve or fourteen cycles per second. This vibration occurs in both the vocal chords producing the glottal tones and the cavities producing the formant frequencies. Research has indicated that this muscle microtremor is linked with the "hunting behavior" of the body's servomechanisms. One of the initial investigators of this phenomenon, has analogized this tremor to the operation of a standard home thermostat. If the thermostat is set at sixty-five the heat does not come on until the house temperature has dropped below sixty-five and then does not turn off until the temperature rises above sixty-five. Thus the temperature is constantly experiencing "tremor." Similarly, human muscles are in a state of constant tremor as they maintain equilibrium.

Thus, under relaxed conditions, the human voice muscles are under control of the central nervous system and tremor at a normal frequency. When the onset of stress causes the autonomic nervous system to "kick in," the muscles begin to tighten up. Cyclic vibra-

32 Id.
28 Leppold, Physiological Tremor, 224 SCIENTIFIC AMER. 65 (1971).
27 Id.
25 See notes 10-14 & accompanying text supra.
tion changes or stops completely. This in turn causes the inaudible FM component to disappear or diminish. Although inaudible, a change, decrease or absence of microtremor can be detected by the PSE. During the development of the PSE it was discovered that increased stress ultimately resulted in a loss of FM microtremor. Since this loss can be measured, the PSE indicates the presence of stress and thus, possibly, deception.

Any statement used for a psychological stress evaluation must be recorded on tape so it can be played back. The PSE works only on a tape recording. Hence, there cannot be simultaneous testing and evaluation as with the polygraph. The PSE is designed to work with an extremely sensitive recorder which produces little distortion. Once a statement is recorded, or re-recorded onto the machine, it may be played into the PSE.

The PSE weighs eighteen pounds and fits into an attache case. It is connected to the tape recorder by a cord so that the audio may be transmitted directly into the PSE. The PSE itself is a signal processor that takes electronically transduced speech patterns from the tape recorder, analyzes them and registers the results on a continually unwinding reel of chart paper. Then follows the crucial part of the operation: evaluation of the results by the operator/expert. PSE testing, like polygraph testing, depends to a large degree on the skill of the evaluator. A trained and experienced PSE expert can look at chart tracings, discern indications of stress and judge whether the amount of stress is high, moderate or low.

The practical advantages of the PSE over the polygraph are many. The most obvious advantage is that the subject need not be connected to a machine, especially one that uses electric current in the galvanic skin response. Others will take the test but feel nervous and awkward about it, thus possibly affecting their responses. Interviews with Cpl. Dorance Howland, Maryland State Police (July 1976, July 1977); J. Reid & F. Inbau, Truth and Deception (1966); Note, 7 U. Cal. D.L. Rev. 332, supra note 1, at 334-36.

Polygraph testing can be tedious business. Each test runs about ten questions. There is a 15 second pause between questions to allow any built up reaction to dissipate. The subject must sit motionless during the test. The test is generally repeated several times so as to insure

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41 Kradz Interview, supra note 29.
42 Id.
43 Id.
44 R. Edson, supra note 35, at 17.
45 Kradz Interview, supra note 29.
46 A statement taken for later psychological stress evaluation is recorded at a tape speed of seven and one-half inches per second. This extremely high speed (the standard cassette player records at one and seven-eighths inches per second) results in very high fidelity. Id.
47 Id.
48 Id.; J. Reid & F. Inbau, Lie Detection and Criminal Interrogation 4 (1953).
49 Some subjects will decline to take the test merely because of the need to be connected to a machine, especially one that uses electric current in the galvanic skin response. Others will take the test but feel nervous and awkward about it, thus possibly affecting their responses. Interviews with Cpl. Dorance Howland, Maryland State Police (July 1976, July 1977); J. Reid & F. Inbau, Truth and Deception (1966); Note, 7 U. Cal. D.L. Rev. 332, supra note 1, at 334-36.
“hooked up” to a machine. Whereas the polygraph “hook up” may cause stress, the PSE test is free from these physical constraints. It is thus a less onerous, more attractive exam which some subjects who might be frightened by the polygraph would be willing to take.

The stress caused by the polygraph exam itself may be reflected in the results. Lesser stress in the PSE exam means that indications of stress in the results are more likely to be the result of deception rather than a reaction to the equipment.

The PSE has considerably more flexibility than the polygraph. It is not restricted to “yes” and “no” answers as is the polygraph, but rather can analyze any spoken word or even a dull groan. It also has the tremendous advantage of being able to analyze a prior recording. Thus an interrogation, speech or conversation could be taped in 1975 and analyzed in 1980.

The PSE also has another advantage, one that frightens many people. A psychological stress evaluation can be made without the subject’s knowledge. Any apparently innocuous conversation could be recorded and later analyzed. A tape recorder could be fitted to record telephone calls. Similarly, tests could be run on speeches or statements taped from television or radio broadcasts. Such possibilities concern civil libertarians on a variety of grounds ranging from invasion of privacy to illegal wiretapping.

