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Terminology Reference for the Science of Psychophysiological Detection of Deception[1]

4th Edition, 2022

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Introduction

Since the first edition of this reference was published 25 years ago much has taken place in the polygraph field, progress which has continued in the decade since the last edition of the *Terminology Reference*. The transition from analog to digital polygraph is now complete, the polygraph profession has accomplished the shift from authority-based practices to those that are evidence-based, concepts and terms adopted by the polygraph field are substantially more mainstream, new credibility assessment technologies have appeared while others have disappeared, and much to the surprise of critics and detractors, predictions of the demise of the polygraph have proven to be premature.

In this fourth edition of the *Terminology Reference for the Science of Psychophysiological Detection of Deception* we strived to capture these changes. We have updated the references, added new terms, removed others, and included images for some terms to help readers understand them better. We hope readers appreciate these updates.

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And finally, we sadly report the passing of our friend, colleague and contributor to previous editions of this work, Shirley Sturm in 2020. Shirley was one of the greats in the polygraph field. She was the first woman President of the American Polygraph Association, a teacher, a coveted mentor, and a fiercely independent thinker. We and the rest of the polygraph field will miss Shirley, her sense of humor, her passion for polygraph, her concern for her fellow practitioners, her commitment to the field. There was always only one Shirley Sturm and we were fortunate to have known her. Because of her lasting contribution to our shared field of endeavor we dedicate this edition of the *Terminology Reference* to Shirley Sturm.

3-position scale

Abbreviated form of the *7-position scale* for PDD test data analysis. The major difference is that the range of values for each comparison is from -1 to +1, rather than the range of -3 to +3 in the 7-position scoring system. This process is based on the simple and robust principle that physiological reactions of greater magnitude are caused by stimuli that are more salient to the examinee due to emotional, cognitive, or behaviorally conditioned factors. See: Capps & Ansley (1992); Harwell (2000); Krapohl (1998); Van Herk (1990).

7-position scale

System for assigning values to individual physiological responses in PDD, based on differential responding to relevant and comparison questions. The values in 7-position scoring are whole numbers between -3 and +3. By convention, negative values represent greater responding to relevant questions, while positive values indicate greater responses to comparison questions. A zero usually indicates equal or no reactions to the relevant and comparison questions, or that the spot does not meet minimum standards for interpretation. In the PDD literature, the 7-position scale is sometimes referred to as a semi-objective scoring system and is loosely based on the psychometric scales developed by Rensis Likert. See: Bell, Raskin, Honts & Kircher (1999); Handler & Nelson (2008); Swinford (1999); Weaver (1985).

acetylcholine (ACh)

Neurotransmitter substance found in the motor nerves to skeletal muscle, in preganglionic autonomic endings (sympathetic and parasympathetic), in post-

ganglionic parasympathetic nerves, postganglionic sympathetic nerves to eccrine sweat glands and muscle vasodilator endings, and many parts of the brain as well as in some cells in the retina. Neurons that release ACh are called *cholinergic neurons*.

acquaintance test

Typically, a test given at the beginning of the test phase of an examination in which the examinee agrees to lie to a number or letter. The test is not scored nor used for veracity testing. The acquaintance test serves several purposes: to familiarize the examinee with the test procedures; to properly set the gains and centerings; to help detect countermeasures; and to assess the range of responsiveness of the examinee. Other forms and terms for this type of test include Numbers Test, Demonstration Test, Stimulation (Stim) Test, Practice Test, Blind Numbers Test, Calibration Verification of Sensitivity Test (CVOS), and True Blue Control Test.

activity monitor

Device attached to or built into PDD testing chairs designed to record peripheral behavioral activity and cooperation during the examination.

Adrenalin

Trademark name for epinephrine (called *adrenaline* in British references), discovered and named by J. Takamine in 1901. See: *epinephrine*.

adrenergic

Those neurons that release the neurotransmitter norepinephrine. Also, substances that mimic norepinephrine in its physiological effects.

afferent nerves

Nerve fibers that carry impulses from the periphery toward the central nervous system. Also called *sensory nerves*.

Air Force Modified General Question Test (AFMGQT)

PDD comparison question testing format with flexible question orderings and numbers of relevant questions. The AFMGQT can be used in single-issue, multiple-facet, and mixed-issue PDD examinations. The AFMGQT uses relevant, probable-lie, sacrifice relevant, and irrelevant questions. Some versions permit the use of directed-lie comparison questions. See: Senter, Waller & Krapohl (2008).

algorithm

System of standardized steps that lead to a solution. A series of decision rules. The term algorithm is frequently used in the context of automated data analysis that produces a decision or result. Algorithms have many applications; Polygraph algorithms analyze the physiologic data from structured examinations and make estimates of the likelihood of deception or to assess which question has elicited the greatest physiologic response. There are several algorithms now available for analysis of polygraph data. See: Dollins, Krapohl & Dutton (1999); Nelson, Krapohl & Handler (2008).

alarm reaction

The first stage of general adaptation, which is triggered by the impact of the stressor and is characterized by heightened sympathetic activity.

all-or-none law

A neuron will respond to its greatest ability or not at all. Stimuli that do not meet or exceed the threshold will not be sufficient to cause a response. Skeletal muscles, cardiac muscles and nerve tissues conform to the all-or-none law.

allostasis

A central nervous system mediated, integrated brain-body response geared towards viability or survival. It occurs in regulatory systems which have no fixed set point and is comprised of both physiological and behavioral processes designed to maintain internal parameters within limits essential for life. A modern concept that replaces "homeostasis" as a central concept in physiological responding. See: Handler, Rovner & Nelson (2008).

alpha

A Greek letter (α) used to denote the probability of incorrectly rejecting a null hypothesis in statistical testing. It refers to the probability of making a Type-1 or false-positive error. If the probability of obtaining the sample result is less than alpha (often set a priori less than or equal to 0.05), the results are declared "statistically significant."

American Association of Police Polygraphists (AAPP)

Professional organization dedicated to serving the needs of criminal justice and military PDD examiners. Founded in 1977, AAPP has about 1500 members and is headquartered in Waynesville, Ohio.

American Polygraph Association (APA)

Professional organization made up of PDD professionals from law enforcement, government, and the private sector. Incorporated in 1966 in Washington, D.C., the APA resulted from the merger of the several polygraph associations, including the Academy of Scientific Interrogation, the American Academy of Polygraph Sciences, the National Board of Polygraph Examiners, the International Association of Polygraph Examiners, and the International Association for Polygraph Research. It currently has about 2,800 members and is headquartered in Chattanooga, Tennessee.

Americans with Disabilities Act (ADA)

"An Act to establish a clear and comprehensive prohibition of discrimination on the basis of disability." PDD is used in employee selection and loss investigation in both the public and private sector, and some provisions of the ADA limit the types of inquiries that can be included in the test coverage. Some of the lines of questioning historically taken during pre-employment screening may not be in compliance with ADA rules (e.g. historic alcohol or drug use). Provisions of the Act can be found at the Department of Labor Web site: www.dol.gov.

anacrotic limb

Ascending portion of an arterial pulse wave.

analog study

Experimental design that attempts to replicate real world activities under controlled circumstances, i.e., a mock crime study. Analog methodologies are frequently used in polygraph validation studies because it is possible to establish ground truth, something extremely difficult to determine independently in field cases. Despite this important feature, mock crime studies in polygraphy have been criticized for not being able to induce the level of emotional involvement or personal risk engendered in real criminal investigations.

analysis spot

The specific location on a polygraph chart where the spot analysis concept is employed and is generally anchored to a relevant question.

anecdote

Personal narrative relating to an issue or event. Anecdotal evidence pertains to non-empirical observations, and it is sometimes used to forward an assertion for which there may be no clear evidence.

anticlimax dampening concept

Based on Cleve Backster's overarching concept for the polygraph that a person's fears, anxieties, and apprehensions will be directed to that situation which holds the greatest threat to his or her well-being or self-preservation at that point in time. In the polygraph examination, a guilty examinee's concern over an intense relevant question may result in a full or partial dampening of responses to other questions. The anti-climax dampening concept remains a proposed explanation for an often-observed phenomenon in which examinees sometimes react only to a single relevant question when they are actually being deceptive to two or more in the same test. The concept is a description, however, and not an explanation. See: Backster (1963a).

anti-countermeasures

Preventative measures used by PDD examiners to block or neutralize the countermeasure efforts of examinees. For example, if the aim were to be to preclude an ex-

aminee from pressing his toes against the floor during testing, an anti-countermeasure might include elevating the examinee's feet from the floor so that this strategy cannot be acted upon. Lynn Marcy is credited with making the distinction between anti-countermeasures (proactive) and the counter-countermeasures (reactive).

aorta

Main systemic artery from the heart. The aorta receives blood from the left ventricle through the aortic valve, normally tricuspid and having three leaflets. The upward extending portion is considered the ascending aorta, followed by a downward bend, the arch of the aorta. The portion passing through the chest is the thoracic aorta, from where the blood flows to all parts of the body.

apnea

Temporary cessation of breathing. Apnea is considered the ultimate manifestation of respiratory suppression or slowing. When they are specifically associated with certain questions during a polygraph examination, they are considered significant physiological reactions and strongly diagnostic of deception. True involuntary apneas almost always take place near the bottom of the exhalation cycle.

a posteriori

(L: from what comes later). That which is done after the experiment. This expression is commonly seen in research. An example of a typical a posteriori decision is post hoc statistical analyses of data that had not been anticipated by the experimenters. Opposed to *a priori*.

a priori

(L: from what precedes). Refers to that which is done before the conduct of an experiment. An example is the number and type of subjects to be recruited for the study, or the alpha level for a PDD test result to be considered significant. Opposed to *a posteriori*.

Army Modified General Question Test (Army MGQT)

Test format patterned after the Reid test and developed by the U.S. military. Unlike the Zone formats, it has more relevant questions than comparison questions and does not include symptomatic questions, though some versions employ a sacrifice relevant question. The use of the Army MGQT has declined since research has shown poor validity. See: Blackwell (1998); Krapohl & Norris (2000); Podlesny & Truslow (1993).

arousal

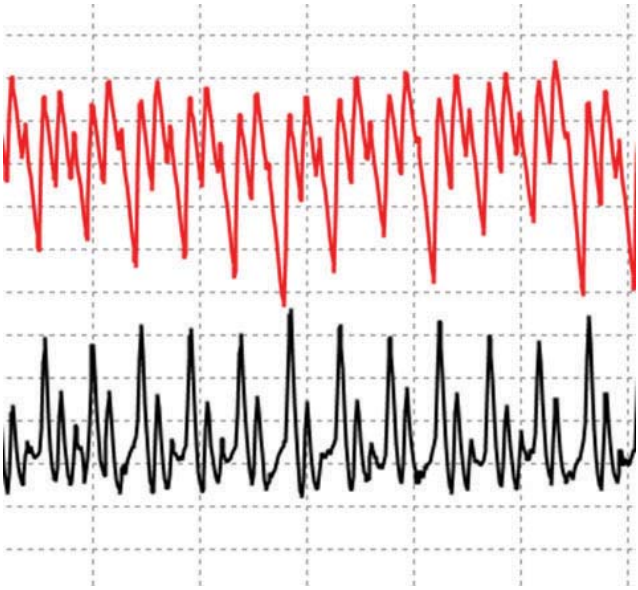
A state of excitement. Lacey proposed that three types of arousal exist 1) behavioral, 2) autonomic, and 3) cortical. Behavioral arousal can be observed in a person's outward responses, autonomic arousal can be measured by psychophysiological changes in the peripheral nervous system, and cortical arousal can be measured as EEG desynchonization and fast waves. See: Lacey (1967).

arousal theory

One of several theories that attempt to explain PDD. It holds that stimuli have different intrinsic cognitive and/or emotional arousal potential for each subject, and discrimination between guilty and innocent subjects is achieved by assessing which type of stimuli has drawn the most responsivity which are mediated via behavioral conditioning.

arrhythmia

Any variation of the heart's normal rhythm is considered an arrhythmia. An example of a regular variation, associated with respiratory activity, is sinus arrhythmia. Examples of irregular variations include premature contractions (PVCs), heart block, flutter, fibrillation and other ectopic beats. Rapid arrhythmias are termed tachycardias while slow arrhythmias are termed bradycardias. The image below shows the effect of PVCs on the cardiograph (top) and photoplethysmograph (bottom) tracings.



Arther technique

A probable-lie comparison question technique developed by Richard O. Arther (d. 2007) which he taught at his training school in New York City. It was built upon the methods of the Reid school, of which he was a student. The Arther technique relies heavily on behavioral indicators to assess deception. His question series is unique in that it includes a known truth pseudo-relevant question. Arther taught thousands of students in the U.S. and abroad and focused on the law enforcement sector.

attention

The focusing or concentration of mental activity. Attention is central to the theory of *salience*, currently the most parsimonious explanation for the differential arousal patterns observed with the Comparison Question Technique.

autogenic training

Instruction in one form of self-hypnosis. Subjects can be taught to induce a state of profound relaxation through a series of simple exercises. Because autogenic train-

ing can help individuals modify physiological arousal, it is considered by some as a potential countermeasure against PDD. There is little data to support or refute this argument. Because autogenic training focuses on self-regulation of tonic levels of physiological activity, and conventional polygraphy relies on phasic response patterns, its usefulness in defeating modern PDD techniques is not expected to be high.

automatic mode

Depending on the polygraph manufacturer, this mode may also be labeled as Auto, Auto-Center or Auto EDA. It is a setting for the electrodermal activity channel, which uses a combination of filtering that may include; a low-pass filter, a high-pass filter and/or a smoothing filter. It is intended to keep the electrodermal tracing near the center of the display by filtering out low frequency changes that are typically a consequence of shifts in tonic skin conductivity. All modern polygraphs have this feature. While the self-centering action of the automatic mode is attractive to many PDD examiners for practical reasons, it has been criticized for altering data in ways that affect data analysis. Most modern instrument manufactures include both a manual and automatic mode.

autonomic nervous system (ANS)

In vertebrates, the system of nerves that regulates all innervated tissues and organs except striated muscle fibers. The ANS is divided into the sympathetic and parasympathetic portions. The ANS performs the vegetative functions and regulates arousal levels. All conventional PDD methodologies monitor ANS activity. See: *sympathetic* and *parasympathetic nervous systems*.

AVATAR

A platform of multiple sensors designed to detect deception at border crossing and airports. AVATAR stands for Automated Virtual Agent for Truth Assessment in Real-time. Field testing has suggested it performs at levels higher than chance. See: Elkins, Golob, Nunamaker, Burgoon & Derrick (2014).

Axciton

An American manufactured computer polygraph, developed and marketed by Bruce White of Houston, Texas.

axon

The long central process of a neuron. A single axon extends from each cell body of the neuron to the synapse or end organ and is responsible for the transmission of the nerve impulse. In humans and other vertebrates, most peripheral axons are sheathed in a fatty layer called myelin, which acts to insulate the axon from the surrounding tissue. There are regular breaks in the myelin sheathing, called the nodes of Ranvier, that allow the electrical impulses to jump from node to node (saltatory transmission) rather than transit in the axon via the slower chemical depolarization process.

Backster, Cleve

Originator of the Trizone Comparison Test, more often referred to as the Zone Comparison Technique. Backster (d. 2013) also introduced to the polygraph profession the concepts of "psychological set," zones, spots, superdampening, anticlimax dampening, symptomatic (outside issue) questions, exclusionary comparison questions, and 7-position scoring for use in chart analysis. Backster owned a private training facility in San Diego, California, and provided training for thousands of examiners since the late 1940s. He began the CIA polygraph program in 1949.

baseline arousal

Term used in PDD to characterize a marked upward shift in the entire breathing tracing. Baseline arousals do not always occur during deception; however, when they are observed they are reliable indicators of stress. Some baseline arousals are relatively short-lived, lasting only a few breathing cycles, while others may continue much longer.

base rate

Incidence of something in a population, often expressed as a proportion or percentage. Base rates can affect the confidence in a decision. When base rates are relatively

high, detection is much easier than in low base rate conditions. As an example, in medicine there is a much lower false positive rate with a diagnostic technique when the base rate of incidence is 50% than 0.1%. Similarly, in PDD it is much easier to find the one guilty individual in a tested population of two (50% base rate) than the 1 guilty person among 1,000 suspects (0.1% base rate). Statements of PDD validity are incomplete unless they also identify the characteristics of the tested population. The base rate problem is not unique to PDD but is also found in all other diagnostic tests. See: Gastwirth (1987); Kircher & Raskin (1987); Murphy (1987).

behavioral analysis

Method for developing extra-polygraphic information that may be useful in the diagnosis of truth or deception. The behaviors of interest may be naturally occurring within the context of the polygraph examination or are the result of questions posed by polygraph examiners during the interview phase of the session. The inclusion of behavioral analysis in the polygraph decision process is controversial.

behavior countermeasures

A class of countermeasures by which an examinee attempts to sway the examiner or influence the conduct of the session. The intent is to influence the decision maker or restrict the ability of the decision maker to conduct a valid examination. By definition, behavioral countermeasures have no influence on the physiologic tracings. The effect is sociopsychological in nature (interpersonal dynamics) rather than psychophysiological. See: Krapohl (1996).

Berkeley psychograph (or Lee Polygraph)

Two-channel polygraph with event marker assembled by C.D. Lee of Berkeley and used in criminal testing. It included a stimulation marker, pneumograph and cardiograph, and recorded these channels simultaneously on moving graph paper. It was designed to be as portable as a suitcase. Lee sold his Berkeley psychographs from the 1930s into the 1950s. They were delivered complete with pens, sensors, paper, and instructions.

Benussi, Vittorio

One of the first researchers to examine breathing tracings for detecting deception. He proposed that a ratio created by the time need to inhale divided by the time to exhale produced a ratio that changed during deception. Though Italian, Benussi did most of his work in Austria at the University of Graz. Benussi's approach was very different from what is sometimes taught in polygraph schools, and subsequent researchers did not find the same degree of accuracy that Benussi reported. See: Benussi (1914); Landis & Wiley (1926).

beta blocker

Adrenergic blocking agent affecting responsivity of the cardiovascular system and used to treat specific cardiovascular conditions such as high blood pressure and arrhythmias. Because they appear to dampen cardiovascular phasic responsiveness, beta blockers are of concern to PDD examiners because of their potential as a pharmacological countermeasure. Testing of examinees who take beta blockers is routine practice, as some cardiovascular responsiveness usually persists even with the medication.

bias

In research it is a source of systematic error that can influence the outcome of the experiment. Bias can be introduced into research by factors such as, among others, nonrandom sampling, faulty subject instructions, or expectations of the researcher or the participants. In a PDD study looking at the validity of blind scoring, for example, a researcher using only cases which were verified by the original examiner are likely biasing the study, since cases that the original examiner made the wrong diagnosis could be systematically excluded from the research sample. Researchers attempt to control bias through experimental design.

biphasic response

Physiological reaction that has two phasic responses in opposite directions. Biphasic responses of a diagnostic nature in PDD are found in the skin potential and heart rate recordings.

biofeedback

Use of a device to measure and convey physiological information back to a subject. It has been proposed as a potential countermeasure approach. Biofeedback is not a countermeasure in itself, but rather a means of teaching a subject to influence autonomic responsivity. Research indicates that biofeedback is better suited for self-regulation of tonic activity than phasic activity. As a result, it may be useful to dampen or increase responsiveness in general during a test, but less so within a test to a given question. It has been suggested that this has implications for test formats such as Relevant/Irrelevant and Peak of Tension, but probably not for tests using comparison questions such as the Reid and Zone formats. Biofeedback can also be used to enhance responsiveness in subjects during testing. It has been hypothesized that the immediate biofeedback serves to elicit greater responding to questions when deception is practiced by the examinee. There is some empirical evidence of this effect, but it has not been unequivocally established.

bizone

Incorrect term applied to a Zone Comparison Test containing two relevant questions. See: *zone*.

black zone

In the Backster framework, it is a 20- to 35-second block of polygraph chart time initiated by a symptomatic question having a unique psychological focusing appeal to the examinee who is fearful that the examiner may ask an unreviewed question dealing with an outside issue. Because subsequent research has not been supportive of the symptomatic question, the value of the black zone has been called into question. See: Backster (2001); Krapohl & Ryan (2001).

blind chart analysis

Evaluation of PDD recordings without the benefit of extra-polygraphic information, such as subject behavior, case facts, pretest admissions, base rates of deception, etc. Studies employ various degrees of "blindness." It is a popular research approach to gauge interrater reliability. Assessments of the accuracy of PDD test evaluation techniques also use blind chart analysis.

blind stimulation test

Stimulation test in which the examiner does not know the critical item at the beginning of the test. See: *stimulation test*.

blocking

Pattern sometimes seen in the pneumograph tracing in which the examinee discontinues breathing at or near the inspiratory peak. Blocking can be differentiated from a typical apnea in that the latter most often occurs near the end of the expiratory segment of the breathing cycle. Blocking is many times a deliberate attempt on the part of the examinee to influence the physiological activity recorded by the polygraph.

blood pressure

The force blood exerts against the walls of the blood vessels, usually measured in millimeters of mercury, is called blood pressure. PDD examiners evaluate only relative blood volume changes, as current polygraphs are not capable of providing absolute blood pressure measurements. See: *systolic blood pressure*, *diastolic blood pressure*, *mean blood pressure*, and *pulse pressure*.

blood volume (BV)

Quantity of blood in an organ or limb, usually recorded as relative increases and decreases in the circumference of the affected area or size of blood vessels. Localized changes in blood volume are mediated by chemical and neural mechanisms, such as the shunting of blood to the major muscle groups during sympathetic nervous system activations.

bogus pipeline (BPL)

Sociopsychological effect whereby a subject will make more candid and sometimes more incriminating revelations about himself when he believes a device attached to him will reveal his true knowledge or attitudes. The BPL was first reported by Jones and Sigall, who convinced subjects that the electromyograph used in their study could measure internal feelings and found that their subjects were more willing

to disclose socially-undesirable attitudes. Some critics of polygraphy contend that PDD is merely an elaborate BPL that has only the power to elicit confessions but not assess truthfulness or deception. See: Jones & Sigall (1971).

bootstrapping

A statistical technique. Bootstrapping involves pooling the data from two samples and drawing samples repeatedly from the pool, with replacement, to create a single distribution. The number of samplings taken to create the distribution is typically in the thousands. Then the two original samples are compared using this grand distribution as an estimate of the true population to determine whether they are significantly different from one another. Bootstrapping has been applied both to PDD and brain wave approaches. See: Farwell & Donchin (1988); Honts & Devitt (1992); MacLaren & Taukulis (2000).

brachial artery

Major blood vessel located in upper arm. Occlusion blood pressure sensors are frequently placed there, and it is the preferred placement site for the blood pressure cuff in PDD.

bradycardia

Heart rate of under 60 beats per minute. Brachycardia is common among athletes and those with hypothyroidism. Slow heart rate can also indicate the influence of medications.

bradypnea

Very slow and abnormal breathing, longer cycle time. The term does not distinguish between autonomic and deliberate breathing slowing.

brain stem

Includes the adult brain structures, i.e., midbrain, pons and medulla (mesencephalon) region structures including the thalamus, third ventricle and hypothalamus.