In the end, the utility of the PSE depends on two factors: the reliability of the machine and the skill of the operator. As with the polygraph, skill in question formation and answer evaluation are essential to a valid test. Assuming a qualified operator/evaluator,
the PSE seems to have limitless possibilities. Its suitability for covert intelligence operations is obvious. Beyond that, it is far more practical than the polygraph for many overt purposes. Its ease of operation makes it a more attractive test for subjects and faster for the operator. Certainly it is an attractive alternative to the polygraph in employment screening cases where a large number of prospective employees must be questioned. Its use in law enforcement is clear. But underlying all of these practical applications is one central question: Does the PSE work?

VALIDATION STUDIES: IS THE PSE ACCURATE AND RELIABLE?

Whether the PSE works is the key question confronting PSE advocates. There have been no controlled scientific field studies of the PSE conducted by a disinterested party. The results of laboratory simulations have been inconclusive and conflicting, and although field results and manufacturers' studies have indicated that the PSE may have considerable utility, as yet they have not been validated by independent research. These field tests\(^6\) hold out the hope that the PSE could be a valuable tool in the detection of deception and indicate that further study is warranted. As yet, however, the extent of its validity remains undetermined.

Early testing of the PSE was conducted largely in the field.\(^5\) Michael Kradz, a police officer and polygrapher for the Howard...
County, Maryland, Police Department tested subjects with both the polygraph and the PSE in 1971. In this first thorough field test of the PSE, Kradz tested a variety of criminal suspects and victims and had the tape recordings independently analyzed for stress by two PSE operators. As a result of his analysis he concluded that twenty-seven of the forty-three suspects/defendants should be cleared and that sixteen should not. Of the twenty-seven cleared by the PSE twenty-one were later shown to be innocent by independent investigation, while no additional evidence as to guilt or innocence was found with respect to the other six. The guilt of the sixteen not cleared by the PSE was later shown through an independent investigation or confession.

Kradz compared the PSE results with simultaneously administered polygraph tests. Four tests were considered inconclusive; of the remaining thirty-eight, two polygraph examiners agreed as to their conclusions concerning thirty-five but disagreed on three, whereas the two PSE examiners’ conclusions matched in all forty-three cases. Kradz ran pre-polygraph test PSE analyses as well, and found considerably more situational stress during the simultaneous test and concluded that the presence of the polygraph equipment itself caused underlying stress which inhibited the truth-finding process.

Another analysis, by the Planar Corporation of Alexandria, Virginia, tested voice transmissions in three potentially stressful situations. Planar found recordings of astronauts indicated greater stress during periods of perceived danger or task difficulty than during normal operation; increased stress in cockpit voice recordings preceding three fatal aircraft crashes; and identifiable stress patterns in air traffic controllers’ speech.

James W. Worth and Bernard J. Lewis of Washington & Lee University evaluated the PSE in a laboratory study in 1972. Worth
and Lewis used twelve subjects each of whom hid money in one of four ashtrays. The subject selected the amount of money involved and the situation was structured so that if the operator correctly identified the ashtray holding the money, he won it. If not, the subject won it. The operator then asked questions concerning the hidden money. The subjects lied when asked whether the ashtray the operator had chosen held the money. The test was run twice. During the first test the PSE operator's evaluations were not above chance. On the second test the operator was correct fifty percent of the time. The operator's assistant, a Washington & Lee senior with no formal training on the PSE, was correct fifty-eight percent of the time. On both tests there was high inter-rater reliability—in other words, both the evaluators made the same decisions, be they right or wrong. The authors concluded that "even under conditions of low or moderate stress the PSE was able to function along lines predicted by its manufacturer" while noting that "the PSE holds promise of being a valuable research tool, although more scrutiny is needed to establish the limits of its capabilities."

The next major study was done by Gordon H. Barland, a trained polygrapher and psychological stress evaluator of the Psychology Department at the University of Utah. Barland conducted two separate tests. The first involved individuals in low stress laboratory situations. Barland found that in this low stress situation the PSE's ability to detect stress and deception was not significantly greater than chance. Barland's second test involved fourteen criminal suspects in actual cases. A PSE test was run simultaneously with a polygraph test. Barland concluded that all the suspects tested were lying when they denied criminal activity. This judgment was confirmed by outside investigation in six of the cases while no evidence was discovered to disprove his conclusions in the other eight.

Barland rated the various components of the polygraph and PSE in order to discover which most accurately indicated stress patterns. Barland found the galvanic skin response (perspiration) to be the most indicative, followed by the voice (PSE), then the pneumo-

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67 See R. Edson, supra note 35, at 44-47.
68 Cf. note 60 & accompanying text supra (Kradz Study found inter-rater reliability of 100%).
69 R. Edson, supra note 35, at 47.
70 J. Worth & B. Lewis, supra note 66, at 1, in Moorhead Hearings, supra note 11, at 285.
73 Id. at __, reprinted in R. Edson, supra note 35, at 49.
graph (respiration) and cardiograph. Combining the results of all the tests together, Barland hypothesized that "a certain level of stress must be reached in the individual before changes in the voice occur; but once that level of stress is exceeded, differential changes in the voice can be used to determine deceptiveness."

A subsequent study, the Kubis Report, released in 1973, flatly rejected the PSE and found it less useful than random selection in determining which of three subjects was lying. Dr. Joseph F. Kubis of Fordham University used a laboratory setting, and selected a triad simulation in which student volunteers were separated into groups of three. Each group contained a Thief, a Lookout and an Innocent Suspect. During questioning all three players denied any involvement in the crime.

The results were disastrous for the PSE. The tests were first analyzed individually—that is, each individual was analyzed without reference to the others. The examiner was able to correctly detect deception in only thirty-three percent of the individuals—a percentage that was no better than the one in three chance any person would have. The data from each group of three were then reviewed together. Two results were obtained: when the PSE had been used simultaneously with a polygraph test, triad analysis revealed a nineteen percent accuracy rate. When the PSE had been taped without a polygraph present the results were fifty-three percent accurate. Individuals operating the tape recorders attempted to "guess" deception merely on the basis of their immediate impressions. They were found to be correct an astounding eighty-nine percent of the time. Kubis found the polygraph to be accurate seventy-six percent of the time. As to the PSE, Kubis concluded that "the results

74 Id. at ____, reprinted in R. Edson, supra note 35, at 51; see also Horvath, An Experimental Comparison of the Psychological Stress Evaluator and the Galvanic Skin Response in the Detection of Deception, 63 J. APPLIED PSYCH. 338 (1978).
75 Id. at 283.
77 Kubis Report, supra note 76, at 8-9, reprinted in Moorhead Hearings, supra note 11, at 514-15.
78 Id. at 23, reprinted in Moorhead Hearings, supra note 11, at 529.
79 Id. at 24, reprinted in Moorhead Hearings, supra note 11, at 530.
80 This tends to bear out fears that the polygraph itself produces such stress as to make the test less useful. But cf. note 71 supra (certain level of stress must be reached before changes in an individual's voice occur).
81 Kubis Report, supra note 76, at 25, reprinted in Moorhead Hearings, supra note 11, at 531.
82 Moorhead Hearings, supra note 11, at 297 (abstract of Kubis Report).
failed to demonstrate that either of the voice analysis techniques was effective.\footnote{Dektor Counterintelligence and Security, Inc., The Kubis Report of 1973: An Invalid Study (1974), reprinted in Moorhead Hearings, supra note 11, at 301.}

The manufacturer of the PSE released its own "critical analysis" which termed the Kubis Report invalid on a number of grounds.\footnote{Id. at 1, reprinted in Moorhead Hearings, supra note 11, at 301.} It stated that Kubis should have tested real criminal suspects instead of using a laboratory simulation,\footnote{Id. at 3, reprinted in Moorhead Hearings, supra note 11, at 303.} that the questioning should have included the use of control questions,\footnote{Id.; Kradz Interview, supra note 29. Kradz originally was selected to perform the PSE analysis but withdrew because of the poor tape quality. The actual analysis was then carried out by Gordon Barland. Barland apparently found the tapes of marginal quality himself. See G. O'Toole, THE ASSASSINATION TAPES 247 (1975).} and that the tapes were of poor quality.\footnote{See Note, 24 CLEV. ST. L. REV. 299, supra note 1, at 308-09. Dektor has not responded to Kubis' rebuttal of Dektor's charges.}

Kubis responded that previous lie detection studies at Fordham had used simulated settings, the questions asked had previously been used for experimental use, and that the PSE examiner had been told to use only the tapes he thought were of acceptable quality.\footnote{A. Dahm, Study of the Field Use of the Psychological Stress Evaluator (1974), reprinted in Moorhead Hearings, supra note 11, at 255.}

The manufacturer has published a further study of its own since the Kubis Report. The Dahm Study,\footnote{Note, 24 CLEV. ST. L. REV., supra note 1, at 310.} made in preparation for the Moorhead Hearings, tabulated forty-six responses from PSE users in the field, which covered some 39,329 PSE tests. The Dahm Study reported that 5,045 of these tests were simultaneous with polygraph examinations and that there was a 99.84% correlation rate. Selected users reported that the results of twenty-two percent of the examinations had been independently corroborated and that no PSE findings had been contradicted by independent investigation. These findings have been criticized, however, as being the work of an interested party, incomplete, unverified and possibly tainted by the desire of the PSE examiner to obtain identical results from both the PSE and polygraph.\footnote{M. Brenner, Stagefright and Stevens' Law: A Study (April, 1974), reprinted in Moorhead Hearings, supra note 11, at 310.}

Various other studies have related to voice stress, although not directly to the PSE. Malcolm Brenner of the Ohio State University Psychology Department analyzed the voice stress of students as they recited a poem before an audience.\footnote{Id.} As the number of specta-
tors increased from zero to twenty-two people the physiological voice stress raised in proportion to audience size. G. Alan Smith, Department of Psychology, Powick Hospital, Worcester, England, used the PSE to measure stress in patients. Smith found the technique useful in identifying areas of anxiety. Lowell Borgen and Dr. Lowell Goodman conducted tests for Parke-Davis Research Laboratories concerning the effect of anti-anxiety drugs. They found that PSE evaluations of stress correlated well with other indicators of stress and that it was a potentially useful technique for assessing anxiety.