These structures are essential for the automatic control of respiration and cardiovascular systems.

breakdown (or breakout) test

PDD test in which a single issue is addressed and is always given after a multiple-issue test has indicated that the examinee has consistently responded to that issue. It is generally conducted in one of the validated test formats, such as Zone Comparison Tests or the Modified General Question Test. Question coverage can be single- or multi-faceted. The rationale for this two-stage approach to PDD testing is that, while multiple-issue screening examinations are very useful in identifying which among several issues the examinee is concerned with, they lack the power of these single-issue formats in making correct determinations of deception or truthfulness. This approach is used in many polygraph screening programs to maximize both utility and accuracy of PDD in preemployment screening and other applications.

breathing

One of the standard physiological signals in PDD testing. Respiratory data are generally obtained via a pneumograph transducer placed around the thorax and abdomen of the test subject. PDD examiners historically evaluated breathing movement data through a subjective approach that relied on the presence or absence of various signature patterns indicative of deception. Since breathing is more readily controlled than other activity recorded with the polygraph, it is one of the first areas examiners look for indications of countermeasures. Such indications are paced breathing, holding one's breath, very slow breathing, irregularly shaped waveforms, hyperventilation, and tactical use of deep breaths. In physiology, *respiration* refers to the movement of gases across membranes in the lungs, while *ventilation* is the term used for the expansion and compression of the chest during breathing. See: Handler, Reicherter, Nelson & Fausett (2009).

Brilograf

Device for measuring changes in skin resistance. Built in the 1940s by Jacques Bril, a criminologist, Brilograf was based on similar work he had done with Rev. Walter Summers on the "Pathometer." Not generally used and is only of historical note.

British One-issue Screening Test (BOST)

A variation of the screening version of the Air Force Modified General Question Test (AFMGQT). It was designed to fill a requirement for a screening method that allowed testing of only one issue. The two differences between the standard screening AFMGQT and the BOST is that in the latter the two relevant questions cover identical behaviors and time periods, and that the decision rules include the grand total score of both questions. See: Krapohl, Grubin, Benson & Morris (2020).

Calibration Verification of Sensitivity Test (CVOS)

A testing procedure conducted as the first chart, which is designed to assess an examinee's capability to process information, detect psychological or chemical countermeasures, permit adjustment of gain settings to match the response capability of the examinee, determine whether sufficient professional rapport has been established with the examinee, and reduce excessive anxiety.

card test

One of several types of stimulation tests used in conjunction with the standard PDD examination. In the traditional card test the examinee is invited to select a card from a deck of cards and then is tested on which number, letter, color, or character is on the card. While widely practiced in the early years of the polygraph profession, it has been replaced by other methods. See: *stimulation test*.

cardioactivity monitor (CAM)

One of several cardiovascular sensors used in PDD. The CAM sensor is placed on the end of the finger or thumb, and it detects changes in distal blood volume via small strain gauge sensors attached to a metal diaphragm. CAMs require electronically enhanced cardiograph components. While some consider the CAM useful, it is employed less often than the traditional blood pressure cuff.

cardiograph

General term for any recording of heart activity. In PDD the use of a blood pressure cuff to monitor relative arterial blood pressure changes and pulse wave is more

precisely described as *sphygmography* (recording of the arterial pulse) or *occlusion plethysmography* (partial blockage of circulation to measure volume changes in a body part). While cardiograph is not incorrect in this context, it lacks precision in denoting the actual phenomenon being recorded in PDD. The term *cardiograph* in the psychophysiological and medical literature most often refers to the electrocardiograph.

cardio-pneumo-psychograph

A two-channel polygraph developed by John Larson in the 1920s and used in criminal cases to uncover deception. See: Larson (1923).

cardiosphygmograph

Alternate term for the pulse wave and relative blood pressure tracing used in PDD. While the term *cardiosphygmograph* was common parlance in the 1930s through 1950s, it is used less frequently today even though it is more precise than the current expression *cardiograph* or its abbreviated form, *cardio*.

cardiotachometer

Instrument that measures heart rate. Since heart rate can only be accurately measured over several seconds, real-time displays usually reflect the inter-beat interval that has been converted into the reciprocal to give the cardiac rate.

catacrotic limb

Descending portion of an arterial pulse wave.

category bar

One method of restricting the coverage of the comparison question so that it will not overlap the relevant question. For example, if a relevant question concerned whether the examinee had stolen anything from an employer, a comparison question that excluded the relevant question by covering another category might involve whether the examinee had ever been dishonest with an authority figure. There

is a school of thought that examinees may confuse the relevant questions with the comparison questions unless these two types of questions are designed to avoid any degree of overlap. Research has not supported this hypothesis. See: Amsel (1999); Podlesny & Raskin (1978); Horvath (1988); Horvath & Palmatier (2008). Also see: *exclusive (exclusionary) comparison question*.

central nervous system (CNS)

That portion of the nervous system consisting of the brain and spinal cord. CNS activity, although closely integrated with autonomic nervous system (ANS) activity, is not separately considered in traditional PDD approaches. It has been used with event-related potentials (ERPs) in Concealed Information Tests.

chart

Graphical record of phenomena. In PDD it refers to the polygram on which is recorded the physiological activity during testing. The term *chart* is sometimes used interchangeably with *test*.

chart identification

Information annotated on a PDD chart by the examiner to record identifying data such as date, time, test number, examiner, case number, signatures, fingerprints, or other details required by the polygraph program. Not to be confused with *chart markings*.

chart markings

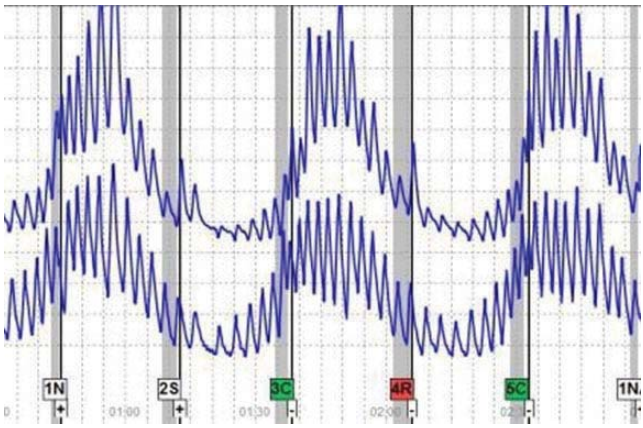
Annotation of the physiologic tracings to denote stimulus (question) onset and offset, examinee's answer, question number, question label, artifacts, and other details important to the interpretation of the physiological data.

chemical countermeasures

See: *pharmacological countermeasures*.

Cheyne-Stokes respiration

Periods of cyclical variation in the amplitude of breathing cycles sometimes interspersed with periods of apnea. This pattern of breathing is usually associated with brain damage, congestive heart failure, kidney disease or drug abuse. See image below as an example.



chi-square test ($\chi 2$)

A nonparametric inferential statistical test based on the chi-square distribution. The chi-square test is frequently applied to determining the randomness of deviations between observed and expected values. Generally, the test is used to evaluate hypotheses dealing with the relationship between two categorical variables and "goodness of fit tests." The chi-square test lacks the sensitivity of other available methods and is used primarily when the data can only be tabular in form. It is often reported in PDD literature, principally when comparing groups of test outcomes.

cholinergic

Those neurons that release the neurotransmitter acetylcholine.

classical conditioning

Characterized by the establishing of a response to a stimulus that does not normally evoke the response. The Russian physiologist Ivan Pavlov reported producing a con-

ditioned reflex in dogs during the last part of the 19th century. He used the sight of food (unconditioned stimulus) to induce salivation in the dog (unconditioned response) and fostered a mental connection between the food and the sound of the bell, and the bell's ring became the conditioned stimulus. It is theoretically possible to classically condition physiological responses to occur uniquely when a subject is deceptive, and this method is one of the promising areas of future research in lie detection. See: Petty & Cacioppo (1981).

clearing chart

Usually, a Relevant/Irrelevant screening test used after a breakdown test and includes the remaining relevant test questions that were not covered in the breakdown test. In the field it normally involves one chart.

clinical approach

Assessment technique used in PDD that includes the use of extra-polygraphic information to arrive at a conclusion of truthfulness or deception. Also called *global analysis*.

closed-eyes technique

As the name indicates, it is the PDD examination in which the examinee is instructed to keep his eyes closed during testing. This method is used by a minority of PDD examiners, and questions about the effects of open or closed eyes have not been thoroughly investigated.

community safety examinations

A broad category of examinations that serve to detect and deter illegal behaviors that jeopardize the safety of communities. Types of community safety examinations include Post-Conviction Sex Offender Testing (PCSOT), Intoxicated Drivers on Probation (IDOP), and Domestic Violence Offender Testing (DVOT).

comparison question

Type of question used to elicit responses that are compared with the responses to relevant questions. There are two main types: directed lie (DLC) and probable lie

(PLC). Subtypes for the DLC are the trivial and the personal. For the PLC they are the exclusive (exclusionary), and non-exclusive (inclusive). Historically called the *control question*, *comparative response question*, and *emotional standard*. See: Waller (2001).

Comparison Question Technique (CQT)

An umbrella term for standard testing formats that use probable-lie or directed-lie comparison questions. Included are the Reid, the MGQT, the Zone Comparison, the Positive Control, the Utah, the Arthur, the Quadri-Track, and the Test for Espionage and Sabotage. None of the following are considered CQTs: Relevant/Irrelevant, Peak of Tension, and Concealed Information Tests.

comparative response question

Name given by John Reid in 1947 for what would later be called the *control question*, and ultimately *comparison question*. See: *comparison question*.

Computer Assisted Polygraph System CAPS

System developed by David Raskin and John Kircher of the University of Utah that permitted modified field analog polygraphs to interface with a computer. Signals were extracted from the pen drive motors and routed to an analog-to-digital converter, where they were digitized, stored, edited, and analyzed. Discriminant analysis was used to weigh and combine measurements, and the software produced a statement of the probability of deception. CAPS, which stood for Computer Assisted Polygraph System, was later replaced by CPS, Computerized Polygraph System, which used a computer without the analog polygraph.

Computer Voice Stress Analyzer (CVSA)

National Institute for Truth Verification produces the CVSA, first introduced in 1988. The company advertises that this device was developed from the Psychological Stress Evaluator (PSE) and is widely distributed amongst law enforcement agencies. Examiner certification is required. The CVSA testing format is dissimilar to PDD formats. Like other voice-based deception detection systems, published scientific research has failed to find any accuracy with the CVSA. See: *Psychological Stress Evaluator (PSE)* and *voice stress analysis.*

Concealed Information Test (CIT)

Otherwise known as the Guilty Knowledge Test. The CIT is a series of tests, perhaps as many as 10 or more, in which there is only one critical item in each series. The tests are constructed so that the order of the item presentations is random except the first item, which is not a critical item and is used as a buffer. The theoretical operating mechanism of the CIT is there is greater signal value in the critical item for guilty examinees than in the irrelevant items. The CIT is believed to rely on cognitive processes and is therefore not subject to false positives from nervous examinees. CIT tests could be used in a small proportion of all criminal cases where sufficient details were available to construct it, however in most crimes such details are lacking or would be already known to innocent persons via the media or investigating officers. Despite assertions of theoretical superiority of the CIT over the CQT, the CIT has practical limitations that have hindered its broad acceptance among field practitioners. Moreover, the preponderance of independent research suggests that false negatives may be a problem with the CIT. See: Lykken (1959); MacLaren (2001); Podlesny (1993).

conditional probabilities

A statistical concept in which the likelihood of an event is predicated on a set of conditions. Conditional probabilities are expressed as p(A·B), which may be read as: what is the probability that event A will occur given event B has occurred? More specifically, a false negative polygraph result can be represented as p (no evidence of DI responses ½ the person is lying). Conditional probabilities are important when characterizing the accuracy of PDD. The following illustration is one offered by critics of the use of PDD in screening. Suppose that PDD is 90% accurate in detecting both deception and truthfulness. Also, assume that it is used to test 1,000 government employees, only one of whom is involved in the activity of interest, say, treason. There is a 90% chance that the one guilty person will be caught. Of the 999 innocent employees, 899 (90%) will pass the examination, and the remaining 100 will be false positives. The ratio of true positives (1 guilty) versus false positives (100 innocent) is a low payoff if the consequences are employment termination or criminal prosecution. Not used in this example is the influence of repeated testing and other methods that can reduce false positives, but it is clear from this example that PDD validity estimates are not well represented by a single percentage. See: *base rates*.

conditioned response theory

One of several theories that attempt to explain the underlying mechanisms of PDD. Conditioned response theory holds that physiologic responding is the consequence of an emotional response triggered by the conditioned stimulus. When a given stimulus is associated with strong emotions, larger responses are expected. There is some support for this theory in that physiologic responding has been established to be positively correlated with the personal significance of the test question. It does not explain why PDD continues to work in non-threatening and low motivation conditions, however. The conditioned response theory is not the prevailing explanation for PDD.

conductance

Capacity of a material to permit the flow of electricity. Skin conductance is a common measure used in PDD. A related measure, resistance, is the reciprocal of conductance.

confabulation

The reporting of information from imaginary experiences to fill in gaps of memory without any overt intention to deceive, though the information is most likely false. Confabulation can be a symptom of some organic brain disorders, though developmental factors explain other cases. The effect on deception tests has not been investigated.

confession criterion

A potential confound in field research on polygraphy. If cases are selected for research that use confession as a form of confirmation, then the study sample may be biased for the following reason. Standard practice in polygraphy is to only interrogate after a deceptive outcome on the examination. Therefore, confessions will only be obtained from examinees who failed the examination, but not from those who managed to defeat the examination. The sample will then represent those cases in which the examinee was caught by the original examiner, rather than all cases in which the examinee was deceptive. It has been asserted that the use of the confession-verified cases in blind scoring studies to assess polygraph validity may overes-

timate the accuracy of the polygraph, because they may have charts in which deception is the easiest to interpret. Most field studies that have examined this source of research error have not a meaningful effect, though the issue is still hotly debated. See: Horvath (1977); Honts (1996); Iacono (1991); Krapohl, Shull & Ryan (2002); Patrick & Iacono (1991); Raskin, Kircher, Honts & Horowitz (1988).

confirmatory testing

PDD examination used to verify the statements of witnesses, victims and confidential reporting sources.

conflict theory

One of several theories that attempt to explain the underlying mechanisms of PDD. According to conflict theory, the simultaneous activation of two conflicting tendencies, such as the motivations to lie and tell the truth, results in physiologic arousal. The greater the conflict, the larger will be the response. This explanation arises from the work of Luria in the 1920s and 1930s. The conflict theory predicts that psychopaths, by virtue of a defective conscience, do not produce arousal responses as large as non-psychopaths, and this effect has been demonstrated in laboratory studies for psychopaths as a group. However, it does not explain well why phasic responses occur even when an examinee is not required to answer the question, or even when the examinee answers truthfully. The conflict theory is rarely cited as the principal explanation for PDD. See: Gardner (1937).

conspecnificance

Mnemonic device used in the instruction of PDD. It stands for consistency, specificity, and significance, three characteristics of a physiologic response indicative of deception. In order for response patterns to support a PDD outcome of deception, they must appear regularly to the same questions, manifest themselves uniquely to those questions, and be of a magnitude to be distinguishable from baseline variability. See: Weir (1976).

constant current method

Measurement of skin resistance where the current applied to the skin is held constant.

constant voltage method

Measurement of skin conductance where the voltage applied to the skin is held constant.

containment approach

Criminal justice system, treatment team, and polygraph examiner working together in a team concept sharing information equally with the other members of the team. As an offspring some containment teams now include one or more of the following: law enforcement, child protective services, rape crisis centers, prosecuting attorneys, judges, and in some cases school counselors, victim advocates, and medical staff. See: Cooley-Towel, Pasini-Hill & Patrick (2000); English, Pullen & Jones (1996); Heil, Ahlmeyer, McCullar & McKee (2000).

control group

The group in research that differs from the experimental group only in that the latter receives the positive manipulation pertaining to the independent variable. A control group is necessary to infer that the changes observed in the experimental group are the result of the independent variable. For example, if a researcher wished to know the effects of the drug diazapam (independent variable) on electrodermal responses (dependent variable), the group that did not receive the medication would be called the control group and the medicated group would be the experimental group.

control question

Superseded term, now call the *comparison question*. Class of questions used in deception examinations that serves to elicit larger physiologic responses from innocent examinees when compared to the relevant questions. There are several types, such as the exclusionary, non-exclusionary, probable-lie, directed-lie, the positive, and minor variations. The term "control" in PDD traces its roots to the 1930s and to what are now called stimulation tests. These tests were used as "controls" for the production of deception response patterns that would later be compared with responses to relevant questions in the Relevant/Irrelevant technique. In 1947 John Reid published a paper in which he referred to two types of questions as controls—

one he called a "guilt complex" and the other a "comparative response" question, the latter being a probable-lie question. The "comparative response" question was called a "control question" in a paper published by Fred Inbau in 1948, and the name became the standard terminology in PDD for nearly 50 years. This was not the first use of this class of question, however. Walter Summers used similar questions with his Pathometer technique which he labeled *emotional standards* as early as 1939, and they were used by New York State Troopers from 1939 until at least 1952. Elizabeth Marston, widow of William Marston, and Olive Richard, Marston's former secretary, reported that they had participated in deception examinations with Marston some years before in which "hot" questions were used for comparison. A typical hot question would be, "Did you ever think of stealing money from that safe?" Elizabeth stated during an interview that they did not believe it wise to publish these types of questions, and consequently they have not been generally credited with this contribution to the science. Beginning in the 1970s, critics of PDD noted that the word "control" as used in PDD tests did not meet the criteria of the term as used in science. The term has since been replaced by *comparison question* in publications of the American Polygraph Association, American Society for Testing and Materials, federal polygraph programs, and scientific papers. See: Waller, 2001.

comparison/control question validation test

Test procedure in which probable-lie comparison questions are tested against relevant questions from a contrived crime to theoretically verify that the subject will respond to the comparison questions. These questions are then carried into the actual testing. Proposed and taught by James Matte and used in his testing technique, though not a widespread practice nor are there any published data in support of the theory. See: Matte (1976).

control test

An alternate term for a known numbers test. See: *stimulation test*.

correlation

Measure of how one variable changes with another, for example, chart scoring ability and years of experience are positively correlated. Measures of correlation range from -1.00 (indicating a perfect negative correlation—as variable x increases,

variable *y* decreases) to +1.00 (indicating a perfect positive relationship—as variable *x* increases, variable *y* increases). A correlation equal to 0.00 means that two variables are not linearly related. One should not infer cause from correlation; two variables can be correlated without one causing the other. For example, in most cities the number of churches and the number of criminals are positively correlated, but one does not cause the other. Both are correlated to a third factor, population.

cortisol

A glucocorticoid or steroid hormone substance made from cholesterol found in the bloodstream which is produced by the adrenal cortex in response to stress. Cortisol replenishes energy stores depleted during an adrenaline rush by converting a variety of food sources into storage forms such as glycogen or fat.

counter-countermeasures

Methods used to detect and neutralize those efforts an examinee has engaged in while trying to defeat the PDD examination. For example, if a PDD examiner concluded from an examinee's behavior that the examinee had tried to dissociate during testing, he could insist that the examinee respond to the test questions with both a key word and the answer, thus ensuring attention to the content of each question. Lynn Marcy is credited with distinguishing counter-countermeasures (reactive) from anti-countermeasures (proactive).

Counterintelligence-Scope Polygraph (CSP)

PDD screening examination administered by the Federal Government on individuals with sensitive security clearances to detect and deter espionage, security breaches, sabotage, or other acts against the Government. Sometimes referred to as a *loyalty examination*.

countermeasures

Generally, methods used to mislead an observer. In polygraph research it has been labeled as actions taken by the examinee to influence the physiological responses to produce a truthful test outcome. There are several typologies for countermeasures, depending on the definition used. Under some circumstances polygraph

countermeasures have been found to be effective, such as when an examinee receives special training and feedback. Most spontaneous attempts are crude and ineffective. Various methods have been devised by PDD practitioners to deter and detect countermeasures. See: Honts (1987); Krapohl (1996).