Thus the debate goes on. There are serious questions about the validity and reliability of the PSE. Reservations about the Kubis Report raise many of those questions. Any industry study will most likely be questioned on the grounds of bias. A competent, independent study is needed but none seems forthcoming. An evaluation of the existing studies suggests that the PSE does have some validity as a stress tester. It seems to work best in high-stress, real-life situations. An independent report confirming that would settle many of the doubts surrounding the PSE.

Other voice analyzer systems currently on the market have been subjected to even fewer validation studies than the PSE.

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Hearings, supra note 11, at 279-82.
12 Id. at 2, reprinted in Moorhead Hearings, supra note 11, at 281.
13 G. Smith, supra note 33, reprinted in Moorhead Hearings, supra note 11, at 268-78.
15 The Mark II Voice Analyzer, marketed by Law Enforcement Associates of Belleville, New Jersey, operates on somewhat different principles than does the PSE. TECHNICAL DEVELOPMENT, INC., MARK II VOICE ANALYZER TRAINING MANUAL (1976). Current LEA sales literature states that they “are completely different instruments.” The Mark II uses a cassette recorder to feed recordings into the machine. It can also operate “live” while an individual is speaking. The Mark II analyzes the vibrato or tremolo in the subject’s speech and discerns changes in amplitude and microtremor. As a live or recorded voice is played into the machine the Mark II digital analyzer displays numbers. An increase or decrease of 20% over the response to control questions is deemed to indicate stress. Thus an instantaneous analysis can be made without the use of chart tracings or graph paper. Current LEA sales literature claims that “[t]he Mark II reduces to the absolute minimum the time and training necessary to perform an investigation” and that “[n]o other instrument requires so little training to produce expert results.” Fred Fuller, developer of the Mark II and President of Technical Development, Inc. (TDI) claimed a 98% accuracy rate with his machine. Moorhead Hearings, supra note 11, at 400.
LEA offers 10 unpublished studies validating the Mark II. All were conducted by Fuller and TDI. Rice, The New Truth Machines, PSYCH. TODAY 61, 72 (June, 1978).
LEA has recently developed the 2001 Stress Decoder, a 6" by 10¼" “voice analyzer that knows fact from fiction.” Moorhead Hearings, supra note 11, at 394 (statement of Fred Fuller, President, TDI).
THE LEGAL STATUS OF THE PSE

Legally the PSE has faced major obstacles of three different sorts. The first concerns whether PSE results will be admitted in court as.

There appears to be little love lost between Dektor and LEA. Edward Kupec, Dektor's marketing vice-president, has said that the Mark II "is only about 70% as accurate" as the PSE. Rice, supra, at 64. Fred Fuller has responded "I have nothing against the PSE but basically it's a dinosaur compared to ours in the sense of technological growth." Id. Michael Kradz has stated that Fuller offered the Mark II to Dektor as part of a future partnership but was rejected. Kradz Interview, supra note 29.

The third voice analyzer on the market is the Hagoth HS/3 Voice Stress Analyzer marketed by the Hagoth Corporation of Issaquah, Washington. The Hagoth is a small device weighing only two pounds and can be easily hidden. It is approximately the size of a cigarette carton. The Hagoth does not use needles or chart paper but rather eight green lights and eight red lights which flash as an individual speaks. Stress is said to be indicated when more red lights flash than green lights.

Hagoth sales literature states that the HS/3 "provides objective results with minimal operator training." Hagoth's former president, Rick Bennet, has stated "any fool can use one" after several days of practice. Rice, supra, at 77. There are no known validation studies of the Hagoth and when asked, Bennet has replied "I give them my banker's phone number. That's my study." Id.

Dektor tested HS/3's predecessor, the HS/1, and reported "the same utterance from the same tape, from the same tape recorder, at the same output level" produced vastly different readings on Hagoth equipment when played at different times. Dektor Counterintelligence & Security, Inc., Reliability Test of Hagoth HS/1 Scanner.

Hagoth sales literature notes the following application of the HS/3: "Businessmen can be assured prospective partners have genuine confidence in proposed new ventures;" "[n]egotiators can use the HS/3 to develop psychological profiles of the involved parties;" and "voters may evaluate a politician's candor." At one-third the price of a PSE, the Hagoth is, however, clearly the least expensive voice analyzer on the market today.

Many of the problems surrounding the PSE concern its lack of independent validation. These problems are even more pronounced for the Mark II and Hagoth. Even more than the PSE, the machines need an independent analysis if they are to gain credibility.

Progress has provided even more "second generation" deception detection devices. There now exists a "wiggle seat" detector. A subject being questioned sits in the "wiggle seat." The seat measures changes in body temperature and limb volume, as well as any nervous movements. The results of a session in the "wiggle seat" are said to indicate deception. 5 AFL-CIO Trades Dept., Transportation Institute, The People's Forum: The Privacy Battleground 8 (1971), cited in Moorhead Hearings, supra note 11, at 11. See also Reid & Inbau, supra note 10, at 471.