CPS

Computer polygraph developed by Drs. David Raskin and John Kircher of the University of Utah. The CPS, which stands for Computer Polygraph System. Like its predecessor, the CAPS, the CPS has a discriminant analysis algorithm that weighs and combines physiological measures to calculate the probability of deception.

craniosacral division of autonomic nervous system

An anatomical division of the autonomic nervous system (ANS) that represents the sites for outflow from the parasympathetic division of the ANS, i.e., some of the cranial and sacral nerves carry parasympathetic nerves.

credibility assessment

An umbrella expression for the multiple-disciplinary field that relies on physiological and behavioral measures to test the agreement between an individual's memories and statements. Credibility assessment approaches have included reaction time tests, word association tests, polygraph, central nervous system measures, and behavioral analysis. See: Krapohl & Trimarco (2005).

critical item

In the Peak of Tension or Concealed Information Test, the critical item is the stimulus the guilty persons recognize from among the other items as being related to the event of interest. Sometimes called a "key".

current exclusive comparison question

An exclusionary probable-lie comparison question in which the scope includes the time period of the relevant issue, but is excluded from the relevant issue by category, place, or some other delimiter. See: Matte (1996).

Daubert v Merrell Dow Pharmaceuticals, Inc.

Although not a PDD case, the Daubert case set aside the Frye Rule's "general acceptability" provisions in favor of the Federal Rules of Evidence. The case paved the way for the admissibility of PDD evidence in most jurisdictions. The *Daubert* standard is a rule of evidence regarding the admissibility of expert witness testimony. Essentially it states that the judge is gatekeeper and determines what gets into evidence. The judge determines if it is relevant to this case and reliable. The judge also decides whether the evidence is based on scientific knowledge or methodology: falsifiable, refutable, and testable; subjected to peer review and publication; known or potential error rate; existence and maintenance of standards and controls concerning its operation, and; degree to which the theory and technique is generally accepted by a relevant scientific community. See: Daubert v Merrell Dow Pharmaceuticals, Inc. (1993).

deception

The act of deliberately providing or omitting information with the intention of misleading. The most critical element of the definition is the intention of the information provider. With no intent, deception does not take place regardless of the accuracy of the information being conveyed. This is an important concept to consider with regard to PDD. Inconsistencies between ground truth and examinee beliefs may erroneously appear to be mistakes of the PDD technique.

deception exemplar

Physiological response pattern which examinees expect to be used as a sample, or exemplar, of that which occurs when they are deceptive, and will be used for comparison against their responses to relevant questions. See: Matte (2000).

Deception Indicated (DI)

Along with *NDI* (*No Deception Indicated*) and *Inconclusive*, a conventional term for a polygraph outcome. A decision of DI in PDD means that (1) the physiological data are stable and interpretable, and (2) the evaluation criteria used by the examiner led him to conclude that the examinee is not wholly truthful to the relevant issue under investigation. The DI and NDI decision options are used primarily in

single-issue testing, and they correspond with SR (*Significant Response*) or *SPR* (*Significant Physiological Responses*) and NSR (*No Significant Response*) or *NSPR* (*No Significant Physiological Responses*) in mixed-issue, or screening, examinations.

deception test

These methods ask directly about the matter to be assessed, are capable of addressing multiple behavioral issues of concern and may or may not depend on the existence of a known incident or known allegation. There are two broad categories of deception tests, the historically older Relevant-Irrelevant and the Comparison Question Tests (CQT). Term is used in contrast to *recognition test*.

decision rule

Generically, decision rules determine when data meet the criteria for inclusion in a particular category. Decision rules are the final steps in polygraph numerical scoring, producing categorical classifications. Optimal decision rules require the following: tracing feature selection; development of best scoring rules, consideration given for base rates; assessing and weighting collateral or countervailing information, and; performance of a cost and benefit analysis to determine the achievable level of accuracy and errors that meet the needs of the consumer. In polygraphy, feature selection and scoring rules have been thoroughly investigated. There are also decision rules in some polygraph analysis systems that include extra-polygraphic information as part of the decision process, though there is no validated method yet published. However, few published decision scoring procedures allow for consideration of the base rate issue. Also, few models publish a sufficient level of detail to allow a formal cost-benefit analysis to identify the appropriate cutting scores for a set of conditions. See: Swets, Dawes & Monahan (2000).

defensible dozen

An expression to connote the ensemble of tracing features used in chart interpretation that have replicated scientific evidence. There are four often-overlapping validated features for breathing (suppression, apnea, slowing, baseline rise), three for electrodermal (phasic response amplitude, duration, and complexity), three for cardiograph (baseline rise and duration, and pulse amplitude increase) and one for vasomotor (reduction in tracing width). The actual number of features can vary

depending on how the tracings are characterized. For example, respiratory apnea is a form of respiratory suppression, but in some chart interpretation regimens they are counted separately. Moreover, there are wide individual differences in that certain examinees may present idiosyncratic features that do not generalize to other examinees. Nevertheless, the "Defensible Dozen" is used as a convenient mnemonic device that focuses on those features that tend to be the most universal. See: Kircher, Kristjansson, Gardner & Webb (2005); Krapohl, Stern & Bronkema (2003).

degrees of freedom (df)

For any set of values, every value within a set can be freely selected except the last, which is determined. Or, in other words, when there is only one value remaining, the final selection is not free to vary. Technically, the concept of degrees of freedom refers to the number of independent observations minus the number of parameters being estimated. The degrees of freedom are essential in the calculation of the threshold or critical value of a test distribution.

delayed answer test (DAT)

Experimental methodology used to determine whether physiologic responding was elicited by the stimulus question or an untruthful answer. It was experimentally demonstrated that the physiological arousal was more closely tied to the stimulus presentation than the act of giving the deceptive answer. The DAT is not used in field PDD examinations. See: Dawson (1980).

dendrite

Process of a neuron specialized to function as a postsynaptic receptor region of the neuron.

Department of Defense Polygraph Institute (DoDPI)

See: National Center for Credibility Assessment.

dependent variable

Variable that changes as a result of the experimenter's manipulation of the independent variable. For example, electrodermal activity could act as a dependent variable to changes in stimulus intensity, an independent variable.

devil's finger

See: *finger of death*.

Diagnostic and Statistical Manual of Mental Disorders, 5th Edition

The official system for classification of psychiatric and psychological disorders prepared and published by the *American Psychiatric Association* in 2013.

diastole

Portion of the heartbeat cycle when the heart muscles have relaxed and the chambers fill with blood. The left ventricular diastole is represented in the PDD sphygmograph tracing as the descending limb of the pulse wave (catacrotic limb).

diastolic blood pressure

Lowest blood pressure value occurring during the relaxation phase of the cardiac cycle.

dichotomization theory

A hypothesis that holds there is a difference in habituation rates for relevant and comparison question responses. According to this theory, guilty subjects habituate more slowly to relevant questions, while innocent examinees continue to respond more strongly to the comparison questions over time. Dichotomization theory has not been generally accepted in PDD. See: Ben-Shakhar (1977).

dichotomous variables

Those for which there are only two mutually exclusive and exhaustive possibilities: yes or no, 0 or 1, heads or tails, etc.

dicrotic notch

A regular feature in diastolic limb of the pulse wave recorded on the sphygmograph of the polygraph. It occurs between the systole and subsequent diastole of the waveform, and its proximity to either of these two cardiac events is a function of the air pressure in the recording system. The greatest contributor to the dicrotic notch is the rebounding of the blood against the closed aortic semilunar valve after systole. It has not been found to be a reliable diagnostic feature in PDD. Also called *incisura*.

differential responsivity (reactivity)

Term frequently reported in PDD literature regarding the differences in responses to two types of questions. In Comparison Question Technique (CQT) formats, differential responsivity (differential reactivity) relates to the relative response magnitudes from relevant questions as compared to those from \comparison questions. Within normal limits, this differential responsivity (reactivity) persists even when overall responsivity is attenuated, or as it habituates. For this reason, CQT formats are unlikely to render false negative decisions that are attributable to countermeasures that attack general arousal, such as the use of drugs, relaxation, or dissociation. By contrast, the Peak of Tension and Concealed Information Tests rely on differential responsivity (reactivity) between critical and neutral items. Decisions in these concealed information tests are based, not on the type of question that induces the response, but rather the presence or absence of significant responses to the critical items only. Therefore, the type of differential responsivity used in decision making in PDD, along with vulnerability to certain types of countermeasures, will depend on the polygraph technique.

differential salience

Expression that characterizes the positive correlation between the degree of psychological significance and intensity of the physiological response. The concept of differential salience is based on the premise that responsivity can reveal underlying mental processes which can be exploited to detect deception or recognition under controlled and structured conditions. It does not restrict the operating mechanism to fear, but assumes a common pathway for the physiological expression of those cognitive and emotional processes that gave rise to the psychological salience. It is proposed as a substitute for the older "Psychological Set" hypothesis. See: Handler & Nelson (2007); Handler, Shaw & Gougler (2010); Senter, Weatherman, Krapohl & Horvath (2010).

directed-lie comparison (DLC) question

Type of question used to elicit a response that is compared with the response evoked by the relevant question. The DLC question is different from the probable-lie comparison (PLC) question in that the examinee is instructed by the examiner to answer the DLC question untruthfully, whereas the principle of the PLC requires the examiner to lead the examinee to be untruthful to that question without revealing the purpose. DLCs can be further delineated into the *trivial DLC* and the *personally significant DLC*, which, as their names indicate, depend on the content of the DLC. The true strengths of DLCs are that they can be standardized much easier than the PLCs, they are less intrusive, and their effectiveness is less subject to examiner skill. DLCs are being used in many quarters of the PDD profession. See: Horowitz, Kircher, Honts & Raskin (1997); Raskin & Honts (2002).

Directed Lie Screening Test (DLST)

A screening test for law enforcement based on the technique and procedures for the Test for Espionage and Sabotage (TES). The DLST uses a repeated series of two relevant and two directed-lie comparison questions, and the conventional 7-position scoring system. See: Blalock (2009); Handler, Nelson & Blalock (2008). Reed (1994); Research Staff (1995, 1998).

disclosure examination

See: *sexual history examination*.

discontinuous blood pressure method

Deception test procedure developed by William Marston before 1915. Marston's instrumentation was a standard sphygmomanometer that he used to take intermittent systolic blood pressure measurements during questioning on relevant and irrelevant topics. He plotted these measurements by hand, creating a curve that was interpreted for assessing deception. In 1923 Marston attempted to have the results of his deception test entered into evidence in a murder trial in Washington, DC. The Frye case, which was the first to consider deception tests, established the precedent for exclusion of "lie detector" results. The discontinuous blood pressure method did not enjoy widespread field acceptance, and there are no reports of its use after

the 1930s. In the 1920s William Marston included a cardio-pneumo polygraph to augment his discontinuous blood pressure method. In practice, Marston and his wife, Elizabeth, would either ask the examinations questions or take the blood pressure measurements, while Olive Richard, an assistant, operated the equipment. If a stenographer were present, there were four participants in the administration of the examination in addition to the examinee. While William Marston was usually the examiner, Elizabeth Marston and Olive Richard did conduct examinations on occasion without him, making them the first women in this field. Given the great methodological and instrumentation differences, Marston discontinuous blood pressure method is not truly in the lineage of modern polygraphy, though it is frequently included in history lessons at polygraph schools. See: Marston (1917; 1938).

discovery test

See: *disclosure test*.

discriminant analysis

Regression analysis with a categorical criterion—that is, attempting to predict group membership from one or more predictor variables. The CPS algorithm is based on discriminant analysis.

disguised comparison question

Comparison questions that are designed to be difficult to identify as such. Typically used in multiple- issue screening examinations. For example, the examinee might have the following disguised comparison question: Did you ever cheat in school? It is expected that nearly every examinee would have doubts about the integrity of his entire academic career, and also believe that truthfulness on the question is required to pass the polygraph examination. Sometimes call *hidden comparison question*.

dissociation

Psychologists use the term *dissociation* to denote largely unconscious processes by which normal relationships in thought, memory, attitudes, or other psychological activities do not adhere to their established relationships and become separate or

independent. It is also used in PDD to characterize the deliberate disengagement of attention by examinees from the testing situation. Such tactical redirection of attention is considered a mental countermeasure. Examinees who use this approach are hopeful that they may eliminate physiological responding by virtue of their mental distance from the test questions. Dissociation may be effective in test formats where examinees respond with the same answer to each question, such as with the Peak of Tension. In that format the examinee needs only listen for the point when the examiner stops speaking and give the rote answer. Dissociation is considered a more unlikely countermeasure for those formats that require both yes and no answers, and where the order of the questions is not predictable to the examinee, or where examinees are required to use key words from the test question in the answer. See: Elaad & Ben-Shakhar (1991); Kircher, Woltz, Bell & Bernhardt (2006).

domestic violence offender testing

A program intended to incorporate the polygraph in an attempt to verify compliance with the conditions of probation for convicted domestic violence offenders. As with post-conviction sex offender testing (PCSOT) and intoxicated drivers on probation (IDOP), it is designed to contribute to community safety by detecting and discouraging behaviors that pose a threat to the public by individuals with a demonstrated propensity to engage in certain criminal acts.

double verification test

Alternate term for *card test*. See: *stimulation test*.

dyspnea

Labored or difficult breathing, generally resulting from disease.

Easterbrook Hypothesis

The premise that attentional resources are more restricted as the level of arousal increases. See: Easterbrook (1959).

eccrine glands

One of two types of sweat glands, the eccrine glands influence electrodermal activity as measured in PDD. They are found throughout the skin surface of the body, but in highest concentration on the hands and feet. See: Handler et al. (2010)

efferent nerves

Neurons that carry nerve impulse from the central nervous system to the effector organ or muscles. Also called *motor nerves*.

Either-Or Rule

PDD scoring rule forwarded by Cleve Backster and used exclusively in the Backster Zone Comparison Technique. According to the rule, if a relevant question does not evoke a physiological reaction, it is scored against the adjacent comparison question with the larger reaction. If the relevant question does produce a significant reaction, it is compared to the comparison question with the smaller reaction. See: Matte (1996); Meiron, Krapohl & Ashkenazi (2008).

electrocardiogram (EKG or ECG)

Tracing of the electrical activity of the heart. This endosomatic waveform consists of the P, Q, R, S, T, and U waves. The search for diagnostic information in the ECG for PDD purposes has not been fruitful to date. There are preliminary data that suggest that the pre-ejection period (PEP), which is derived from the ECG and the impedance cardiograph (ICG), is a reliable gauge of sympathetic nervous system arousal. Inter-beat interval has also shown promise. See: Kircher, Packard, Bell & Bernhardt (2003).

electrodermal activity (EDA)

All exosomatic and endosomatic changes in the electrical properties of the skin. See: Handler et al. (2010).

electrodermal response (EDR)

Reaction of skin measured by changes in its electrical properties, including skin resistance (SR), skin conductance (SC), and skin potential (SP). See: Handler et al. (2010).

electroencephalogram (EEG)

Recording of the electrical activity of the brain generated by the firing of clusters of neurons. In recent years EEG methodology has been applied to deception and concealed information tests. See: *P300*.

electromyograph (EMG)

Tracing of the endosomatic electrical properties of the voluntary muscles. This activity is recorded through sensors placed on the skin near the muscles of interest. EMG could be used for the detection of physical countermeasures when the sites are correctly chosen by the examiner.

electrooculograph (EOG)

Recording of the electrical activity produced during eye movements. EOGs have had two principal uses in deception testing. One is as a deception indicator. Some research has shown lateral eye movements have diagnostic information useful in assessing whether a person harbors concealed information. The second application is with evoked cortical potentials, which also have been used in concealed information paradigms. Brain wave activity generates very small voltages, and eye movements generate electrical potentials that interfere with these signals. EOGs are often collected for subtraction from the brain wave signals

embarrassing personal question (EPQ)

A question, frequently with a sexual theme, sometimes used with the Keeler Relevant/Irrelevant test in the late 1940s and early 1950s. Leonarde Keeler experimented with the embarrassing personal question, hypothesizing that guilty subjects would not respond to it, remaining instead focused on the relevant questions, while the innocent examinees would produce significant responses in the opposite

pattern. The embarrassing personal question did not have widespread use and was not taught at Keeler's school after 1951.

emotional standard

A term coined by Rev. Walter Summers in his research into lie detection. The emotional standard was an emotion-provoking question to which the examinee answers truthfully, but one that the examinee would prefer to hide. It was included in a test series so the reaction evoked by it could be compared with the reaction elicited by relevant questions. Summers' test format included an established ordering of pairs of relevant and emotional standard questions, interspers2,5ed with irrelevant questions, as needed. It is the first report in the literature of this type of question, and it predates Reid's "comparative response question". See: Summers (1939).

empirical

An approach based entirely on observation rather than speculation. Much of PDD research is empirical in nature, though several theories exist.

Empirical Scoring System

The Empirical Scoring System (ESS) is an evidence-based numerical scoring model for manual test data analysis (TDA) of PDD test data from examinations conducted using comparison question test (CQT) formats. The ESS includes a description of the physiological data features that are correlated with truth and deception, mathematical transformation methods for assigning and aggregating numerical scores, decision rules for the classification of numerical scores as indicative of truthfulness or deception, and numerical cutscores that define the *a priori* thresholds of statistical significance. ESS cutscores are based on normative data that allow for calculation of the probability of an erroneous test result. Thus, the ESS allows for the selection of statistically optimal cutscores based on operational needs for the resolution and precision of the test result. See: Blalock, Cushman & Nelson (2009); Handler, Nelson & Blalock (2008); Nelson, Krapohl & Handler (2008).

Employee Polygraph Protection Act of 1988 (EPPA)

US legislation that restricts the use of "lie detector tests" by private employers except under specified conditions. Employers may not compel or request employees

or applicants to submit to such testing, nor may they use any results for adverse action. All levels of government are exempt from the provisions of EPPA. There are also exemptions for companies that provide security services and those involved in the manufacture and storage of controlled substances, who may use the polygraph for preemployment screening. Employers may request an employee to undergo PDD testing if it is part of an investigation of a loss to the employer, the employee had access to the property lost, there is a reasonable belief that the employee was involved in the loss, and the employee is given 48 hours notice prior to the examination that outlines the loss, investigation, and the reasons the employee is under suspicion. The employer is prohibited, however, from taking any action against the employee who refuses to cooperate with a PDD examination. Two of the major effects of EPPA have been a sharp decrease in the number of private examiners in the United States, and a move by the professional polygraph associations to upgrade standards of practice. Full text of the law can be found on the Department of Labor website: www.dol.gov.

endosomatic

Something produced from within the body itself. One type of electrodermal response, skin potential response, is produced by electrical activity generated by the dermis. Its measurement requires the placement of one electrode over an area well supplied with sweat glands (active site) and the other over an area devoid of them (reference site). The active site is negative in relation to the reference site by an amount that varies from a few to 50 to 60 mV. An alerting stimulus generally produces an increase in negative potential, followed by a positive wave, usually commensurate with the production of surface sweat, and sometimes a second negative wave. Similarly, EEG signals are generated by bioelectric processes in the brain, and EKG from the heart. For contrast, See: *exosomatic*.

epinephrine

A hormonal stimulator of the sympathetic nervous system. It acts to constrict peripheral blood flow, raise blood pressure, increase cardiac activity, promote metabolic activity through the release of glucose, and inhibit digestive processes. Epinephrine is considered a psychogenic hormone because it alters psychological processes when released in large quantities, such as under stress. It is produced in the adrenal medulla, located immediately above each kidney. Called *adrenaline* in British reports.

error-related negativity (ERN)

Brain wave time-locked to response selection that corresponds with incorrect choices. One of several electrocortical phenomena being investigated as a deception detection measure.

eupnea

Normal quiet breathing.

event marker

Annotations, markings, or abbreviations placed on the chart to alert a reviewer of a significant event. Examples include; start and stop of examination announcement, reading of question, examinee's answer, movements, talking, deep breathes, etc. Many event markers have generally accepted universal meanings.

event-related potentials (ERPs)

A change in electrical activity of the brain in response to a stimulus, recorded as changes in voltage at the scalp surface. Current signal processing approaches allow averaging of EEG activity, and ERPs are extracted by the averaging of brain waves over several repetitions of stimulus items. ERPs have been useful to scientists as markers for specific processes in the brain. There are several types of ERPs: the N100, N200, P300, and N400, to name a few. The "N" and "P" designators are conventions for the polarity of the signal, negative and positive. The number denotes the latency after stimulus presentation, measured in milliseconds. The P300 has been reported to be a dependable indicator of concealed information, though its application to deception detection is not established. ERPs are generated by the central nervous system, and their use in deception tests is attractive because they are expected to be resistant to countermeasures.

evidence-connecting question

Test question in which the examinee is asked about a particular piece of physical evidence that would incriminate the guilty person. It could be items left at the crime scene by the perpetrator, stolen property that could be discovered in his possession,

or even doubts about leaving incriminating fingerprints. For example, if a PDD examination was being administered to resolve a fraudulent use of a credit card, a test question could center on the signature on a receipt, the possibility of a photograph being taken at an ATM where the card was used, or possession of property wrongfully obtained by use of the card. The evidence-connecting question could be more salient to the examinee than the "did you do it" relevant question because the examinee knows it can lead to physical evidence that will implicate him.

evidentiary decision rules

Decision rules proposed by Krapohl (2005) that begin with asymmetric cutting scores for 7-position scoring: if the grand sum of scores is -6 or lower, the call is DI; if the grand sum of all scores is +4 or greater, the call is NDI. In those cases where the grand sums ranged from -5 to +3, the sub-totals (Spot Scores) are evaluated. For those cases, if a single relevant question has a sub-total of -3 or below, the decision is DI. All other cases are called Inconclusive. See: Krapohl (2005); Krapohl & Cushman (2006).

evidentiary examination

A polygraph examination in which the written and stated purpose agreed to by the parties involved is to provide a diagnostic opinion as evidence in a pending judicial proceeding.

evoked cortical potentials

Brain waves that are induced by stimuli controlled by the experimenter.

examination

The entirety of the PDD process, including pretest, test, and posttest elements, from onset to completion.

exclusive (exclusionary) comparison question

Probable-lie comparison questions that do not overlap the event covered by the relevant issue questions. There is a school of thought that examinees may confuse the

relevant questions with the comparison questions unless these two types of questions are designed to avoid any degree of overlap. This is accomplished by constructing comparison questions that are different from the relevant issue by time period, location, or type of activity. Although exclusive comparison questions have better face validity over non-exclusive comparison questions, research has supported the non-exclusionary version. See: Amsel (1999); Podlesny & Raskin (1978); Horvath (1988); Horvath & Palmatier (2008).

exculpatory examination

A PDD examination offered to an accused against whom other strong evidence exists. The exculpatory examination is often used in the military services when urinalysis has indicated a service member has used an illegal drug. The service member is not obligated to undergo the PDD examination with the military investigative services, but because adverse action can be taken based solely on the urinalysis, many avail themselves of the opportunity. Exculpatory exams are so named because they are intended to offer an opportunity to present evidence to support one's assertion of innocence.

exosomatic

Something generated from outside the body. Electrodermal recordings that apply a voltage or current to the skin are called exosomatic and in polygraphy a direct current (DC) is used to measure aspects of EDA. Constant voltage DC systems record EDA as skin conductance (SC) for which the units are Siemens (S) or mhos, which is the inverse of ohm in both spelling and in computation. Constant current systems measure and record skin resistance (SR), which is measured in ohms. EDL is the accepted abbreviation for electrodermal level and refers to the tonic or baseline level at any given moment, while EDR is reserved for the phasic response or reactions to stimulation. The designators R and L may be appropriately applied to the type of measurement taken, for example SRR (skin resistance response) or SCL (skin conductance level). Both skin conductance and skin resistance are exosomatic measures because electrical currents are applied from outside sources to detect the electrodermal activity. As opposed to *endosomatic*. See: Handler, Nelson, Krapohl & Honts (2010).

ex parte phenomenon

Literally, from the Latin meaning taken from one side or party. Legal term that has been used to indicate the "friendly polygrapher" hypothesis. See: Orne (1973).

experimental group

In research, subjects fall into two broad categories: *experimental* and *control groups*. The experimental group is subjected to the independent variable—that is, the variable of interest to the experimenter. The control group is treated exactly the same, except that it does not receive the independent variable. When the dependent variables of the experimental and control groups are compared, their differences are attributable to the independent variable. Consider research examining the validity of PDD: one group would be assigned to the innocent condition, and the other to the guilty condition. Since the variable of interest is the detection of deception, the guilty would be the experimental group and commit the mock crime, and the innocent would not commit the mock crime and would be the control group.

exploratory test

Zone Comparison Technique test format for dealing with multiple issues.

extrapolygraphic

That which is not derived exclusively from the polygraph waveforms or tracings. Some polygraph schools teach that there are sources of information to assist the polygraph examiner in rendering a decision that are not registered in the physiological data. These sources of extrapolygraphic information include case facts, behavioral indicators, and base rates. Blind interpretation of polygraph charts is one way of parsing out what information is available in the test recordings and that which comes from other sources.

extrasystolic beat (ESB)

See: *premature ventricle contraction*.

false key

A term coined by Arther (1970) for the deliberate placement of a false distracter item among other items on a Peak of Tension test that the examiner has hinted is the correct item. Arther reported it to be a useful diversion of attention of the innocent examinee who does not know the true key or critical item. The false key is the most plausible item in a list for the naive examinee, though it is by design the incorrect item. The false key is used exclusively in Known Solution Peak of Tension tests. No published research is available on the use of the false key.

F3

See: *Fight, Flight and Freeze*.

false negative

The failure to detect the presence of a particular event or item. A false negative in PDD refers to the incorrect decision that deception was not practiced by the examinee. Also called a Type-2 error.

false positive

The false detection of something that is not actually present. In PDD, it is the incorrect decision that deception was practiced by the examinee. Also called a Type-1 error.

fear of detection model

One of several theoretical explanations for the psychophysiological mechanisms underlying arousal during deception. According to this 'concern-based' model, examinees physiologically respond to test questions to which they are lying out of concern that their deceptions will be detected and adverse consequences will follow. The greater the fear, the greater will be the response. While incomplete and unproven, this remains a prevailing theory taught to PDD practitioners because it appears to have some face-validity. Unfortunately, it ignores the large body of scientific literature dealing with cognition, emotion and behavioral conditioning. One obvious exception relates to those instances where the PDD test continues to

be effective even when there are no or trivial consequences for detection, or when directed-lie comparison questions are used.

fear of error

Concept forwarded by James Matte to account for a portion of false positive errors in polygraphy. According to the theory, the innocent examinee is inclined to physiologically react to relevant questions if he is excessively concerned about a polygraph error. To correct this confound, Matte advocates the insertion of an "inside track" pair of questions among the test questions. Empirical support for the inside track is not yet available. See: Matte (1996); Nelson & Cushman (2011).

feature

In polygraphy, the term refers to a specific aspect of a waveform, pattern or measurement in a tracing. Features are the fundamental components of chart interpretation on which scoring and decision rules depend. Currently there are about 12 individually validated manual scoring features. In the breathing channel they are: apnea, baseline increase, suppression, and increase in cycle time (slowing). For the electrodermal channel they are peak amplitude, complexity, and duration. In the cardiograph, the features are amplitude and duration. The finger plethysmograph relies on the duration and magnitude of the constriction of the pulse amplitude. Other features are sometimes taught as part of scoring systems, though their validity is disproven or absent. See: Kircher & Raskin (1988); Bell, Raskin, Honts & Kircher (1999).

field research

Scientific investigation using actual PDD cases conducted by practicing examiners on suspects, witnesses, and victims. In contrast to *laboratory research*.

fight, flight, freeze

Three stereotypic behavioral responses to threat, sometimes simply called *F3*. The physiological responses concomitant to these behaviors are the same, namely mobilizing bodily resources for an expenditure of energy, and narrowing attentional focus to the features of the threat. This preparation activity of the body has been used

as a rudimentary explanation for the pattern of arousal responses that are recorded during PDD. Handler and Honts (2007; 2008) offered an alternative based on the Behavioral Inhibition System theory proposed by Gray and Mc Naughton (2003).

finger of death

Somewhat whimsical informal expression for a tracing pattern sometimes found in the electrodermal channel that is putatively associated with deception. It is the sudden plunging of the electrodermal tracing shortly after the presentation of a relevant question followed by a normal return to baseline, creating the visual impression of a "finger." The sudden drop and recovery may or may not have been preceded by a phasic response. Some writers have attributed the phenomenon to a loss of contact between the sensors and the skin, such as when certain types of physical countermeasures are practiced. The cause of the phenomenon is not well understood, and it has not been scientifically established as a reliable indicator of deception. Sometimes called the *devil's finger*.

finger pulse amplitude (FPA)

Cardiographic measure of the pulse wave recorded by plethysmograph (both occlusion and photo type) at the finger. Constrictions in amplitude are associated with sympathetic nervous system arousal. See: Handler & Krapohl, (2007); Kircher & Raskin (1988).

Fleiss' kappa

Statistical measure for the degree of agreement among multiple raters for their classifications of items. In PDD, it provides a metric for the reliability of decisions among different scorers interpreting the same test charts and is the preferred method for gauging inter-rater agreement. See: Fleiss (1971).

foil

An irrelevant item in a Concealed Information Test. Sometimes called *padding*, *buffer*, *control*, or *non-critical item*.

forensic psychophysiological detection of deception examination

A process that encompasses all activities that take place between a forensic psychophysiologist and an examinee during a specific series of interactions. These interactions include the pretest interview; the use of the polygraph to collect physiological data from the examinee while presenting a series of tests; the diagnostic phase, which includes the analysis of physiological data in correlation with the questions asked during each test to support a diagnostic decision; and the posttest phase, which may or may not include interrogation of the examinee. See: Yankee (1995).

forensic psychophysiologist

Proposed alternate title for polygraph examiner. It is a person who has successfully completed an academic program in Forensic Psychophysiology, including the appropriate internship, which has been inspected and accredited by the American Polygraph Association.

forensic psychophysiology

Defined by Dr. William J. Yankee in 1992 as the science that deals with the relationship and applications of PDD tests to the legal system. It is the academic discipline that provides the student, the practitioner, and the researcher with the theoretical and applied psychological, physiological, and psychophysiological fundamentals for a thorough understanding of PDD tests, and the skills and qualifications for conducting PDD examinations. The modifier "forensic" delineates and delimits this discipline from the broader discipline of psychophysiology. See: Yankee (1992).

format

A particular order of question presentations, or rules that govern the order, along with the types of questions. "Format" is sometimes incorrectly used interchangeably with "technique," a broader term that encompasses not only the format, but all practices in the pretest and test phase.

frame of reference

The circumstances or facts (crime report, criminal complaint, victim allegation, etc.) presented to the polygraph examiner which form the basis for the PDD examination. See: Holden (2000).

"friendly polygrapher" hypothesis

A hypothesis proposed by Martin Orne that a deceptive examinee would not be as detectible by an examiner who conducts a polygraph examination on behalf of the examinee's attorney because the examinee has no fear of adverse consequences. All field studies that have investigated it have failed to find the effect. See: Honts (1997); Ishida & Sevilla (1981); Matte & Reuss (1990); Orne (1973); Raskin (1976).

functional Magnetic Resonance Image (fMRI)

An image of the brain processes created from the metabolism of neurons. There are three types of fMRI imaging, which use blood flow, blood volume and blood oxygenation level-dependent (BOLD) signals. The BOLD method is the most common method used as it has the highest functional contrast. As the brain regions are engaged in a task they require more blood. The fMRI is an image of changes in blood flow based on task demands. The fMRI is one tool being researched to find central nervous system indicators of deception. See: Kozel, Johnson, Grenesko, Laken, Kose, Lu, Pollina, Ryan & George (2009); Pollina, Horvath, Denver, Dollins & Brown (2008).

Functional Near-Infrared Spectroscopy (fNIRS)

An approach to neuroimaging in which lasers emit infrared light through the skull into the brain and light-detecting sensors record the light that returns. The absorption and reflection of the infrared light can indicate where in the upper brain regions oxygenated red blood cells are concentrated, thereby allowing inferences for those areas that are active during a given task. fNIRS has been tried experimentally in deception detection. See: Butta et al. (2015); Li et al. (2018); Tian et al. (2009).

Galvanic Skin Response (GSR)

A superseded term for the electrodermal response measured exosomatically by the change in the electrical resistance of skin. GSR is sometimes erroneously called Galvanic Skin Resistance or Galvanic Skin Reflex. The modern term is *electrodermal response* (*EDR*).

galvanograph

Polygraph component responsible for producing the graphic recording of skin resistance.

ganglion

A cluster of nerve cell bodies. (pl. *ganglia*).

general state countermeasures

Attempts to defeat the polygraph examination by influencing tonic physiological activity, or altering phasic lability. Typical approaches include the use of drugs, meditation, biofeedback, and fatigue. The goal of state countermeasures is to diminish the body's responses to all polygraph questions. State countermeasures may affect testing techniques that rely on the presence or absence of responses to diagnose deception, such as the Concealed Information Test or Peak of Tension tests. Because comparison question tests use differential responsivity to different types of questions, state countermeasures are more likely to result in inconclusive findings than errors. See: Honts & Amato (2002).

generalizability

Extent to which a set of research results can translate to other research paradigms or to the real world.

general nervous tension (GNT)

Expression used in the practice of PDD to characterize recorded physiological patterns that suggest the examinee's basal level of arousal is high. This arousal is not

indicative of deception in itself. GNT is sometimes indicated by very fast heart rates, unusually labile electrodermal activity, and uneven breathing cycles. PDD examiners try to bring examinee's arousal state to a median level to optimize the interpretability of the test charts.

general question technique

Alternate expression for the Keeler Relevant/Irrelevant Technique.

global analysis

Evaluation of the polygraph recordings as a whole, as opposed to making systematic comparisons among questions. Global evaluation can also represent the use of extra-polygraphic information such as examinee behavior and case facts when rendering a polygraph decision, an approach championed by Reid and Arther. When information beyond the physiological tracings is considered to produce the final outcome, it is also called the *clinical approach*.

green zone

Term used by Cleve Backster to describe a 20- to 35-second block of polygraph chart initiated by an exclusionary comparison question which has a unique psychological focusing appeal to innocent (truthful) examinees. See: Backster (1963c).

ground truth

Reality. In the PDD context it is the veridical state of truthfulness or deception against which polygraph outcomes are compared in validity studies. Ground truth is an elusive feature in field studies because it is difficult to independently verify guilt or innocence in many cases. In laboratory studies, it is delineated into programmed guilty and programmed innocent groups.

GSG

Expression by a polygraph manufacturer to represent a measure of skin conductance. An adaptation of GSR, substituting the letter "R" with "G," the engineering

shorthand for conductance. However, GSR stands for Galvanic Skin Response, not Resistance. The phenomenon called GSG is more correctly denoted as *skin conductance (SC)*.

guilt complex reactor

Hypothetical personality trait that causes innocent examinees to physiologically respond to any question that they consider accusatory. Guilt complex questions have been used in many of the contemporary formats at one time or another in an attempt to identify those examinees who would produce a false positive outcome because of this tendency. No empirical support exists for the existence of guilt complex examinees nor for the benefit of using a test question aimed at identifying them.

guilt complex test

A PDD test format in which an examinee is tested on a fabricated crime. The guilt complex text has several hypothetical purposes, primarily in avoiding false positive outcomes. The guilt complex test was taught in the earliest years of the Reid and Keeler schools. See: Abrams (1977).

Guilty Knowledge Test (GKT)

A test published by Dr. David Lykken and is based on a concealed information paradigm. While similar tests are described in the literature as early as 1904 (Wertheimer & Klein), and Hugo Munsterberg outlines a comparable approach in his 1908 book *On the Witness Stand*, Lykken formalized the procedures and advocated its use in place of the CQT. Recent writers have renamed this method the *Concealed Information Test* (CIT). See: Lykken (1959); Verschuere, Ben-Shakhar & Meijer (2011).

habituation

Adaptation to a stimulus over time. As an organism habituates to a stimulus or environment, its response diminishes both in intensity and frequency. In PDD, habituation has been found within tests, but little or none between tests. See: Dollins, Cestaro & Pettit (1998); Kircher, Raskin & Honts (1984).

halo effect

Tendency of an observer to be unduly influenced by a single trait of an individual. This term was coined by Thorndike in 1920 in the context of psychological assessment. For the PDD examiner, it is a potential source of error if examineee-examiner interactions are factored into the final PDD decision. See: O'Sullivan (2003); Thorndike (1920).

heart rate

Rate of ventricular contractions, usually measured in beats per minute. It is one index of physiological arousal. Some recent research indicates that after stimulus onset cardiac arousal takes the form of an immediate decrease in heart rate if the response is an orienting response (OR). Heart rate and the interbeat interval are reciprocals of one another.

hertz

Term for frequency, in cycles per second. For example, a heart rate of 80 beats per minute would equal 1.33 hertz. Frequency measures in psychophysiology are often reported in hertz, particularly when identifying engineering specifications of instrumentation. Named for German physicist Heinrich R. Hertz. Sometimes called *cycles per second (cps)*.

Hg

Chemical symbol for the element mercury. Millimeters of mercury is the reference for measures of pressure, such as barometric and blood pressure. Conventional polygraph notation for air pressure in the sphygmomanometer is gauged in millimeters of mercury (i.e., 72 mm Hg). Hg stands for *hydrargyrum*, from Greek for water and silver.

hidden comparison question

Question designed to evoke a response from a truthful person, but appears to be relevant to the examinee, and therefore its true purpose is concealed. Useful for testing victims or those knowledgeable in CQT formats. Sometimes called *disguised comparison question*.

hidden key

Critical item in the Known Solution Peak of Tension test. It is called *hidden* because it is not known to be the critical question to the innocent examinee, and it is embedded in a list of apparently similar questions. There is one key per test.

Hobson's Choice

An expression referring to an apparently free choice that offers no genuine alternative. It was named after Thomas Hobson, a stable owner in the 16th century, who offered patrons the horse nearest the door, or none at all. For Hobson's customers, there was the illusion of choice, but no actual options. Hobson's Choice is used in polygraphy when the probable-lie questions are developed in the pretest interview. The examinee feels as if he or she must pass this question to pass the examination. During the pretest interview the question is presented and refined until the examinee chooses to deceive rather than to accept the much less desirable option of acknowledging socially proscribed behaviors. Truthfulness is not a true choice in that circumstance, and therefore the examinee's decision to lie is based not on a free choice but on a Hobson's Choice. The lack of alternatives or "escapes," which is associated with a state of "learned helplessness," may be a mechanism in the arousal level. See: Vendemia (2002).

homeostasis

Homeostasis is a term in physiology to describe the maintenance of the internal viability of organisms within a prescribed range. The word homeostasis is derived from the Greek homeo, means "same," while stasis means "stable;" thus, "remaining stable by staying the same." Walter Cannon coined the term "homeostasis" from a related idea developed earlier by Claude Bernard. Claude Bernard declared "All the vital mechanisms have only one object, to preserve constant the condition of the internal environment." Studies in physiology and medicine have interpreted that statement to mean certain aspects of the internal milieu are fixed at a specific set point. The historical concept of homeostasis is the basis of modern concepts of autonomic regulation and control. Organisms are always in a state of homeostasis, even during states of arousal, except during illness or disease. Also see: *allostasis*.

hope of error

Concept introduced by James Matte, and a central component of his Quadri-Track Technique. Because guilty examinees usually stand to lose something of importance if their deceptions are uncovered by the polygraph, Matte argues that they are hopeful that there will be an error in the outcome. A challenge to Matte's hypothesis is that truthful subjects are also deceptive during testing – to probable lie comparison questions – and they too might be hopeful for an error to occur. During testing Matte includes a direct question regarding the examinee's hope of an error and scores the question as a relevant question. See: Matte (1996); Matte & Reuss (1989); Nelson & Cushman (2011).

Horizontal Scoring System

A method devised by Gordon and Cochetti in the 1980s. All responses within each channel are ranked from largest to smallest; ranks assigned to comparison questions are given positive values, while those to relevant questions receive negative values. For example, if a test had three each of relevant and comparison questions, and the magnitude of the responses in a given channel resulted in an order of R3, R1, C1, R2, C3, and C2, their values would be designated as -6, -5, +4, -3, +2, and +1, respectively. This method is repeated for all channels in all tests and then summed for a grand total. Thresholds suggested by Gordon and Cochetti were two points per relevant question per test, and a minimum of two tests. Because of the ranking approach, this scoring system may be limited to single-issue testing situations. Additionally, some of the diagnostic criteria and transformation procedures have not been shown to be empirically supported. See: Gordon (1999); Gordon & Cochetti (1987); Gordon, Mohamed, Faro, Platek, Ahmad & Williams (2005); Krapohl, Gordon & Lombardi (2008); Nelson & Handler (2011).

hydrosphygmograph

Device used by Cesare Lombroso at the end of the 19th century to detect changes in blood pressure during deception, though the hydrosphygmograph that had been invented years earlier for medical purposes. It consisted of a container of water and a rubber seal through which an examinee's fist was placed into the water. Once the container was sealed, changes in relative blood volume changes were transferred to the closed system and could be recorded with tubing leading to a recording pen that wrote on a smoked drum. This is the first mechanical device reported in the literature used specifically for deception tests. See: Trovillo (1939).

hyperventilation

Increase in rate and depth of breathing.

hypnosis

Altered state of consciousness in which the subject is very receptive to suggestion and direction. Hypnosis has been a concern to PDD practitioners because it is thought to be a possible undetectable countermeasure. In a highly suggestible state, guilty subjects could conceivably have memories of their crimes blocked, altered, or replaced so that physiologic responsiveness would be unreliable for diagnosing deception. It could also be used to enhance desensitization training, or autonomic conditioning. The little research on hypnosis has not conclusively settled the issue. See: Weinstein, Abrams & Gibbons (1970); Timm (1991).

hypothenar eminence

Prominence on the palm corresponding with the musculature of the little finger. One of the most productive recording sites, along with the thenar eminence, for electrodermal activity. See: Handler, Nelson, Krapohl & Honts (2010).

Inbau, Fred

Inbau (d. 1998) is most known in the polygraph community for his collaboration with polygraph pioneer John Reid. Though a lawyer, Inbau joined the new established Scientific Crime Detection Laboratory in Chicago in 1933 to pursue his interest in forensic science and stayed with the lab as director when it was assumed by the Chicago Police Department. He left to be a trial lawyer in 1941 and joined the faculty of Northwestern University School of Law in 1945. Inbau was a prolific writer, and his book *Criminal Interrogation and Confessions* is considered a classic.

imagery

The use of visualization to experience memories or fantasies. Imagery has been shown to produce profound physiologic responses, and because it can be performed covertly by an examinee, it is a concern to PDD examiners as a possible countermeasure. Imagery is one form of *dissociation*.

impedance cardiogram (ICG)

Specialized cardiogram by which the timing and stroke volume of the heart can be derived. Though not currently used in PDD, it has been shown to provide a gauge of sympathetic arousal when used in tandem with the ECG. See: Harrell & Clark (1985).

incisura

A notch or indentation on any form. See: *dicrotic notch*.

inclusive (inclusionary, non-exclusionary) comparison question

Comparison question that potentially encompasses the activity of interest in the relevant questions. While contemporary practice tends to favor exclusionary comparison questions, no research has not found them to increase decision accuracy over inclusive comparison questions, and most studies support the inclusive comparison question. See: Amsel (1999); Podlesny & Raskin (1978); Horvath (1988); Horvath & Palmatier (2008).