The Weizmann Institute of Rehovot, Israel, has developed a Microwave Respiration Monitor (MRM), which is supposed to be able to monitor inner movements of the human stomach by microwave detector. The theory is that stress causes increased breathing which in turn is reflected by internal stomach movements. The Israelis apparently do not use this device as a "lie detector" but rather as a means of screening for terrorists at border and airport checkpoints. Manchester Guardian, June 4, 1974, reprinted in Moorhead Hearings, supra note 11, at 112; Paper presented by I. Horowitz of the Israeli Police Polygraph Laboratory (Tel Aviv) (at the 1973 APA Convention) reprinted in Moorhead Hearings, supra note 11, at 121-40.

The retinoscope has been devised at Kent State University in Ohio. The retinoscope measures responses in the eye of the subject during questioning. The responses are said to be indicative of stress and hence deception. There is no record of validity testing conducted on the wiggle seat, MRM, or retinoscope. See Moorhead Hearings, supra note 11, at 113-20.
evidence during a trial. The second, whether the administration of PSE tests should be permitted in investigative or other non-courtroom situations. The third concerns licensing and regulation of PSEs and their operators.

The PSE in Court

The polygraph has been fighting for many years to gain acceptance in court. It has, for the most part, failed. Generally, courts rely on a test of whether a scientific device has gained "general acceptance" among experts in that field of science. Despite several notable instances where polygraph results have been admitted, the great majority of decisions go against the admission of polygraph results.

The mixed results of the PSE validity studies indicate that it has thus far failed to attain the "general acceptance among experts" which has also eluded its predecessor, the polygraph, for so long. Courts which have rejected polygraph evidence, similarly have found the PSE beyond the pale of judicial acceptance.

Thus in Smith v. State, the Maryland Court of Special Appeals rejected a defendant's request to admit PSE evidence. The court found that Maryland did not allow polygraph evidence and that the PSE should be treated in a like manner. The court stated that "the difference, if any, between the psychological stress evaluation test and a lie detector test is too minor and shadowy to justify a departure from our prior decision. A lie detector test by any other name is still a lie detector test."

A similar result was reached in State v. Schouest. In that case a trial judge refused to allow a murder defendant to present evidence of two favorable polygraph tests and one favorable voice stress test. The Louisiana Supreme Court upheld, citing four Louisiana cases rejecting polygraph tests and stated that "like the

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8 See Abbell, supra note 20 (collecting cases).
10 Id. at 120, 355 A.2d at 535 (citing Rawlings v. State, 7 Md. App. 611, 256 A.2d 704 (1969)).
11 Id. at 120, 355 A.2d at 536.
12 351 So. 2d 462 (La. 1977).
13 Id. at 468 (citing State v. Weeks, 345 So. 2d 26 (La. 1977); State v. Governor, 331 So. 2d 443 (La. 1976); State v. Corbin, 285 So. 2d 234 (La. 1973); State v. Refuge, 264 La. 135, 270 So. 2d 842 (1972)).
'polygraph' tests, there has been no adequate showing of the reliability of the 'voice stress' test."^{104}

However, in an earlier Louisiana case, *State v. Brumbly*,^{105} the PSE was considered and arguably approved by both the trial court and Louisiana Supreme Court. In *Brumbly* the defendant was questioned and administered PSE tests on two different days during a murder investigation. As the Louisiana Supreme Court noted, the "tests indicated that defendant was under 'stress' when he answered . . . questions relating to the death."^{106} The defendant was confronted with this "proof" of his deception and, at the end of the second day's questioning, made oral and written confessions. During both the suppression hearing and the trial the defendant argued that the confessions were involuntary. To prove this contention, evidence was introduced concerning the nature of this test in particular and the PSE in general. The state argued that since the fact of the test had been admitted, so should the results. The defense did not object and the inculpatory results were admitted.^{107} The confession was not suppressed, the defendant was convicted, and the Louisiana Supreme Court upheld the admission of the confession although reversing on the basis of a question concerning voir dire. Arguably, the PSE was "approved" as an investigatory tool since its use did not render the confession involuntary. It was also "approved" in the sense that its results were admitted into evidence.

PSE results were also admitted during the trial of *People v. Herm*,^{108} on the basis that a psychiatrist had used the results of a PSE test in forming his expert opinion concerning the defendant and hence those results were an integral part of his expert testimony.^{109}

In spite of these scattered successes, it would seem that the reasoning in *Schouest* and *Smith* will continue to prevail until the PSE gains greater acceptance within the scientific community. The PSE's best chance of gaining legal acceptance is on the coat-tails of its forerunner, the polygraph. A court disallowing polygraph testimony, however, is unlikely to admit PSE testimony.

Generally, courts have allowed the results of polygraph tests to be

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^{104} Id. at 469.

^{105} 320 So. 2d 129 (La. 1975).

^{106} Id. at 131.

^{107} See Note, 24 CLEV. ST. L. REV. 299, supra note 1, at 319-20 (discussion of events at trial level).

^{108} No. C 32133 (Mun. Ct., West Orange County, Calif., Aug. 5, 1974).

^{109} Note, 24 CLEV. ST. L. REV. 299, supra note 1, at 319.
admitted into evidence pursuant to a stipulation between the parties.\textsuperscript{110} Certainly this practice could be extended to PSE results. In polygraph cases, courts require that a proper foundation be laid and that the examiner be present for cross-examination.\textsuperscript{111} These requirements could easily be met in PSE cases.

Although there are no reported decisions concerning PSE admission by stipulation, the analogous polygraph cases might serve as a model. The cases allowing stipulated polygraph results fall into two broad categories—those that expressly authorize admission by stipulation and those that imply it. In \textit{People v. Trujillo},\textsuperscript{112} the California Court of Appeals flatly stated that the “results of a polygraph examination may be admitted into evidence at the trial pursuant to a stipulation.”\textsuperscript{113} Other courts\textsuperscript{114} have suggested this position with statements along the lines of “the established law in this jurisdiction does not allow the admission of [polygraph] tests without stipulation of the parties.”\textsuperscript{115}

A trial judge is not bound by a stipulation,\textsuperscript{116} however, and may release the parties from a stipulation.\textsuperscript{117} At least one court\textsuperscript{118} has faced the situation where the prosecutor and the defense attorney stipulated and asked the trial judge to order polygraph examinations of all witnesses, only to be turned down. The Louisiana Supreme Court upheld the trial judge’s decision on the grounds that the attorneys stipulated “without any personal stipulations by witnesses.”\textsuperscript{119}

Even though there may be a stipulation by the parties that test results be admitted, there remain general requirements concerning the quality of the test. The operator must be a qualified expert, the test must be run properly, and the subject must be in normal physi-
Failure to meet these requirements may result in the test results being kept out of evidence.\(^2\)

**Non-Courtroom Uses of the PSE**

The polygraph, and hence the PSE, can have a direct effect on the course of a case even if its results are not directly admitted into evidence during the course of a trial. In criminal cases prosecutors may dismiss a charge if the results of a PSE or polygraph test are favorable to the defendant.\(^2\) Sometimes a defense attorney and prosecutor may bargain with respect to test results. Two appellate courts have held that where a prosecutor had agreed to dismiss a case if the defendant “passed” a polygraph test, the agreement was binding and the prosecution was barred from proceeding with the case.\(^2\)

In *People v. Barbara*, the Michigan Supreme Court ruled that polygraph test results may be considered by a trial judge in ruling upon a motion for a new trial based on newly discovered evidence.\(^4\) However, the Minnesota Supreme Court has rejected the extension of the *Barbara* rule to PSE results.\(^5\) Furthermore, the Michigan

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2. United States v. Oliver, 525 F.2d 731 (8th Cir. 1975).
3. See, e.g., cases cited notes 130, 132 infra.
5. People v. Barbara, 400 Mich. 352, 255 N.W.2d 171, 199 (1977). The court established nine relevant factors: (1) the defendant must offer the results of a polygraph test; (2) the test must have been voluntarily taken; (3) the polygraph operator’s qualifications must be approved by the trial judge; (4) the polygraph equipment must be similarly approved; (5) the testing procedure itself must also be approved; (6) the prosecutor or trial judge may ask for a reexamination or review by an operator of the court’s own choosing; (7) the results may be considered only as they reflect on the general credibility of the subject and may not be used to judge the truth or falsity of any particular statement; (8) the results cannot be used at a subsequent trial; and (9) a judge hearing these results may not act as trier of fact at a subsequent trial of the defendant if the new trial motion is granted. *Id.* at 412-13, 255 N.W.2d at 198. The court went on to explain that it viewed this decision as starting an experiment and that it should give the polygraph an opportunity to establish a “track record.” *Id.* at 413, 255 N.W.2d at 198. See 55 Der. J. URA. L. 155 (1977); 56 N.C.L. Rev. 380 (1978).

With respect to the PSE evidence we should point out that we are not presented with nor do we decide the issue of the admissibility of so-called polygraph evidence at a postconviction hearing to determine whether newly discovered evidence mandates a new trial. See, *People v. Barbara*, 400 Mich. 352, 255 N.W.2d 171 (1977). Rather, we are dealing with the issue of admissibility of the so-called PSE evidence, which is not the same as polygraph evidence, at such a hearing. Petitioner fails to call to our attention any cases admitting this evidence and we have found none. Without a greater showing of the reliability of
Court of Appeals ruled that the results of a polygraph test may be considered by a trial judge in sentencing, in People v. Allen.\textsuperscript{126}

Thus polygraph results are "getting in the back door" despite the general rule that they are not directly admissible during trial. It is reasonable to expect that more courts will follow this trend and that PSE results may be admitted as a result of stipulation, at a new trial motion or at sentencing.