Incomplete

PDD outcome used in some sectors that indicates that testing was terminated before sufficient physiological information was collected. This may be due to the sudden onset of health problems, extreme emotional distress, or the examinee's unwillingness or inability to remain for further testing. It may also signify that the examinee provided information after initial testing that necessitated subsequent testing, but it was not completed due to examinee fatigue, time limits, or equipment problems. A PDD decision of incomplete implies that testing may continue at a future date.

Inconclusive

PDD outcome where testing was completed, but neither deception nor truthfulness can be diagnosed because the physiological data are inconsistent, inadequate, artifacted, or contaminated. There is disagreement whether an inconclusive outcome should be considered an error when computing validity of PDD. Some argue that examinees are either truthful or deceptive, but never inconclusive; therefore,

such an outcome is necessarily in error. Conversely, in the forensic sciences it has been asserted that the inconclusive outcome is used to assess utility, but not validity, because samples in forensic disciplines are often inadequate, or contaminated. Because of this controversy, PDD validity studies report accuracies both with and without inconclusive results. In practice, inconclusive outcomes are the default results when the criteria for deception or not-deception decisions are not satisfied and are a matter of the decision thresholds employed. Alternate term is *indefinite, or no opinion*.

indefinite

See: *inconclusive*.

independent variable

The variable manipulated by the experimenter to determine the effects on the dependent variable. As an example, if a researcher were interested in sex differences in PDD validity, the independent variable would be the gender of examinee and the dependent variable would be the accuracy of the PDD technique for each sex.

information gain

Statistical approach to determine the usefulness of a technique over the non-use of the technique. In forensic applications, the polygraph has been shown to provide a significant information gain over unassisted lay judgments across a wide range of base rates. In screening, only decisions of deception led to a significant improvement in information gain. See: Honts & Schweinle (2009).

innervation

Provide nerve supply, or to stimulate an organ through its nerves.

inside-issue comparison question

Test question used only the Quadri-Track Comparison Technique. Advocates of the technique assert it is designed to elicit a response from the truthful examinee concerned about a false positive error. Empirical support is mixed between advo-

cate and independent research. See: Matte (1996); Mangan, Armitage & Adams (2008); Nelson & Cushman (2011); Shurany, Stein & Brand (2009).

inside-issue relevant question

Test question used only the Quadri-Track Comparison Technique. Advocates of the technique state that it is designed to elicit a response from the deceptive examinee hoping for a false negative error. Empirical support is mixed between advocate and independent research. See: Matte (1996); Mangan, Armitage & Adams (2008); Nelson & Cushman (2011); Shurany, Stein & Brand (2009).

inside track

One of three tracks in the Quadri-Track Zone Comparison Technique which include the primary, secondary, and outside tracks. The inside track employs two questions. One of these questions addresses an examinee's fear of a false positive error and is used as a comparison question. The other concerns the examinee's hope of a false negative error, which is treated and interpreted as a relevant question. Empirical support is mixed between advocate and independent research. See: Matte (1996); Mangan, Armitage & Adams (2008); Nelson & Cushman (2011); Shurany, Stein & Brand (2009).

inspiration (inhalation) / expiration (exhalation) ratio (I/E ratio)

The duration of inhalation compared with that of exhalation. Normally the ratio is about 1:2 in a resting human and changes during stress. It was first reported by Benussi in 1914. Changes in the I/E ratio are considered by some to be a diagnostic criterion in manual scoring. The I/E ratio as described by Benussi is quite different from that traditionally taught in polygraph schools. Also, more recent research has not found it to be of diagnostic value in manual scoring. See: Krapohl (2020); Kircher, Kristjansson, Gardner & Webb (2005).

instant offense examination

A form of *Post-Conviction Sex Offender Testing,* conducted when a subject is in denial of the offense or of some significant element of the offense for which he or she was convicted, and is often used to break down the denial barrier. This is

also an examination that can be given when a new allegation has been made while the subject is on probation or parole. The polygraph is used to determine whether the allegations are true. Also called a specific issue examination. See: Cooley-Towel, Pasini-Hill & Patrick (2000); Dutton (2000); English, Pullen & Jones (1996); Heil, Ahlmeyer, McCullar & McKee (2000).

Integrated Zone Comparison Technique

The Integrated Zone Comparison Technique (IZCT) was developed in 1987 by Nathan J. Gordon, William Waid, and Philip Cochetti at the Academy for Scientific Investigative Training. Much of the design of the IZCT was based on formatting principles from the Backster Zone Comparison Technique although there are significant differences. Developers of the IZCT allow the examiner the flexibility to use the same test structure for both single-issue and multiple-issue casses. The IZCT is unique in that it uses a rank ordering system of analysis, called the *Horizontal Scoring System*. Also, unlike other techniques, the first chart is conducted as a silent answer test, and in the third chart there is a reversal of the positions of comparison- relevant questions to relevant-comparisons. See: Gordon, Fleisher, Morsie, Habib & Salah (2000); Nelson & Handler (2011).

integument

Covering of the body (skin). Human skin consists of three primary layers: *epidermis, dermis,* and *subdermis*. It is comprised of a complex set of organs that provide protective and sense functions. Skin protects the body from environmental threats such as temperature, chemical, mechanical and infectious agents by acting as a selective barrier. Skin can aid in the removal of substances like water and solutes from the bloodstream through the sweat glands. From a sensory standpoint, skin houses various receptors to provide afferent information related to touch, pain and temperature See: Handler, Nelson, Krapohl & Honts (2010).

intent question

Question used in polygraph testing to determine whether the examinee had engaged in an act with criminal intent, rather than merely committed the act. It is considered the least reliable of all types of relevant questions in PDD testing and is avoided whenever possible. Some behavioral acts include intent by their definition, e.g. sexual contact.

interbeat interval (IBI)

Period between cardiac pulse waves, usually measured from systole to systole. The IBI has been shown to shorten just after the onset of stress in most people if a defense response has been found to occur. Contrarily, IBI has been found to increase initially during an orienting response. IBI and heart rate are reciprocals of one another.

inter-chart stimulation

Examiner-examinee interaction that takes place in the few minutes between individual tests. The interaction might include general reminders for the examinee to answer all questions truthfully (in the case of PLC techniques), or further emphasizing the comparison questions. Some research suggests that inter-chart stimulation may improve the validity of polygraphy, though it remains a controversial procedure. See: Abrams (1999); Honts (1999; 2000); Matte (2000).

introductory test

Alternate term for a stimulation test. See: *stimulation test*.

investigative examination

A polygraph examination which is intended to supplement and/or assist an investigation and for which the examiner has not been informed and does not reasonably believe that the results of the examination will be tendered for admission as evidence in a court proceeding. Types of investigative examinations can include applicant testing, counterintelligence screening, community safety examinations (e.g., post conviction sex offender testing, domestic violence testing, intoxicated drivers on probation, etc.), as well as routine specific issue and single issue or multiple-facet diagnostic testing.

irrelevant question

A question designed to be emotionally neutral to examinees. Irrelevant questions are most often placed in the first position of a question list because an orienting response usually follows the presentation of the first question and is of no diagnostic value. In CQT formats it is also used after a relevant or comparison question

that has elicited a strong response to permit physiologic arousal levels to return to baseline before presenting another question. Irrelevant questions are used in nearly every type of PDD test. Also called *norms* or *neutrals*.

jackknife procedure

Statistical technique sometimes used to test a model. All data sets are used to develop a model except one, and the excluded set is tested against the model. This method is repeated until all sets have been excluded once and tested against the model built with the remaining data. This method produces a distribution of outcomes constructed from the individual outcomes of each data set, and is a method sometimes used to validate a model. Jackknife procedures have been used in PDD algorithm development.

Karpman's classification of lying

Classification of lies and their underlying motives. They are *benign lies* (for social conventions), *hysterical lies* (to attract attention), *defensive lies* (to avoid an adverse situation), *compensatory lies* (to impress another), *malicious lies* (for gain), *gossip* (exaggeration), *implied lies* (deceive with partial truths), "*love intoxication*" *lies* (idealistic exaggeration), and *pathological lies* (self-destructive or maladaptive). See: Karpman (1949).

Keeler, Leonarde

Student of John Larson and influential PDD pi2oneer. Among Keeler's (d. 1949) accomplishments were: the addition of the electrodermal channel to the polygraph, establishing the first PDD school, devising the Keeler Technique, and popularizing the polygraph field.

Keeler Polygraph

Originally manufactured by the Western Electro-Mechanical Company, this instrument was not produced after 1938. It had three tambours: one for the cardiosphygmograph, another for the pneumograph, and a third for either a second pneumograph or a muscular movement device. The kymograph could be geared to move the graph paper 3, 6, or 12 inches per minute. Associated Research, Inc. later

produced the Keeler polygraph, similar to the original design except it permitted a galvanograph channel, and the chart speeds were 6 and 12 inches per minute. The Keeler polygraph is no longer in production.

Keeler Technique

A Relevant/Irrelevant testing method devised by Leonarde Keeler and used in single- and multiple- issue testing. Its popularity has declined since the introduction of the CQT formats and it is rarely used today.

key

The critical item in a series of similar but neutral items used in Peak of Tension (POT) tests. In a known solution POT, the key is the relevant question that contains the incriminating information that only a guilty person should know. A key in a searching POT is the test item that holds information that only the guilty person knows and the PDD examiner is trying to uncover. In stimulation tests, the key is the question to which the examiner directs the examinee to lie. Also See: *false key*.

key word method

Procedure employed during PDD testing in which the examinee is instructed to provide not only a yes or no reply but repeat an important word from the test question. Based on the stimulus–stimulus theory in which cognitive activity is involved as an intermediary step between a stimulus and a response. The key word in the test question is associated with the concept it is supposed to represent. The key word method is used to neutralize dissociation countermeasures.

Kircher features

Ensemble of measurable physiological features found in traditional polygraph recordings that correlate highest with deception. They are: respiration line length, electrodermal response amplitude, relative blood pressure amplitude, and finger pulse amplitude. See: Kircher & Raskin (1988).

known numbers acquaintance test

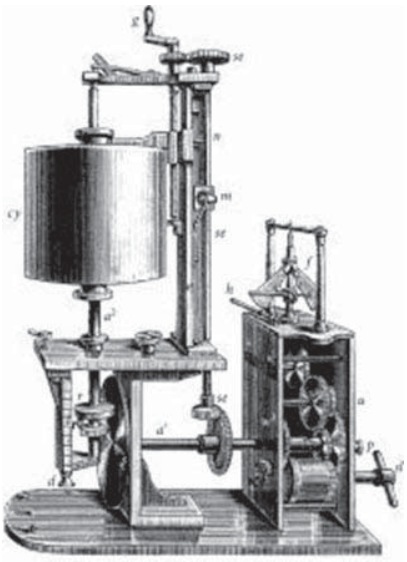
Stimulation test with several variants, it has as a central feature that the critical item is known to both the examinee and the polygraph examiner prior to the test. See: *stimulation test*.

Known Solution Peak of Tension test (KSPOT)

Peak of Tension test in which the critical item, or key, is known only to the investigator, polygraph examiner, a guilty person, or a person with incriminating knowledge. The key is placed in a question series among other items equally plausible to an innocent examinee and presented to the subject to determine if a consistent physiologic arousal occurs to the key. Like all Peak of Tension procedures, trend responses are used in addition to specific responses to interpret the recordings.

kymographion

Mechanical device that used a clockwork mechanism to rotate a drum on which many different types of phenomena could be recorded. The drum was covered with smoked paper. A stylus scratched the surface of the paper, creating a tracing that could be analyzed. The image below is a Ludwig kymographion from the mid-1800s. It was the forerunner of what later would be called a kymograph.



labile

Unstable, inconsistent, or dynamic. PDD tracings that display a high degree of responsivity or broad amplitude changes are referred to as labile.

laboratory research

Scientific investigation in which experimental procedures are designed to mimic real-world circumstances, but in which there is direct control over the independent variables.

Lafayette Instrument Company

An American manufacturer of polygraphs, both analog and computerized, founded by Max Wastl. Headquarters is located in Lafayette, Indiana.

Larson, John

One of the first modern researchers in PDD, Dr. Larson (d. 1965) first used continuous recordings of respiratory and vasomotor activity with a test format using relevant and irrelevant questions. Dr. Larson's 1932 book, *Lying and Its Detection*, provided the best scientific evaluation of PDD up to that time.

latency

The delay between stimulus presentation and some aspect of the response. Onset latency relates to the delay between the stimulus presentation and the beginning of the response, while the peak latency uses the time of the maximum amplitude of the response as the second point. Latencies of specific physiologic responses vary. The latency of an electrodermal response, for example, from stimulus onset is about one to three seconds for the average person, while hormonal influences on blood pressure require several seconds more. A significant departure from typical latencies can indicate that a given response is unrelated to the stimulus, that there are problems in attention for the subject, or that countermeasures are being engaged. Because of individual differences, within-subject analyses are to be preferred.

law of initial values (LIV)

The magnitude of a given physiologic response will be constrained by the level of arousal present when the response begins. If a response occurs when arousal is already high, the amplitude of the response measured from onset to maximum expression will be less than if the same response occurred during a median level. While there are differing opinions regarding this psychophysiologic principle, it can certainly be said that all biological systems do have upper limits in their potential for response, and ceiling effects can come into play. This is because compensatory systems mediated via the sympathetic and parasympathetic nervous systems work to limit response intensities. Additionally, concrete limitations may exist, such as the finite number of sweat glands establishes the maximum electrodermal response.

Layered Voice Analysis (LVA)

A voice-based technology sold as a means of detecting emotions and deceit. LVA was developed in Israel by Amir Liberman, owner of Nemesysco, Ltd, and is sold in the US through Voice Analysis Technologies in Madison, Wisconsin. The LVA software operates on a laptop computer and applies numerous algorithms to the voice signal to assess a wide range of factors. The company has a very assertive promotional campaign. The company also attempts to distance this technology from the Computer Voice Stress Analyzer (CVSA) in part because of reports of poor validity for the CVSA, and the different approach to analysis of voice data. Research on the LVA has found its validity to be poor to none. See: Damphousse, Pointon, Upchurch & Moore (2007); Harnsberger, Hollien, Martin & Hollien (2009); Hollien & Harnsberger (2006).

law of intensity

Within limits, response magnitudes and stimulus intensities share a log-linear relationship; the stronger the stimulus, the greater the magnitude of the response. Response magnitudes are used in PDD to infer the type of question the examinee considers most salient or threatening.

lens model

Model for studying the decision rules used by human decision-makers, first proposed by E. Brunswik in the early 1950s. Conceptually, the model characterizes

the decision process as the selection and evaluation of cues in the assessing of reality. Which cues are used and how they are weighted are central to this model. The term *lens model* springs from the sense that subjects view reality through the lens of these cues. This approach has been applied in the study of PDD decisions at the University of Utah. The lens model is useful to assess the diagnosticity of physiological responses, in identifying how examiners use the physiological information, and to determine the combination and weights of the cues that will maximize decision accuracy. See: Kircher, Kristjansson, Gardner & Webb (2005); Kircher & Raskin (1983); Kircher, Raskin, Honts & Horowitz (1995).

Law Enforcement Pre-Employment Test (LEPET)

A form of the Air Force Modified General Question Test (AFMGQT) which uses specific relevant questions and is used for police candidate screening.

lie detector

A common but inaccurate term for the polygraph.

likelihood ratio

The Likelihood Ratio (LR) provides an index of how much a test result will change the probability or odds of having a condition after a known or assumed prior incidence rate (base rate). In the case of polygraph testing, the condition of interest is involvement in the issue under investigation. The LR+ tells us how much more likely it is that a person is lying than not, after failing a polygraph test, compared with the likelihood before he or she sat in the chair and completed the test. If a person produces a truthful test result, the LR- tells us how much more likely the person is to be telling the truth than before the test. LRs may also be used to compare the efficacy of two or more scoring and decision models, for a given or assumed base rate. The advantage of the LR, compared with traditional Bayesian metrics such as positive predictive value (PPV) and negative predictive value (NPV) is that the LR is inclusive of inconclusive results, and will provide information that more accurately generalizes to field settings.

Limestone Technologies

A Canadian manufacturer of computerized polygraph instruments. Headquartered in Kingston, Ontario, Canada.

Lombroso, Cesare

Italian physician biologist who first employed instrumentation in an effort to detect deception in suspects in live criminal investigations. He reported in 1885 in the second edition of his book, *L'Homme Criminel* the use of the "hydrosphygmograph," a mechanical arrangement invented for medical purposes, to detect blood pressure changes during interrogation.

Luria, Aleksandr

Russian researcher and originator of the conflict theory, one of the theories proffered to explain the psychophysiological mechanisms underlying PDD. Luria did deception detection experiments with a tremograph. See: Luria (1930); Runkel (1936).

Lykken, David T.

Psychologist (d. 2006) and ardent critic of the CQT. Dr. Lykken produced numerous writings for the scientific and general press, including a book, *A Tremor in the Blood*, in which he argued strongly that the CQT is fatally flawed, that it resulted in wrongful criminal convictions, and it was vulnerable to countermeasures by the guilty. Dr. Lykken did not publish any research of his own on the CQT but used anecdotal histories and interpretations of other research to form his arguments. Lykken endorsed the Guilty Knowledge Test (GKT, now known as the Concealed Information Test, or CIT), an alternate PDD testing format. The CIT has not been widely used outside of Japan. See: Lykken (1998).

Lykken scoring

System of scoring electrodermal responses in the Concealed Information Test (formerly the Guilty Knowledge Test) and establishing the threshold for decisions. The Lykken scoring system compares the responses of the critical test items in a rank

order method against those of the neutral items. One variant uses averaged ranks. See: Lykken (1998).

maintenance examination

A form of *Post-Conviction Sex Offender Testing* (PCSOT) that is requested by a treatment provider, and looks at treatment-type issues; i.e., weekly report logs, masturbation habits, boredom tapes etc. See: Cooley-Towel, Pasini-Hill & Patrick (2000); English, Pullen & Jones (1996); Heil, Ahlmeyer, McCullar & McKee (2000).

manual mode

Setting for the electrodermal activity channel in computerized PDD instruments in which filtering of the tonic activity is minimal. All modern polygraphs manufactured in the U.S., have this feature. As opposed to *automatic mode*.

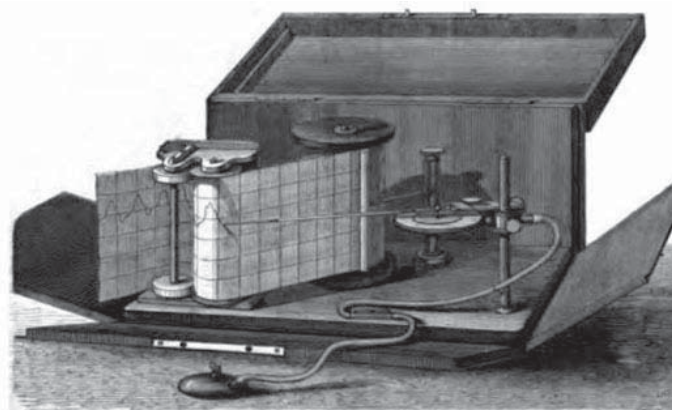
Marston, William

Psychologist, inventor of the discontinuous blood pressure method deception test, and author of the 1938 book *The Lie Detector Test*. Marston was the first to attempt to have instrumental deception test results entered into evidence in court, from which resulted the Frye decision of 1923. Marston's test entailed the use of a conventional blood pressure cuff and sphygmomanometer with which he manually plotted the examinees blood pressure during questioning at several points during the interview. Marston's work represented some of the early approaches to lie detection, though it could be considered polygraphy as it is now understood. Marston had several interests, and he was also the co-creator of the Wonder Woman comic book character. Both William Marston and his wife, Elizabeth, were lawyers and worked together to perform deception testing. See: *discontinuous blood pressure method*.

Marey, Étienne-Jules

French researcher and early physiologist who invented the sphygmograph, a device for recording changes in blood pressure and pulse on a smoked drum in a manner

not dissimilar from that later added to the polygraph. The diagram below shows a portable physiological recorder devised by Marey. See: Marey (1885).



mean blood pressure

The value of the pressure during the entire cardiac cycle. An approximation of the value of the mean blood pressure can be derived by averaging the systolic and diastolic values, or by summing of the diastolic pressure and one-third of the pulse pressure.

medulla oblongata

A part of the brain stem responsible for automatic control of respiratory and cardiovascular activity. The medulla oblongata is closely associated with physiological events relating to polygraph test data analysis.

mental countermeasure

A class of countermeasures in which the examinee attempts to affect the polygraph recordings through self-manipulation of attention, memory, emotion, cognition, semantics, or arousal. See: Krapohl (1996).

microtremor

Low-frequency oscillation of the human voice in the range of 8 to 12 hertz, and the component used to infer deception with the Psychological Stress Evaluator and the

Computer Voice Stress Analyzer. It is claimed by the manufacturers of these devices that there is an inverse relationship between stress and the microtremor. Independent research has not yet found any spectral component of human voice a reliable predictor of deception.

Minnesota Multiphasic Personality Inventory (MMPI)

One of the most common personality inventories employed in psychology and psychiatry. It uses a series of questions to make diagnoses according to standard psychiatric clinical criteria. Among the most cited scales reported in the PDD literature are *psychopathy* and *social introversion-extroversion scales*, both of which have been shown to influence physiologic arousal levels, particularly in the electrodermal response. Evaluation and interpretation of the MMPI is generally based on profiles resulting from individual scales. Test-retest validity for the MMPI averages above 70%, though the validity of the individual personality scales has not been conclusively demonstrated.

Mixed Question Test

A Reid polygraph test in which the straight-through (ST) test questions are changed in order, and some of them are repeated. When the Mixed Question Test is used, it is always conducted after the ST.

mixed issue test

Any polygraph test technique in which each there is little or no overlap in the coverage among the relevant questions. Sometimes called a *multiple-issue test*.

model policy

Non-binding standard that outlines best practices in a given area. The American Polygraph Association uses model policies to help agencies and clients know what good polygraph practices are, and thereby provide a competitive advantage for examiners who adopt these best practices. Among the current APA Model Policies are those for police applicant screening, Post Conviction Sex Offender Testing, and Examinee Suitability.

Modified Relevant Irrelevant (MRI) technique

Specific-issue PDD format based on the Keeler RI format, but it uses situational comparison questions. Users of the MRI discuss all tested issues with the examinee during the pretest interview but prefer not to review the relevant questions word for word. The prohibition against relevant question review is not an absolute, however. Results from the MRI are based on extrapolygraphic information, and 3- and 7-position scoring. Reported by Paul Minor (1985) but seldom used in the field.

monitoring examination

A form of *Post-Conviction Sex Offender Testing* (PCSOT) that is requested by a probation or parole officer to ensure compliance with the conditions of the offender's release from prison; i.e., alcohol or drug issues, computer violations, contact with children etc. See: Cooley-Towel, Pasini-Hill & Patrick (2000); Dutton (2000); English, Pullen & Jones (1996); Heil, Ahlmeyer, McCullar & McKee (2000).

Monte Carlo method

A statistical tool which is based on repeated random sampling of data and has been applied to the problem of estimating polygraph decision accuracy. The expression was coined by scientists at the Los Alamos National Laboratory in the 1940s for their approach to estimating radiation shielding.

Mosso, Angelo

Student of Cesare Lombroso, who in 1896 developed the scientific cradle, a device for recording bodily responses to fear.

motor nerves

Neurons that carry nerve impulses from the central nervous system to the effector organ or muscles. Also called *efferent nerves*.

movement sensor

Mechanical sensor that detects covert movements. The movement sensor is used to detect certain types of physical countermeasures.

multiple-facet test

Test format in which the relevant questions are targeted toward different elements of the same crime. For example, in a counterfeiting case, the PDD examiner might use three relevant test questions with a suspect. One could cover printing the bills, the second passing the bills, and the third knowing where the printing equipment is. In such a test the spot scores would determine whether a diagnosis of deception is made, as opposed to the overall score. The Zone "exploratory," the Air Force Modified General Question Test, and criminal RI are three possible formats for this approach.

multiple-issue examination

Typically used in screening, it allows the PDD examiner to determine which of several areas should be followed up with further questioning. It is somewhat uncommon to make decisions of truthfulness or deception in these types of tests because of the known adverse effects on decision accuracy. Such decisions are generally made after subsequent testing on the isolated issue in a single-issue test format. Among the more common multiple-issue test formats are the Law Enforcement Pre-employment Test and the Test for Espionage and Sabotage. See: Barland, Honts & Barger (1989).

Münsterberg , Hugo

Chairman of the Psychology Department at Harvard who, in his 1908 book *On the Witness Stand*, suggested the possibility of devising deception tests using cardiovascular, breathing, and electrodermal measures. Münsterberg also described the Concealed Information Test. He had as a student William Marston, who later went on to develop the discontinuous blood pressure method deception test.

National Center for Credibility Assessment

The NCCA is the US government polygraph education, oversight and research center for credibility assessment, including the polygraph. Other historical names include: the U.S. Army Polygraph School (1951–1962); the US Army Military Police School (USAMP, 1975–1986); the DoD Polygraph Institute (DoDPI, 1986–2007), and; Defense Center for Credibility Assessment (2007–2009). With

its campus located at Ft. Jackson, SC, the NCCA falls under the Defense Counterintelligence and Security Agency. The "Center", as it is often called, provides all polygraph instruction for the US federal government.

nervous system

Consists of the brain, spinal cord, and peripheral nerves, each performing specific functions. Processing of nerve impulses in the brain is somewhat localized. Basic functions are mediated in the lower parts of the brain, activities such as hunger, thirst, and thermoregulation. Sensory regions of the brain are located above, along with most voluntary control of muscles. The highest regions of the brain are dedicated to processing and integrating information, and the production of thought. The spinal cord is the primary pathway by which most of the nerve impulses are carried to the brain. Nerves throughout the body send pulses through the spinal cord to the brain where they are processed, and the brain sends back impulses to regulate and control organs and muscles. There are two main divisions to the nervous system: the *central* (brain and spinal cord) and the *peripheral* (nerves and ganglia located outside of the central nervous system). The peripheral nervous system is further divided into the somatic (voluntary muscular movements) and autonomic branches (various unconscious functions such as digestion, sweating, heart rate, pupillary response, vasomotor activity, etc.) Some taxonomies also add a third branch, the sensory nervous system. In polygraphy, the autonomic branch receives special attention due to its association with the physiological data recorded and analyzed with the polygraph.

neuron

Structural unit of the nervous system and is the conducting cell. The typical neuron consists of a soma body, dendrites and axon.

neurotransmitter

Chemical involved in the transport of the neural signal to another neuron or effector organ. Neurotransmission has six stages: synthesis of the neurotransmitter, storage, release, receptor interaction, re-uptake, and inactivation. There are many pharmacological agents that influence neurotransmission, and they are of interest in PDD research due to their effects on tonic and phasic arousal levels.

neutral question

Another term for the irrelevant question in a CQT. Also called a *norm*.

No Deception Indicated (NDI)

In conventional PDD, NDI signifies that (1) the polygraph test recordings are stable and interpretable and (2) the evaluation criteria used by the examiner led him to conclude that the examinee was truthful to the relevant issue. The NDI and DI (Deception Indicated) decision options are used in specific-issue testing and correspond to NSR (No Significant Responses) and SR (Significant Physiological Responses) in multiple-issue, or screening, examinations.

non-current exclusive comparison question

A probable-lie comparison question that is of the same type or category as the relevant issue but excludes the relevant issue by use of a time-bar. It is the type of comparison question developed and advocated by Cleve Backster. See: Matte (1996).

non-exclusive (inclusive or inclusionary) comparison question

Comparison question that overlaps the relevant issue by time, location, or issue. Also called *Reid*, *inclusionary*, or *inclusive comparison question*. As an example, if the relevant issue were the robbery of a particular bank on a specific date, the comparison question might be, "Have you ever stolen anything in your life?" There is a long-running debate in the PDD community regarding the supremacy of the exclusive over the non-exclusive comparison questions. The current body of evidence supports the non-exclusive comparison question. See: Amsel (1999); Horvath (1988); Horvath & Palmatier (2008); Podlesny & Raskin (1978).

non-specific responses

Physiological responses that do not appear to have any relationship to the presentation of an external stimulus.

noradrenaline

British term for *norepinephrine*. See: *norepinephrine*.

norm

Verbal shorthand currently used by some PDD examiners to signify an irrelevant question in Relevant/Irrelevant and comparison question test formats. Much earlier (1922) John Larson referred to "norms" as individuals who were possible-but-unlikely suspects to a crime whom he added to his list of persons to be tested so he could account for variables such as anger, indignation, and fright that he could expect from innocent-but-likely suspects he would be testing.

No Opinion

Alternate term for an Inconclusive. Sometimes used to denote an Incomplete in some sectors.

No Significant Physiological Responses (NSPR or NSR)

Common verbiage for polygraph screening examination outcomes equivalent to No Deception Indicated in single-issue tests. The alternate language comes from an acceptance that screening examinations do not produce the high validity of single-issue tests, and therefore, the results are better reported as the absence of physiologic arousals rather than inferring truthful intent on the part of the examinee.

numerical analysis

Systematic assignment of numbers to physiologic responses, along with decision rules, so that PDD data analysis is more objective and standardized. The first such system was published by Dr. John Winter in 1936. Contemporary numerical analytic methods include the *Rank Order Scoring System, Horizontal Scoring System, 3-position scoring system, 7-position scoring system, Empirical Scoring System, and the Lykken Scoring*. Sometimes referred to as *semi-objective analysis*.

numerical chart analysis

Method of rendering polygraph decisions that are based exclusively on numeric values that have been assigned to physiological responses recorded during a structured polygraph examination. The numerical approach does not consider extra-polygraphic information such as case facts or examinee behaviors. The numerical approach has four primary components. They are: feature identification, numerical value assignment, computation of the numerical values, and decision rules.

Objective Scoring System (OSS)

A form of 7-position scoring where the individually assigned values are derived from ratios that come from measurements of the "Kircher features." Because the scores come from measurements, the OSS eliminates subjectivity in chart interpretation. However, it is very time-intensive when performed manually, and impractical for routine use. The OSS has been automated by some computer polygraph manufacturers. The OSS version 3 (Nelson, Krapohl & Handler, 2008) can accommodate almost all probable-lie CQTs. See: Dutton (2000); Krapohl & McManus (1999).

Oculomotor Deception Test

A credibility assessment technology that uses eye movements, pupillary responses and reaction time of examinees as they read statements and press a key for true or false. See: Webb, Hacker, Osher, Cook, Woltz, Kristjansson & Kircher (2009).

operant conditioning

Type of conditioning in which reward or punishment is given to the subject, depending on the preceding behavior. Rewards increase the likelihood of the recurrence of the behavior and punishment discourages the behavior. Biofeedback uses operant conditioning to help patients reduce blood pressure, electrodermal activity, and other physiological processes. Since operant conditioning can be used to teach individuals to regulate their own autonomic responses, it is a method for teaching PDD countermeasures. The little research that has evaluated the influence of biofeedback training on PDD efficacy has not found an effect. See: Honts (1987).

orienting response (OR)

Heightened sensitivity to specific sensory input that is characterized by increased information processing, narrowed attentional concentration, and physiologic excitation.

Othello error

Expression coined by Paul Ekman to denote the misattribution of the fear or emotional distress of an innocent person as an indication of guilt. See: Ekman (1985).

outlier

A value beyond the normal range of values. For example, the last value in the following series could be considered an outlier: 5,9,2,6,6,8,3,1,6,9,5,32. Outliers may be excluded from data collection because they have inordinate influence on central tendency. What constitutes an outlier, or extreme score, is established a priori.

outside issue question

See: *symptomatic question*.

outside track

One of four tracks in the Quadri-Track Zone Comparison Technique, which include the primary, secondary, and inside tracks. The outside track consists of two symptomatic questions. See: Matte (1996).

overall truth question

PDD test question that addresses the examinee's overall truthfulness or intention to be truthful during testing. Used in some multiple-issue screening tests.

P300

Event-related potential (ERP) of the brain measured at the scalp that has an average latency of 300 milliseconds from stimulus onset and is recorded maximally at site PZ in the International 10-20 System. The P300 is related to unique characteristics

of the stimulus and is most often associated with the "oddball" or rarely occurring stimulus. For example, the P300 is known to be evoked by a low incidence auditory tone that is of a different pitch than another tone that is occurring much more frequently. A P300-based Concealed Information Test has been developed for criminal testing, though field testing is incomplete. See: Farwell & Donchin (1991); MacLaren & Taukulis (2000); Rosenfeld (1998).

padding

An alternate expression for irrelevant items in a Known Solution Peak of Tension test. In some reports, padding relates to only the first or last one or two items in these tests.

pain countermeasure

Special type of physical countermeasure in which an examinee will attempt to evoke physiologic responses by covertly self-inducing discomfort. Included in this group are strategies such as biting the tongue, pressing against a sharp object in the shoe, forcing a fingernail into the thumb cuticle, and irritating a wound. While spontaneous use of these tactics has not been found effective, they can be more powerful when the examinee receives training and feedback. See: Honts, Raskin & Kircher (1994); Krapohl (1996).

parameter

Term used in PDD to denote a single physiological data channel, such as the pneumograph, cardiograph, etc.

paradigm

Example or model. Experimental paradigms attempt to explain real world phenomena by assessing the critical elements and their relationships with one another.

parasympathetic nervous system

One of the three divisions of the autonomic nervous system also referred to as the craniosacral system because the preganglionic neurons lie in those areas. Parasym-

pathetic ganglia anatomically lie in or near the organs they innervate thus allowing for more localized control. Functionally, it is involved in conservation and restoration of energy. The parasympathetic and sympathetic divisions of the autonomic nervous system function to maintain homeostasis.

parasympathomimetic

An agent whose effects mimic those resulting from stimulation of parasympathetic nerves, especially those produced by acetylcholine.

Pathometer

Device used by Rev. Walter Summers to perform deception tests in the 1930s. Researchers had to order Pathometers from Fordham University, and they were only assembled upon order. Summers conducted testing on hundreds of subjects using this recording galvanometer and a testing procedure he devised that included what would be later known as comparison question See: Summers (1939).

Peak of Tension (POT)

Family of recognition testing procedures, including *known solution*, *searching* (*probing*), and *stimulation tests*. A Known Solution POT (KSPOT) is used to determine whether the examinee is aware of details of a crime that have been kept from the general public and would presumably only be known to the perpetrator of the crime or those with incriminating knowledge. A Searching POT (SPOT) is used to determine details of a crime that are not known to officials, such as the location of an unrecovered body, but would be known to a participant in the crime. The evaluation criterion of Peak of Tension strip charts is simply identifying the point in the tracings where physiologic arousal has peaked, hence the name. Peak of Tension tests are not generally used to determine truth or deception, but rather to assist in the investigation or interrogation.

Pearson product-moment correlation

A test of correlation between two sets of interval level data (See: *scale of data*). The coefficients will lie between -1 and +1. A value of 0 would indicate no correlation, while -1 and +1 would mean perfect negative and positive correlations, respectively.

peripheral nervous system

Portion of the nervous system resident primarily outside of the brain and spinal cord. The cell bodies of the preganglionic sympathetic neurons lie in the spinal cord and those of the parasympathetic branch are situated in the brain stem.

pertinent question

Rarely used term for *relevant question*.

phalanx

Any bone of the fingers and toes. In research and as commonly practiced in PDD, electrodermal sensors are attached to the distal phalanx, or end of the fingertips. Plural is phalanges.

pharmacological countermeasures

Class of countermeasures in which the examinee attempts to affect the polygraph recordings through the use of ingested drugs or application of topical preparations. See: Krapohl (1996).

phasic response

A physiological response characterized by a relatively rapid change from and subsequent return toward baseline.

photoplethysmograph (PPG)

The PPG uses the reflection of a red light emitted into the skin to detect changes in the volume of blood in the upper layers of skin, typically recorded at the finger when using a polygraph. Physiological arousal is marked by a constriction in the pulse amplitude as blood is shunted from the extremity during activation of the sympathetic nervous system. See: Geddes (1974); Handler & Krapohl (2007); Kircher & Raskin (1988).

photopolygraph

A polygraph created by C.W. Darrow in the 1930s. It was one of the most elaborate polygraphs of that era, recording relative blood pressure, skin resistance, breathing, reaction time, and bilateral hand tremors. It had two stimulus markers, one activated by hand and the other was a voice key. Costing upwards of $2,000 and requiring a separate technician to operate, Darrow's photopolygraph was primarily a laboratory instrument and was not used extensively by the PDD community. Also called the *Darrow Photopolygraph*. See: Darrow (1932).

physical countermeasures

Class of countermeasures in which the examinee attempts to manipulate the polygraph recordings through the discreet use of movements. Some of these movements are also used to self-induce pain. See: Honts (1987); Krapohl (1996).

Pinocchio response

Nonexistent lie-specific physiological response. The expression sometimes used to deride the notion that the act of deception produces stereotypical response patterns.

place bar

One method of restricting the coverage of the comparison question so that it will not overlap the relevant question. For example, if a relevant question concerned whether the examinee had physically assaulted a person in the city in which he now resides, a comparison question with a place bar may inquire whether the examinee had ever deliberately hurt another person while living in another city. There is a school of thought that examinees may confuse the relevant questions with the comparison questions unless these two types of questions are designed to avoid any degree of overlap. Research has not supported this hypothesis, however. See: Amsel (1999); Podlesny & Raskin (1978); Horvath (1988); Horvath & Palmatier (2008). Also See: *exclusive (exclusionary) comparison question*.

placebo

Procedure or substance with no intrinsic effect but is useful to convince the patient or subject that an effective treatment has been applied. Placebos often have effects that are attributable to suggestion. They are used extensively in medical research for control purposes during drug testing and for certain psychosomatic illnesses. In PDD it addresses one type of mental countermeasure whereby examinees use ritual objects, incantations, or other ineffectual actions with the expectation that the power of the polygraph to uncover deception will be impeded.

plethysmograph

A device used to measure relative changes in blood volume and pulse volume. The three most commonly used are (a) changes recorded using a strain gauge, (b) impedance changes and (c) photoelectric changes. It is the third technique that is used in modern polygraphy to detect relative changes in pulse volume associated with the vasomotor response, usually at the distal phalanx of one of the examinee's fingers.

pneumograph

A device that records breathing, and one of the three traditional channels of the modern polygraph used in PDD. Most contemporary polygraphs use two pneumograph recordings: abdominal and thoracic. The types of sensors include the traditional corrugated rubber tube, the mercury strain gauge, or the newer piezoelectric.

polygraph

By definition, an instrument that simultaneously records two or more channels of data. The term now most commonly signifies the instrument and techniques used in the psychophysiological detection of deception, though polygraphs are also used in research in other sciences. In PDD the polygraph traditionally records physiologic activity with five sensors: blood pressure cuff, electrodermal sensors, two breathing sensors and a sensor designed to detect covert muscular movements. Some instruments also record *finger pulse amplitude* using a photoplethysmograph.

polygraph surveillance

See: *maintenance polygraph examination.*

polygram

Complete graphical recording of physiological data from a polygraph test with the required annotations. Often called a *polygraph chart*.

positive control pair

The combination of the subjective truth question and the subjective lie question, to form a set in the Positive Control Technique. See: Driscoll, Honts & Jones (1987); Gordon & Cochetti (1982); Howland (1981); Reali (1978).

positive comparison question

In the Positive Control Technique, each question is presented to the examinee twice in a row, and the examinee is instructed to answer differently the first time from the second time. Therefore, each question serves as its own comparison question. See: Driscoll, Honts & Jones (1987); Gordon & Cochetti (1982); Howland (1981); Reali (1978).

Positive Control Technique

Technique that employs most of the standard test questions except a probable-lie comparison questions, and each question is presented twice in succession during the testing. The examinee is instructed to answer truthfully to the first presentation, and untruthfully the second time, or vice versa. While the technique is amenable to the 7-position scoring, it has its own unique set of decision rules that are different from the more familiar comparison question formats. The Positive Control Technique is one form of the Yes-No Technique. See: Driscoll, Honts & Jones (1987); Gordon & Cochetti (1982); Howland (1981); Reali (1978).

Post-Conviction Sex Offender Testing (PCSOT)

Specialized application of polygraphy which aids in the management of the convicted sex offender who has been released into the community, though sometimes

is employed as part of treatment of offenders who are incarcerated. See: Dutton (2000).

post hoc

(L: after this) Establishment of criteria or analyses after the conduct of the experiment is completed.

posttest

Final portion of a polygraph examination. The posttest could include a debriefing of an examinee who passed the examination, or an interview or interrogation of an examinee who failed the examination. The posttest may or may not be a part of any given polygraph technique and plays no part in the formulation of the results in any polygraph technique.

pre-ejection period (PEP)

Time between the Q wave of the electrocardiogram and the B wave of the impedance cardiogram for the same pulse. It is the period between when the ventricular contraction occurs and the semilunar valves open ejecting blood into the aorta. Shorter periods are thought to correlate with sympathetic nervous system arousal. The sensors for the production of the PEP phenomenon are relatively noninvasive, and if future research validates it as a diagnostic measure, the PEP could be added as an alternate PDD channel.

Preliminary Credibility Assessment Screening System (PCASS)

Device developed by the Johns Hopkins Applied Physics Laboratory, in conjunction with the Lafayette Instrument company, at the request of the US Government in 2005. Its concept of operation is to be used by minimally trained US troops as an initial screening tool in war zones to pare down the number of individuals who would undergo subsequent vetting by the polygraph and other tools. It has two sensors: electrodermal and photoplethysmograph. Test questions are typed into the template of the PDA platform, and the user taps the screen to indicate the place of question onset. The PCASS is a one-chart test that runs about 12 minutes. At the completion of testing an algorithm analyzes the data to produce the screening

decision. Five laboratory studies have been conducted with the PCASS using realistic wartime scenarios or mock theft scenarios, with a combined accuracy of 80% when inconclusives were excluded, and about 23% inconclusives. The algorithm was devised to minimize false negatives. The PCASS was approved for use in the Department of Defense in 2007. See: Battelle Memorial Institute (2007); Senter, Waller & Krapohl (2009).

premature ventricle contraction (PVC)

Term loosely applied to distortion in the cardiograph waveform resulting from an ectopic heartbeat. More precisely it is a ventricular contraction between two sinus cycles without a compensatory pause. Sometimes referred to as *extrasystolic beat* (*esb*) in the older literature. See: *arrythmia*.

pretest interview

The earliest portion of the PDD examination process during which the examinee and examiner discuss the test, test procedure, examinee's medical history, and the details of the test issues. The pretest interview also serves to prepare the examinee for the testing. The length of the pretest interview ranges from 30 minutes to 2 hours or longer, depending on the complexity of the case, examiner-examinee interactions, and testing technique. All PDD techniques use pretest interviews.

primary track

One of four tracks in the Quadri-Track Zone Comparison Technique, which include the secondary, outside, and inside tracks. The primary track contains a relevant question, and a non-current exclusive probable-lie comparison question against which the relevant question is compared. See: Matte (1996).

probability

Likelihood of an occurrence, expressed as a number. By convention, probabilities are reported in scientific reports as numbers between 0.00 and 1.00. Probabilities are most often reported in PDD studies to characterize the likelihood of the experimental results occurring by chance.

probable-lie comparison question (PLC)

One of two major types of comparison questions. PLCs are questions to which it is likely that the examinee is untruthful or unsure of his or her answer. Their intended purpose is to create a competition of salience such that the anxious innocent examinees will expend more of their physiologic responses on them than the relevant questions, but the guilty examinee will still find the relevant questions more arousing than the PLCs. Most systems of analysis compare the physiological responses elicited by the PLC with those from the relevant questions. A PLC is fundamentally different from a DLC (directed lie) in that the examinee believes he must pass the PLC question to pass the examination, whereas the true purpose of the DLC is more apparent to the examinee. Two main types of PLCs are the *exclusionary* (Backster type) and the *non-* ex*clusionary* (Reid type).