The state of Maryland has been the site of a considerable amount of such PSE work. In two Howard County cases, the State's Attorney and defense counsel stipulated that PSE tests should be run on three defendants;\textsuperscript{127} all three "passed" the tests and their cases were dismissed.\textsuperscript{128} In a fourth case\textsuperscript{129} the defendant "failed" the test and afterwards pled guilty.\textsuperscript{130}

The PSE had a notable effect on another Maryland case, State v. Brooks.\textsuperscript{131} Riley Brooks had been convicted of murder and given a life sentence. Brooks had protested his innocence, claiming that he had shot the victim in self-defense. There were no witnesses. After Brooks was incarcerated the state and defense agreed he should take a PSE test. Brooks "passed" the PSE test and was subsequently pardoned by then Governor Marvin Mandel.\textsuperscript{132}

An analogous event happened in Virginia some five years ago. A journalist had left Rhode Island for Virginia after witnessing a robbery. The Rhode Island authorities believed he had lied during the trial and charged him with perjury. After a PSE test cleared him, the governor refused to extradite him.\textsuperscript{133}

The PSE is also in widespread use, by numerous law enforcement organizations and commercial organizations.\textsuperscript{134} The PSE may be
used by these organizations in a variety of ways. Frequently the machine is used for employment screening before a job applicant is hired. The PSE may also be used for loss prevention, either during on-going random testing of employees or during inquiries concerning specific shortages.\textsuperscript{135} The states where the PSE seems to be most popular are California, Louisiana, Florida, Pennsylvania and New York.\textsuperscript{136}

Thus the PSE may be useful in special non-trial situations such as pre-trial bargaining, sentencing, and police and employer investigatory work. The polygraph has broken ground in this area; the PSE has indicated that it may have similar utility. Whether courts will extend the PSE a chance to prove itself depends to a large extent on future tests of the reliability of PSE evidence.

**Licensing and Regulation of the PSE**

The third area in which the PSE has run into legal difficulties is in the area of licensing and registration. The American Polygraph Association (APA) has been active in urging states to adopt statutes regulating the polygraph profession and establishing requirements for entry into the field.\textsuperscript{137} Such statutes usually regulate both the examiner and the instrument.\textsuperscript{138} They often require that the instrument measure at least two responses, such as respiration and blood pressure, or galvanic skin response and respiration.\textsuperscript{139} This was laudable at the time. However, the result is that the PSE does not
qualify under most state statutory schemes since it measures only one response—the voice.\textsuperscript{140}

Not surprisingly, polygraph operators in general and the APA in particular have seized upon these laws as means to shut out the PSE. Whether this is because of laudable motives in “protecting” the public or is the result of economic protectionism remains to be seen. However, the APA has passed a resolution disapproving “of the use of the Dektor PSE as the sole source of, or a major contributor to, a determination of truth or deception in a meaningful testing situation.”\textsuperscript{141} The resolution adds that the PSE should not be used without verification by a polygraph.\textsuperscript{142} Various polygraph authorities have also spoken out against the PSE.\textsuperscript{143} One PSE advocate contends that if the PSE is banned (in part, perhaps, because polygraphers attack it) then the polygraph may be next.\textsuperscript{144} The United States Congress is currently considering a bill that would ban the use of deception detection devices in almost all employment situations.\textsuperscript{145}

PSE operation may also be regulated by requiring certain qualifications of the operators. North Carolina’s Protective Services Act\textsuperscript{146} is often pointed to as an example. Under North Carolina licensing requirements a PSE operator must complete certain hours of training before he or she may operate a PSE in North Carolina. An

\textsuperscript{140} See, e.g., 1976 ILL. ATT’Y GEN. REP. 171-72 (Opinion S-1082: “every examiner shall use an instrument which records . . . the subject’s cardiovascular and respiratory patterns as minimum standards.” The opinion concludes that since, “the psychological stress evaluator does not record the minimum physiological indicators required . . . it may not, in my opinion, be used by detection of deception examiners in Illinois”).

\textsuperscript{141} Moorhead Hearings, supra note 11, at 218-19.

\textsuperscript{142} Id.

\textsuperscript{143} See Moorhead Hearings, supra note 11, at 145, 154 (statement of J. Kirk Barefoot, Chairman, Legislative & Law Comm., APA); id. at 373-75 (statement of Cleve Backster, Director, Backster School of Lie Detection, New York, New York).

\textsuperscript{144} As Michael Kradz, Dektor Director of Training, says, “They ought to be working with us, not against us. If we go first, they’ll follow.” Kradz Interview, supra note 29. Kradz is referring to several states that have outlawed some use of lie detection devices in employment testing. See, e.g., ALASKA STAT. § 23.10.037 (1972); CAL. LAB. CODE § 432.2 (West 1971); CONN. GEN. STAT. ANN. § 31-51g (Cum. Supp. 1979); DEL. CODE ANN. tit. 19, § 704 (1974); HAW. REV. STAT. § 378-21 (1976); Md. ANN. CODE art. 100, § 95 (1979); MASS. ANN. LAWS ch. 149, § 19B (Michie/Law Co-op 1976); MINN. STAT. § 181.75 (Cum. Supp. 1979); N.J. STAT. ANN. § 2A: 170-90.1 (1971); OR. REV. STAT. § 659.225 (1977); PA. CONS. STAT. ANN. tit. 18 § 7321 (1973); WASH. REV. CODE § 49.44.120 (Supp. 1978). Most of these statutes make exceptions for political subdivisions particularly if police employment is concerned. Some prohibit the requirement of a test, others prohibit the request as well—all provide some sort of sanction. In New Jersey, the requiring of a test is considered disorderly conduct. N.J. STAT. ANN. § 2A:170-90.1 (1971).