Probing Peak of Tension

See: *Searching Peak of Tension.*

pseudorelevant question

A test question so worded as to appear to be relevant to the examinee. Example: "Did you lie to any question on this test?" or "Do you intend to answer truthfully each question on this test?".

Psychogalvanic Reflex (PGR)

Expression coined by Veraguth for what is now called the *electrodermal response*. See: Veraguth (1906).

psychograph

A term from the 1930s for the polygraph that consisted of the pneumograph, sphygmograph, and a stimulus marker. Sometimes referred to as the *Berkeley Psychograph,* the *Lee Polygraph,* and the *cardio-pneumo-psychograph.*

psychological set

The expression *psychological set* was introduced in PDD by Cleve Backster who initially attributed it to a psychological writer Floyd L. Ruch (Matte & Grove, 2001) but later claimed to have made up the expression himself (Senter, Weatherman, Krapohl & Horvath [2010]). Backster has made the concept central to his Zone Comparison Technique and has tethered the concept to the emotion of fear. According to Backster's PDD hypothesis, examinees are expected to attend more to the category of question that presents the greater threat to their interests, either the relevant or comparison questions. Subjects who are lying to the relevant issues consider these questions more threatening than the others, which, in turn, draw more attention to the relevant questions, and more physiological arousal. Similarly, innocent subjects find the probable-lie comparison questions more disconcerting, and the greater attention paid to them generates the larger arousals. The expression *psychological set,* together with its underlying assumptions, have long been questioned by scientists on both sides of the polygraph debate. Competing concepts include "Differential Salience*"* (Senter, Weatherman, Krapohl & Horvath, 2010) and "Relevant Issue Gravity" (Ginton, 2009.) See: Krapohl (2001); Matte & Grove (2001).

Psychological Stress Evaluator (PSE)

A voice stress device. Dektor Counterintelligence and Security and Allan Bell Enterprises produced the PSE, first introduced in 1971. This device, which is no longer manufactured, is the original voice stress analyzer. See: Horvath (1978; 1979); Lynch & Henry (1979).

psychopath

An individual with a personality marked with superficial charm, habitual lying, no regard for others, showing no remorse after hurting others, having no shame for outrageous and objectionable behavior, impulsivity, inability to form relationships and take responsibility, failure to learn from punishment, lack of empathy and conscience, and need for excitement. Also referred to as antisocial personality. While popular lore holds that the psychopath, with his diminished conscience, is able to defeat PDD testing, all research has found that the guilty psychopath is no different from guilty non-psychopaths in being detected by the polygraph. See: Barland & Raskin (1975); Raskin & Hare (1978); Patrick & Iaconno (1989).

psychophysiological detection of deception (PDD)

Common scientific term to denote the use of the polygraph to diagnose deception.

pulse pressure

The arithmetic difference between the systolic blood pressure and the diastolic blood pressure.

pulse transit time (PTT)

Period of time for the passage of a mechanical pulse wave between two points on the body. Typically, it is derived by an EKG recording of an electrical discharge from the heart signalling the beginning of a ventricle contraction, and then timing when the blood pressure wave arrives at a distant point in the body, often the finger. Faster pulse transit time corresponds with greater sympathetic nervous system activation. PTT may have some usefulness as a PDD parameter.

punishment theory

One of several theories that attempt to explain PDD. It holds that physiologic arousal during deception is activated by the fear of the consequences if detected. This theory fails to explain why polygraph testing still functions well in the absence of fear.

pupillary response

Change in the diameter of the pupil of the eye in response to stimuli. Pupil size is regulated by the sphincter pupillae muscles in the iris, which respond to parasympathetic stimulation, and the dilator pupillae muscles, innervated by the sympathetic nervous system. Dilation can result from sympathetic nervous system stimulation or the suppression of the parasympathetic nervous system. Pupil dilation has been investigated by several researchers as an index of stress and continues to be a phenomenon of interest in PDD. See: Bradley & Janisse (1981); Webb, Honts, Kircher, Bernhardt & Cook (2009).

Purposeful Non-Cooperation (PNC)

An expression first reported by John Reid to denote a PDD outcome in which examinees had used physical countermeasures in an attempt to defeat the polygraph examination. Reid did not consider PNC to be synonymous with the practicing of deception, though he wrote that it was a fairly reliable indicator of the examinee's motives to deceive.

Quadri-Track Zone Comparison Technique

A single-issue polygraph technique developed and advocated by James Matte which extends the method devised by Cleve Backster. This technique has four "tracks:" *primary track, secondary track, inside track,* and *outside track*. The primary and secondary tracks consist of pairings of two relevant questions with two non-current exclusive probable-lie comparison questions. The inside track contains two questions, one relating to the examinee's concern about a false positive error, and the other regarding the examinee's hope for a false negative error. Independent research has to date failed to support the construct of the inside track (See: Nelson & Cushman, 2011). The questions used in the outside track share some similarities with questions historically referred to as *symptomatic questions*. A 7-position scoring system is used for analysis. For a full explanation, see: Matte (1996). Formerly known as the *Quadri-Zone Technique*.

R-wave peak to carotid incisura (RWPCI)

A cardiac response measured by the interval between the peak of the R-wave on an electrocardiograph (indicating ventricular contracture) and the arrival of the pulse waveform at the carotid incisura in the neck. It has been investigated as a possible additional measure of sympathetic nervous system arousal in the PDD setting.

radial artery

Major artery in the forearm and wrist along with the ulna artery, and one of the alternate PDD recording sites for cardiovascular activity using the blood pressure cuff.

random assignment

Research strategy whereby each selected subject is placed in a given group by chance. This can be accomplished through random numbers tables, coin flips, or other chance methods. Random assignment is one way of assuring that experimental effects are not the result of a systematic error in groupings of subjects. Random assignment is not the same as random selection, which addresses which subjects will participate in the study. Most laboratory studies of PDD randomly assign subjects into programmed guilt or programmed innocence.

random selection

Method in research for extracting samples from a population where each individual has an equal opportunity for selection, and the selection of a subject has no influence on the selection of other subjects. Random selection is used to avoid the systematic error that can occur from other strategies. Random selection is not the same as *random assignment*, which addresses to which group the selected subjects will be placed. In practice, true random selection from the larger population is difficult to accomplish in PDD research. Either subjects are drawn from subgroups, such as military recruits or college students, or they self-select in proportions that may not well represent the larger population, such as through newspaper recruitments.

rank order analysis

Any of the methods of PDD scoring that entail the assignment of ranks to response intensities within channel. Rank order analysis methods for the CQT include the Horizontal Scoring System and the Rank Order Scoring System. First published report for ranking of responses was for the Guilty Knowledge Test in the 1950s. See: Gordon & Cochetti (1987); Honts & Driscoll (1987); Krapohl, Dutton & Ryan (2001); Lykken (1959); Ohnishi, Matsuno, Arasuna & Suzuki (1976).

rationalization

Self deception. In the psychoanalytic model, rationalization is a psychic defense mechanism in which one's true motives or behaviors that are threatening to the psyche are reinterpreted to be other motives that are more acceptable. PDD examiners

routinely watch for indications of rationalization during the pretest interview to prevent a false negative through faulty test questions that empower the self-deceit. No research has evaluated the effects of rationalization on PDD efficiency.

reaction tracing

Section of a physiologic tracing in which an arousal is apparent.

Receiver Operating Characteristics (ROC)

Also known as the Relative Operating Characteristics, it is a graphical plot of the sensitivity, or true positive rate (true deceivers correctly identified), vs. false positive rate (percent of non-deceivers falsely implicated), for a given separation of the distribution of all possible scores for all possible choices of threshold. It is a psychophysical conceptual model for detection efficiency based on *signal detection theory* (SDT). The ROC characterizes the sensitivity of the decision criteria versus the specificity, and is useful to predict false positive and false negative rates across all levels of a criterion (cutting score, in PDD). It is an extension of work from the 1940s regarding the ability of radar operators to discriminate radar signals of friendly aircraft from those of enemy aircraft or noise. See: Swets (1995); Swets, Dawes & Monahan (2000).

recognition test

Polygraph techniques can be divided into two major categories, knowledge-based tests, also called recognition tests, and deception-based tests. The recognition test family of PDD techniques includes the Peak of Tension test, acquaintance test and concealed information test. Recognition tests attempt to determine if the examinee has knowledge only available to persons directly involved in an incident of concern. Because this approach depends upon the existence of a known crime or incident facts that remain unknown to the innocent suspect, the recognition test paradigm is not suited for use as a screening test. See: Krapohl, McCloughan & Senter (2006); Lykken (1959); Osugi (2011).

recovery half-time

Interval between response onset and the return of the response to one-half of the maximum amplitude of the phasic response. Recovery half-time has been investi-

gated as a diagnostic feature with electrodermal data using automated analysis. See: Kircher & Raskin (1988).

recovery time

Period between maximum amplitude of a phasic response and the return to a predetermined level.

red zone

In the Backster framework, it is a 20- to 35-second block of polygraph chart time initiated by a relevant question having a unique psychological focusing appeal to the guilty (deceptive) examinees. One of the three primary zones in the Zone Comparison Technique (red, green, black).

regression analysis

Method for mathematically modeling a relationship and is used in prediction and description. Unknown values for the dependent values can be estimated by what is known about the corresponding independent variables. Independent and dependent variables must be at least interval scale. Regression analysis comes in various forms and is very useful to parse out the contributions individual variables make to an outcome. Multivariate and univariate regression are distinguished by the number of independent variables. At least one PDD algorithm uses a form of regression analysis.

Reid, John

One of the first modern PDD examiners, Reid (d. 1982) developed many techniques still in use today. Reid is credited with bringing the probable-lie comparison question into common practice in the field. He also developed the Reid Technique, which includes the Yes Test and the Guilt Complex Test. Reid helped bring about the first state licensure for PDD practitioners in Illinois in 1963. Reid instructed hundreds of students at his school and offered the first accredited Masters program in PDD. Though the Reid School closed in the 1980s, the Reid Technique is used by some PDD examiners today.

Relevant/Irrelevant (RI) Technique

Family of polygraph test formats in which traditional lie comparison questions are not employed. While originally used in criminal testing, RI tests currently are more often found in multiple-issue screening applications. The RI test can trace its roots to word association tests employed in the early 1900s, and these word tests were later used occasionally during the monitoring of electrodermal activity. The RI was used extensively by pioneers John Larson and Leonarde Keeler in the 1920s through the 1940s, and it is still in use today. Among the screening techniques that have undergone validity research, the RI has been shown to have poorer validity and reliability than any of the more modern approaches.

Relevant Issue Gravity (RIG)

A unifying theory proposed by Avital Ginton (2009) to explain the underlying mechanisms in PDD. According to the RIG theory, the force induced by aggregation of qualities possessed by the relevant issue attracts and binds the guilty examinee's attention to the relevant questions in a manner not experienced by the innocent examinee. It is manifested in the preoccupation in the guilty examinee's mind with the relevant issue and in difficulties to divert attention to other topics or issues. It is postulated that the RIG strength for the guilty examinees on average is stronger than the RIG strength for the truth-tellers. Therefore, it is harder to divert the attention of the guilty examinee to the comparison question and relatively easier to do that with the truth-tellers. The theory is compatible with existing experimental evidence, and does not rely on older hypotheses regarding the central role of fear to explain polygraph reactions. See: Ginton (2009).

relevant question

A question that deals with the target issue of concern to the investigation. In addition to "did you do it" types of questions, relevant questions also include evidence-connecting and "do you know who" questions. Strong relevant questions address the "did you do it" type of questions, while moderate-strength relevant questions address evidence connecting and prior knowledge, such as participation in planning, providing help the perpetrators, or knowing the identity of the perpetrators. Moderate-strength relevant questions also address the examinee's alibi or place him at the scene of the crime.

reliability

Stability or consistency of measurement. Reliability studies in PDD often examine the rate of decision agreement among examiners on polygraph test charts. *Interrater (between rater) reliability* denotes agreement among examiners, whereas *intrarater (within rater) agreement* (test-retest reliability) pertains to an examiner agreement with his or her own decisions when evaluating the charts on different occasions. Reliability is not the same as validity, which means accuracy. A technique cannot be more valid than it is reliable since reliability constrains validity.

relief tracing

Section of a physiologic tracing in which a recovery from an arousal is apparent.

resistance

Degree to which a material hinders the flow of electricity. Skin resistance is one of the measures used in conventional polygraphs. Resistance and conductance are reciprocals of one another. See: Handler (2010).

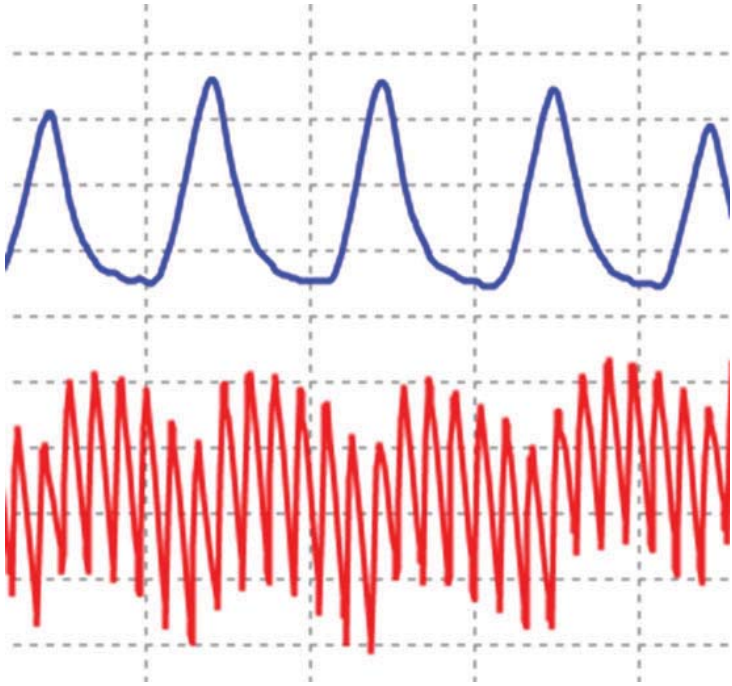
respiratory amplitude

One of several features found in the breathing pattern. Suppression is a reliable indicator of sympathetic nervous system arousal and is one of the features evaluated in the diagnosis of deception.

respiratory blood pressure fluctuations (RBPF)

An undulating waveform observed in the cardiograph channel during PDD testing. During breathing vasoconstrictor neurons are activated in the inspiratory phase leading to rhythmic vasoconstriction of blood vessels controlling blood pressure. Increased vasomotor constriction results in increased blood pressure. Additionally, deep breathing results in negative pressure in the venae cavae resulting in increased blood flow. Increased blood flow results in a larger "pre-load" (the amount of blood returning to the right side of the heart) or end diastolic volume which leads to increased blood pressure. Respiratory Sinus Arrhythmia (RSA) results in increased heart rate during the inspiration cycle. Increased heart rate results in increased car-

diac output which, in turn, results in increased blood pressure. When an examinee engages in a deliberate attempt to control his or her breathing one can expect to see an exacerbation of any cyclic waveform in the cardiovascular channel. The synchronous rise and fall of the relative blood pressure is quite possibly a result of any combination of these physiological factors. The image below shows the undulations in the cardiograph tracing and its relationship with breathing. Note that the timing of cardiograph undulations follows the breathing by about 2–3 seconds. See: Handler & Reicherter (2008).



respiratory cycle time (RCT)

One of several diagnostic features found in the respiratory pattern. The RCT is calculated by measuring the time or linear chart distance between two inspiratory maximums, divided by the same measure of two inspiratory peaks after the subject's vocal response. Lower ratios indicate longer breathing cycle time after stimulus presentation and, therefore, sympathetic nervous system arousal. This principle presupposes stable respiratory patterns.

respiration line length (RLL)

Feature in a breathing tracing that changes during arousal. It is a linear measure of the breathing waveform over a specified period time. RLLs are inversely related to autonomic nervous system activation. This is because the typical breathing response to stimulation or orientation is a suppression in the rate and amplitude of breathing. It was first reported in the PDD literature by Dr. Howard Timm, and several studies have since supported the use of this measure in deception tests. The use of RLL as a deception criterion presupposes stable respiratory patterns. See: Timm (1982).

respiratory sinus arrhythmia (RSA)

Variations in heartbeat directly related to breathing; slower during inspiration and faster during expiration.

rise time

Period between the start of a response to its greatest amplitude.

response onset window

Beginning of the period after question onset in which physiological responses are considered for analysis and scoring.

sacrifice relevant question

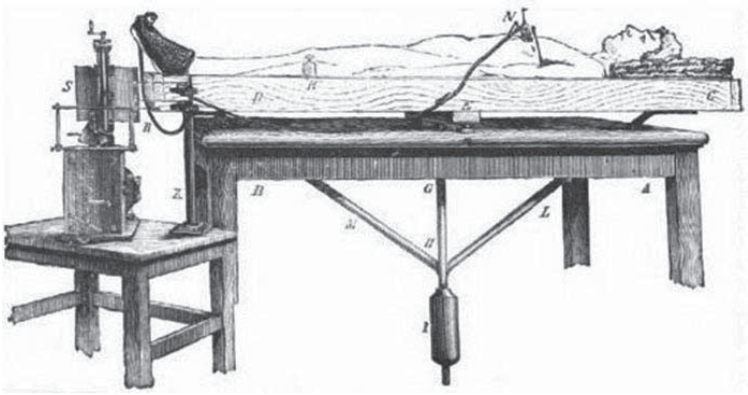
Question introduced by Cleve Backster and used in most forms of the ZCT as well as other types of tests. The sacrifice relevant is a question that asks the examinee if he intends to answer truthfully to every question related to the relevant issue. Its putative role is to dissipate the responses of innocent persons who frequently react to the first relevant question. The sacrifice relevant question is not numerically scored. Its value has been disputed in independent research. See: Capps (1991); Horvath (1994).

salience

The state or quality of standing out relative to other stimuli. It is a vital unconscious process that helps an organism efficiently use limited attentional resources, and facilitates survival. In learning theory, salience refers to the strength of the relationship between a response and a reinforcer or outcome. In general, as the intensity of the outcome increases, the intensity of the response increases. In the framework of PDD testing, the intensity of arousal will increase commensurate with perceived salience of stimuli as they relate to the subject's goals, standards and attitudes.

scientific cradle

Device built by Angelo Mosso to record respiratory and cardiovascular responses to fear. It consisted of a fulcrum base onto which was placed a platform for his subject to lie upon. Using counterweights to bring the platform into balance, the device recorded on a smoked drum using a kymographion the changing balance of the platform that accompanied the undulations of breathing and the shifting concentration of blood in the body. The image below is taken from Mosso's book *Fear* (1896).



screening examination

A polygraph examination conducted in the absence of a reported issue or allegation to investigate whether an examinee has withheld information regarding engagement in behaviors encompassed by the relevant questions that cover specified periods of time. Screening examinations may be designed to investigate both multi-

ple and single types of behavior. The strength of screening examinations is in their utility to develop significant information that is most often not obtainable from any other source. Its weakness is that it is not as powerful an examination as is the specific issue test in terms of validity and reliability. See: Krapohl & Stern (2003).

Searching (or Probing) Peak of Tension (SPOT)

Peak of Tension test in which the testing examiner does not know the critical item, and it is used to determine information concealed by a guilty examinee. Applications of this format include determining the location of stolen goods or the bodies of murder victims, the amount of cash stolen, or the name of an accomplice. There is no published research to support the SPOT.

secondary track

One of four tracks in the Quadri-Track Zone Comparison Technique, which includes the primary, outside, and inside tracks. The secondary track contains a relevant question, and a non-current exclusive probable-lie comparison question against which the relevant question is compared. See: Matte (1996).

sensitivity

Ability of a test to detect specific features at all levels of magnitude or prevalence. Mathematically, sensitivity can be calculated by dividing the number of true positives by the sum of true positives and false negatives. In PDD testing this term is used to describe how well a test identifies a person engaging in deception to the issue under investigation. It is a measure of "true positive" results generally expressed as a decimal (for example a sensitivity of 0.90 would indicate a particular test identified 90% of the liars).

sensory nerves

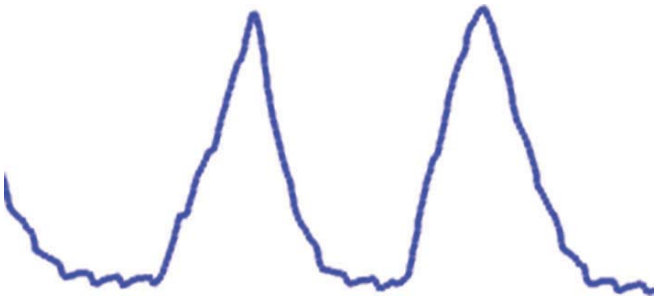
See: *afferent nerves*.