\textsuperscript{145} See note 17 & accompanying text supra.

\textsuperscript{146} N.C. GEN. STAT. § 74C-1 to 15 (Cum. Supp. 1979).
experienced polygraph operator must complete fifty-six hours of training before licensing; an individual who is not a polygrapher must complete eighty-eight hours of training.147

CONCLUSION

Science and its creations are an integral part of the legal process. Many scientific devices are accepted within our legal system. The courthouse computer and the doorway metal detector are obvious examples of the progress and efficiency scientific advances have brought to the law. Scientific evidence is routinely accepted in courts every day.148

Similarly, considerable advancement has been made in using scientific processes to aid in the determination of the truth. Hypnosis


The United States Customs Service now uses a "Forward Looking Infrared Radar" (FLIR) detector system to identify aircraft smuggling contraband, and FLIR results have been used in court. But see, United States v. Kilgus, 571 F.2d 508 (9th Cir. 1978) (results inadmissible because FLIR system not scientifically accepted).
is now accepted by law enforcement agencies as well as by some courts. Similarly, narcoanalysis has made tremendous strides in recent years, and the results of narcoanalysis tests have been accepted by some courts.

Yet while more science is creeping into the courtroom, the polygraph and PSE are generally kept out. This perhaps reflects a feeling that such “direct” evidence of truth impinges on the function of the trier of fact. While such direct evidence of credibility can aid in the search for truth there perhaps exists a fear that a jury will rely too heavily on the opinion of a polygraph or PSE expert. It is one thing for an expert to testify that the soil on the defendant's shoe is identical to that found at the scene of a crime. It is a different situation when an expert witness says, in effect, that the defendant was lying when he denied committing the crime. Such testimony may well go too far.

Those who would question continued use of the PSE offer horror stories such as the following newspaper article:

In one example . . . a jewelry store employee was accused of stealing a diamond ring after a test with a Psychological Stress Evaluator indicated stress when a diamond ring was mentioned. It was only after considerable investigation that it was discovered the man was innocent and his stress related not to the theft but to his guilt feelings over having lost his mother's diamond ring when he was a child.

This story indicates PSE abuse by an unqualified or poorly trained operator. As has been noted before, the PSE does not prove, determine or show truth. It simply indicates stress, which may be caused by any number of factors. It is obvious where the stress came from in the above example. A properly qualified PSE operator should identify such problems during a pre-test interview. If not, then a trained operator would later ask, for example, “The results show considerable stress here on questions two and six. If you didn’t

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152 See note 27 supra.
steal the ring, is there any thing else that might be causing you to feel nervous?” A well-trained PSE expert would have uncovered this situation without the “considerable investigation” that was apparently required in the example.

The PSE certainly does have a place in today’s legal system. PSE results, like polygraph results, no doubt will be held inadmissible as evidence against a defendant in a criminal trial. Even staunch PSE supporters say that it should not be a prosecutorial weapon to be used against a defendant during trial. However, it seems reasonable to admit PSE results where the parties have stipulated to their use.

There are also non-trial areas where PSE test results might prove useful. Sentencing and new trial motion proceedings are areas in which a judge might consider PSE results favorable to a defendant. As the Michigan Supreme Court noted concerning polygraph results in People v. Barbara, this would be an opportunity for the machine to establish a track record if it is able to do so.

The Kradz Study first indicated the usefulness of the PSE in criminal investigations. Since then, numerous law enforcement agencies have used the PSE, some with great success. It is important to note that while the PSE may indicate guilt it may also show innocence. Thus, a properly run PSE test can benefit the innocent as well as the guilty.

The PSE may be abused. Individuals can easily be taped and their voices analyzed without their knowledge. A telephone conversation could be analyzed to show stress when in fact the stress was caused not by deception but by a bleeding wound. No reputable PSE examiner could or would conclude that the stress in a telephone conversation was the result of deception without knowing the circumstances affecting the tested individual.

Thus challenges should not go to the PSE but rather to those operating it. Most people involved with the PSE agree that operators should be trained, tested and licensed. Regulation may be in order to limit various lie detection practices. But these restrictions

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114 Kradz Interview, supra note 29.
115 See notes 110-21 & accompanying text supra.
116 See notes 124-26 & accompanying text supra.
119 Note 56 supra.
120 See note 127 & accompanying text supra.
121 For similar thoughts concerning the polygraph, see Inbau & Reid, supra note 10, at 472-73.
122 See note 17 supra.
should go to the use and operation of the machine and not to its very existence. Those who would ban the PSE\textsuperscript{142} fail to see that the PSE has valuable uses which should be allowed when abuses are curtailed by regulation.

The key to the future of the PSE lies in further testing since much of the controversy surrounding the machine concerns the question of its validity and reliability. If independent tests were to clearly prove that the PSE is reliable, it should be accepted for what it is—a machine capable of detecting stress and thus deception through voice analysis.

\textsuperscript{142} See notes 17, 141-46 supra.