Senter Rules

Also called two-stage rules, Senter Rules are used for single-issue testing. The Senter Rules begin by basing a decision on the total score for the case. If a decision would be inconclusive from the total score rule, the second stage is used in which the spot scores are considered. The net effect of the Senter Rules is to decrease the proportion of inconclusive results while not affecting the proportion of correct decisions. See: Senter & Dollins (2002).

serrated breathing pattern

The breathing tracing that also includes the examinee's pulse due to the proximity of the breathing sensors to the heart. The image below is an example of a serrated breathing pattern.



sexual history examination

A form of *Post-Conviction Sex Offender Testing* (PCSOT) which entails an in-depth look at the entire life cycle of an offender and his or her sexual behaviors up to the date of criminal conviction. Sometimes referred to as a *disclosure examination*. See: Cooley-Towel, Pasini-Hill & Patrick (2000); Dutton (2000); English, Pullen & Jones (1996); Heil, Ahlmeyer, McCullar & McKee (2000).

sexual offender monitoring

Use of the polygraph to verify that sexual offenders on parole or probation are in compliance with the conditions of their release from incarceration.

signal detection theory (SDT)

One approach used to quantify the capacity of a test or method to discriminate between signal and noise. Its greatest value has been in the field of diagnostics, including polygraphy. Using SDT, optimal cutting scores can be calculated that correspond with the costs and benefits of errors. See: Swets (1995) and Green & Swets (1988).

signal value

The perceived significance of a stimulus to an organism, and is related to the concept of salience. Significant stimuli (those with signal value) can elicit physiological responses, and greater signal value corresponds with greater response magnitude. External significance is assigned to a stimulus when it appears to differ from others based on appearance. In polygraphy, this could be when a test question is much longer or is read in a louder tone of voice. Internal significance is assigned to a stimulus due to its meaning. An objective of a CQT examination is to make the external significance of relevant and comparison questions appear equal, and for their internal significance to vary. An innocent examinee would be expected to find higher internal significance in the comparison questions, whereas the relevant questions would hold higher internal significance for the deceptive. See: Handler & Honts (2007).

Significant Physiological Responses (SPR or SR)

Accepted verbiage in the US polygraph screening programs and is equivalent to *Deception Indicated* in specific-issue tests. This alternate language comes from an acceptance that screening examinations do not produce the high validity of specific-issue tests and, therefore, the results are better reported as the presence of physiologic arousals rather than inferring an examinee's deceptive intent.

silent answer test (SAT)

Specialized procedure in which the examinee is directed to answer to himself instead of making a verbal response. The use of the SAT is prescribed by some PDD experts to help avoid distortions to the pneumograph tracings attributable to speech disorders, or to uncover certain countermeasures. To ensure examinees are attending to the content of the test questions, some PDD examiners instruct the examinees to indicate their responses by slightly nodding or shaking their heads. When the SAT is used with head movements, it is called an SAT Nod. See: Horvath (1972).

Silent Talker

A new-generation "lie detector" which extracts measures of body movements and gestures during recorded videos to base assessments of credibility. Decisions are automated using an Artificial Neural Network. Evidence for its accuracy is limited. See: Rothwell, Bandar, O'Shea & McLean (2006).

single-issue examination

An event specific or a screening polygraph examination conducted in response to a single known or alleged incident for which the examinee is suspected of involvement or to investigate the examinee's possible involvement in a single behavioral concern for which there is no known or alleged incident. When used in screening, a single-issue examination typically follows a multiple or mixed issue screening examination in the successive hurdles model.

situational comparison question

Question used for comparison in the Modified Relevant/Irrelevant (MRI) technique that elicits physiologic responses for comparison against those of the relevant question. Situational comparison questions are a departure from their conventional counterparts in that the examinee is not faced with a question to which he is deceiving or uncertain. Rather, this type of comparison question addresses how the examinee is linked to the crime, such as having legitimate access to money that later disappeared or being the last person to see a murder victim alive. The truthful examinee is allowed to respond to a question related to the crime that is not a relevant question, but one for which the examinee may feel uncomfortable because it put him on the list of suspects.

skin conductance (SC)

Broad term for two exosomatic electrodermal phenomena, *skin conductance level* and *skin conductance response*. See: Handler et al. (2010).

skin conductance level (SCL)

Basal conductance of the skin. SCL is the tonic measure of SC.

skin conductance response (SCR)

A change in the electrical conductance of the skin elicited by a stimulus. SCR is a *phasic response*.

skin potential (SP)

General term for the endosomatic electrodermal properties of the skin. Though not currently used in PDD, preliminary laboratory research has shown SP to be as diagnostic as the exosomatic measures. See: Handler (2010); Kircher & Raskin (1988).

skin potential level (SPL)

Basal electropotential of the skin. SPL is the *tonic level*.

skin potential response (SPR)

An endosomatically produced electrodermal response, and of interest as a parameter in PDD. It is frequently measured between the forearm and the hypothenar eminence. (Special note: In the Japanese PDD literature the term *skin potential* was sometimes reported in the English translation when *skin resistance* was actually used in the study.)

skin resistance (SR)

General term for the phenomena of skin resistance level and skin resistance response. SR is recorded exosomatically and was the primary means of detecting electrodermal activity throughout much of PDD history until the introduction of computerized instrumentation with SC. See: Handler (2010).

skin resistance level (SRL)

Tonic level of electrical resistance of the skin.

skin resistance response (SRR)

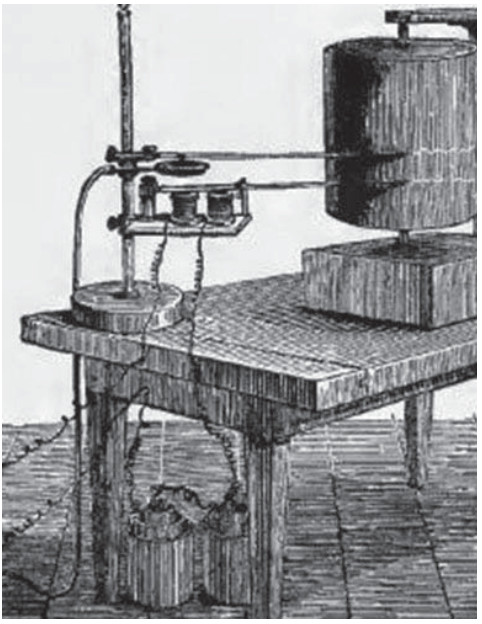
Phasic response measured by electrical resistance of the skin.

S-K-Y

Abbreviation for *Suspect, Know, You*. A standardized Zone Comparison Technique test format that is included under the umbrella of the Backster Zone Comparison Technique. In a structured format, the S-K-Y allows for broadening of the scope of a single-issue test to include questions relating to secondary involvement and knowledge. Along with the questions addressing direct involvement, such as "Did you shoot Henry Jones?", other moderate strength relevant questions could be used, such as "Do you know for sure who shot Henry Jones?" or tertiary issues such as those that place the examinee at the crime scene, address his alibi, or tests prior knowledge. The S-K-Y is rarely used today.

smoked drum recording

An antecedent to the continuous strip chart. A cylinder was wrapped with paper that had been covered with soot produced by a yellow flame. The paper-covered cylinder was rotated against a stylus at a selected rate to produce a graphic recording of physiologic and other events. The recording was preserved by a coat of shellac varnish. The accompanying image is taken from page 153 in Marey's 1885 book *Méthode Graphique Dans Les Sciences Expérimentales Et Principalement En Physiologie Et En Médecine*.



smooth muscles

All of the involuntary nonstriated muscles involved in autonomic functions, except the heart. Smooth muscles are located in the bladder, intestines, and blood vessels. Also called *unstriated muscles*.

Spearman Rank Correlation

Statistical technique for testing the correlation between ordinal-level data (See: *scale of data*). This method can be used to assess interrater reliability for rankings to questions assigned by different evaluators.

specificity

A term most used in the scientific literature to describe the selectivity of a test. It is the proportion of true negatives a test can produce. Mathematically, specificity is the number of true negatives divided by the sum of true negatives and false positives. The specificity of a test will determine its efficiency. If a PDD test can detect deception 100% of the time, but has a high false positive rate, it does not have good specificity and would have lower validity. Specificity and sensitivity are dimensions that characterize the validity of a test.

specific issue polygraph examination

A single-issue PDD examination, almost always administered in conjunction with a criminal investigation, and usually addresses a single issue. Sometimes called a *specific* by PDD practitioners to differentiate from preemployment or periodic testing.

specific point countermeasures

Attempts to defeat a polygraph examination by the self-induction of physiological responses to particular questions. Typical strategies include targeting comparison questions with manipulated respiration, self-inflicted pain, covert tensing of muscles, and sometimes mental imagery. See: Honts & Amato (2002).

sphygmograph

An instrument for graphically recording arterial pulse and blood pressure. A more precise term for the *cardiograph channel* in PDD.

sphygmomanometer

Aneroid gauge used to register air pressure in the polygraph cardiovascular sensor system. Changes in a closed sphygmomanometer system signal changes in relative blood volume at the recording site on the examinee.

spontaneous countermeasures

Efforts used to interfere with PDD testing for which the examinee has not prepared in advance. These types of countermeasures have been shown in laboratory studies to be ineffective. See: Honts & Amato (2002).

spontaneous response

Any reaction not associated with an identifiable stimulus. A high incidence of spontaneous responses can be used as an index of general arousal. Also known as a non-specific response.

spot

A permanently assigned location of a relevant question in a CQT question series.

spot analysis

The numerical evaluation of a relevant question by comparing it to a comparison question to the left or right of that spot location. A "spot" represents the location of a relevant question in a question series; the physiological data at the relevant question (spot) are compared with those of an adjacent comparison question.

spot responder

An as-yet unproven concept wherein an examinee has a propensity to physiologically respond to a question by virtue of its position in a sequence of questions rather

than the content of the question. Some techniques rotate the serial position of relevant questions because of the concern of spot responses.

stabile

Resistant to change. Opposed to *labile*.

staircase respiration

Expression for a pattern of respiration in which the tops of the inhalation cycles move higher or lower with each subsequent cycle, forming the characteristic "staircase" appearance. The increase in respiratory amplitude is called an ascending staircase, while the opposite pattern is a descending staircase. The descending version of this pattern has been found diagnostic in at least one study. See: Kircher, Kristjansson, Gardner & Webb (2005).

standard deviation

Statistical term for a standardized unit of dispersion of scores. When scores are clustered closely together, the standard deviation is small, whereas a wide spread would have a larger standard deviation. Mathematically, the standard deviation is the square root of the variance. Conceptually, the standard deviation is the square root of the average squared deviation from the mean.

statistical significance

Phrase to describe an experimental result that is unlikely to have occurred by chance. In PDD, conventional thresholds of statistical significance are 0.05 and 0.01.

stim marker

See: *event marker*.

stimulation test

Procedure used by many PDD examiners before or between the regular tests. One of its purposes is to demonstrate to examinees that the polygraph works with them,

and in doing so, reassure the innocent while heightening the guilty person's concern about the relevant questions. Other purposes include allowing the testing examiner to set the gains properly, to verify that the sensors are properly placed and functioning correctly, and to acquaint the examinee with the examination procedures. Virtually all stimulation tests use a question set of very similar items in which is embedded a single item that the subject is directed to lie about. There are several types of stimulation tests. The more common are the *card test*, *known numbers acquaintance test*, *blind numbers test*, *control test*, and *true blue control test*. Tests of this nature were used by early polygraph examiners for the purpose of comparing the reactions on the stimulation test with those from the relevant questions on the R/I test. Stimulation tests were sometimes referred to in general as *stim tests*.

Stoelting Instruments

C.H. Stoelting of Chicago, Illinois. An American manufacturer of analog and computer polygraphs.

straight-through test (ST)

A Reid polygraph test with a standard sequence of questions, usually conducted before other sequences are used. In contrast to *Reid's Mixed Question Test* (*MQT*). See: Reid & Inbau (1977).

strain gauge

Generally, any sensor for registering changes occurring in the dimensions of a solid or body. In PDD, respiration is sometimes recorded with pneumatic strain gauges placed about the thorax or abdomen, or both.

striated muscles

Includes all skeletal muscles that perform voluntary contractions, as well as cardiac muscle responsible for the involuntary muscular activity of the heart. Also called *striped muscles*.

stroke volume (SV)

Measure of the amount of blood ejected from the heart in each beat.

strong relevant question

PDD question that goes directly to the heart of the matter under investigation, as compared to knowledge or complicity questions.

subjective lie/truth question

In the Positive Control Technique, examinees are presented with each question two times in succession as a set. Examinees are instructed to admit committing the offense under investigation after the first presentation of each question and deny it after the second reading of the same question. The first time the question is read, it is called the subjective lie question, while the second presentation is called the subjective truth question. See: Driscoll, Honts & Jones (1987); Gordon & Cochetti (1982); Howland (1981); Reali (1978).

successive hurdles approach

In screening, it is a method to maximize accuracy when base rates are unbalanced or very low. For example, an agency may have a vital interest in uncovering past activities of applicants before hiring them, behaviors that are very difficult to investigate effectively with any method except the polygraph. The agency may choose to conduct a single-issue polygraph for each of the subject areas. If there only two or three areas, this approach may be effective, however, if the number is greater, it would tax the agency's resources in terms of polygraph examiners and processing time. Alternatively, in the successive hurdles approach, each applicant would begin with a multiple-issue examination. Though multiple-issue examinations have a higher false positive rate (incorrect decision of deception) than do single-issue examinations, they have a very small rate of false negatives. If no significant responses were noted during the multiple-issue examination, the polygraph session would be over. However, if there were significant responses during the multiple-issue examination, the polygraph session would continue. Next, a single- issue examination would be administered in the area the examiner observed significant responses during the multiple-issue examination. The single-issue examination has much better discrimi-

nation power and would help to elucidate physiological arousal more specifically. In this way, the more resource-intensive single-issue examinations would be reserved for the smaller subset of applicants who did not pass the multiple-issue examination. The net effect of the two-stage screening process is a better accuracy without increased resources. See: Krapohl & Stern (2003); Meehl & Rosen (1955).

Summers, Walter

Early researcher of deception testing who used an electrodermal device and a structured test series to verify truthfulness and deception. Summers reported the use of what he called *emotional standards*, which are similar in many respects to present day comparison questions. See: Summers (1939).

super-dampening concept

Concept forwarded by Cleve Backster which holds that there will be a suppression of general reactivity to relevant and comparison questions when the examinee is more concerned that the examiner will ask an unreviewed question about another issue outside the scope of the current examination questions. Though once widely accepted, the available evidence suggests that the effect is negligible or nonexistent. See: Backster (1964); Capps, Knill & Evans (1993); Honts, Amato & Gordon (2000); Krapohl (2001); Matte (2001).

suppression

One breathing response pattern indicative of orienting and arousal characterized by breathing that is shallower and slower than tracing average. The PDD breathing tracing of suppression will manifest in a decrease in amplitude, a slower rate, or a temporary increase in the baseline of the waveform. Suppression has long been found to be a reliable indicator of salience and a primary reaction criterion for scoring.

surreptitious breathing tracing

Recording of the breathing cycles of an examinee during a portion of the polygraph session when the examinee is not aware of it. Frequently, though not always, this is done just before or immediately after a test is conducted. Surreptitious breathing

recordings are useful to help assess whether an examinee has altered his breathing during testing. Differences can indicate countermeasures. The motives of the examinee may be discerned with a Yes Test or other specialized techniques that help assess the examinee's level of cooperation.

sympathetic nervous system

Thoracolumbar portion of the autonomic nervous system centrally involved in responding to arousing stimuli. Most sympathetic nerves are *adrenergic* and prepare the body to respond to increased demands. Sympathetic nervous activation increases blood flow from the heart, triggers the release of glucose and epinephrine, dilates the pupils, and initiates other responses in preparation for action. Unlike most of the sympathetic nervous system, sympathetic nerves to the eccrine sweat glands are *cholinergic*.

sympathetic chain

A system of 21 to 22 pairs of ganglia located in the thoracic and abdominal areas and is the site of synapse between pre- and postganglionic sympathetic neurons. There is one notable exception—there is no postganglionic sympathetic nerve to adrenal medulla.

sympathomimetic

Drugs that mimic the action of sympathetic postganglionic nerves or their neurotransmitters.

symptomatic question

A question type developed by Cleve Backster that was once thought to identify whether an examinee is fearful the examiner will ask an unreviewed question about an outside issue. In this construct, the examinee's mistrust would dampen his responses to other test questions, and the symptomatic question could determine whether the lack of responsivity was attributable to the outside issue. Symptomatic questions are widely used, though the trend in the research finds they have no meaningful effect. See: Backster (2001a); Honts, Amato & Gordon (2000); Krapohl & Ryan (2001); Matte (2001).

synapse

Junction between neurons. Site where the nervous impulse is transferred from one neuron to another. Neurotransmitters reside in vesicles of one neuron and are released by the axon into the synapse to chemically induce the next neuron or organ to respond.

systole

Contraction of the cardiac muscles. Left ventricular systole results in movement of blood out of the heart into the aorta. Systoles can be subdivided into three primary components: *preejection*, *ejection*, and *relaxation periods*. The left ventricular systolic peak is represented on a conventional polygraph as the highest vertical point in the pulse wave of the cardiovascular tracing.

systolic blood pressure

Force exerted by blood against the wall of the arteries at the height of ventricular contraction. Also called *maximum pressure* and expressed in millimeters of mercury (mmHg).

t test

A statistical test frequently used with small samples (when the number of observations is less than 30) to determine whether the mean of one sample is significantly different from that of other.

tachycardia

Abnormally rapid heartbeat, greater than 100 beats per minute. Tachycardia can result from poisoning, medications, certain illnesses, and during states of anxiety or excitement. A rapid heartbeat is normal for the very young or during the physical exercise of normal adults. While not a diagnostic feature in itself, PDD examiners pay attention to heart rate during evaluation of the polygraphs as it may signal pharmaceutical countermeasures or atypical levels of stress.

tachypnea

Rapid breathing, usually shallow.

technique

All practices taking place in a polygraph examination, including pretest procedures, question formulation, format, number of tests, test sequencing, and scoring and decision rules.

test

In PDD, the *test* is used to differentiate a single running of a question series (sometimes also called a *chart*) during physiological recording from the examination, which is considered to be the totality of the PDD process. It can also refer to specialized procedures within techniques, such as the Yes Test and stimulation test. *Test* has been erroneously used to refer to polygraph techniques, such as the Zone Comparison Test, or Modified General Question Test.

test data analysis (TDA)

Newer expression for polygraph chart interpretation, a change prompted by digital polygraphs where physiological data are displayed on computer screens rather than paper strip charts.

Test for Espionage and Sabotage (TES)

Multiple-issue testing format employed by some U.S. Government agencies for screening purposes. The TES uses a repeated series of relevant and directed-lie comparison questions, and the conventional 7-position scoring system. See: Reed (1994); Research Staff (1995; 1998). Also see: *Directed Lie Screening Test*.

thenar eminence

Prominence on the palm at the base of the thumb. One of the optimal recording sites for electrodermal activity, and a preferred location in psychophysiological research. See: Handler (2010).

thermal imaging

A technique that uses a camera to record the emission of radiant energy from the body. The basis for the technology is that any object with a temperature greater than 0 degrees Kelvin radiates energy in the infrared (IR) range. Although IR energy cannot be seen by the human eye, thermal cameras are equipped to record this form of energy. Changes in thermal patterns on the face have been shown to be associated with physiological arousal, and preliminary evidence suggests that thermal imaging can discriminate between truthtellers and deceivers at better than chance using a probable-lie comparison question technique. See: Pavlidis, Eberhardt & Levine (2002); Pollina (2006); Pollina & Ryan (2003).

thoraco-lumbar division of autonomic nervous system

An anatomical division of the autonomic nervous system (ANS) that represents the sites of outflow from the sympathetic division of the ANS (i.e., nerves from the thoracic and abdominal parts of the body). It is the location of the 21–22 pairs of ganglia that constitute the sympathetic chain.

thumb transducer

Cardiovascular sensor consisting of an external ring and internal bladder, into which is placed the thumb. The bladder is inflated to a small pressure, and the sensor detects changes in the relative blood volume of the thumb. Because of the weakness of the signal, the thumb transducer requires an electronically enhanced cardiograph channel.

time bar

One method of restricting the coverage of the comparison question so that it will not include the time in which the incident under investigation took place. Time bars generally predate the crime. A typical time bar for the comparison question might be phrased "Before the age of X, did you ever..." or "Prior to 1998, did you ever ..." There is a school of thought that examinees may confuse the relevant questions with the comparison questions unless these two types of questions are designed to avoid any degree of overlap. Research has not supported this hypothesis, however. See: Amsel (1999); Podlesny & Raskin (1978); Horvath (1988); Horvath & Palmatier (2008). Also see: *exclusionary comparison question.*

tonic change

Shifting of tonic level to a new baseline, typically at a relatively slow rate compared to phasic responses.

tonic level

Baseline level. This terminology in PDD is frequently used to delineate basal waveform levels from short-term responses induced by stimuli. Tonic levels change slowly compared to phasic activity.

tonic response

Shifting of tonic level, typically in response to changing conditions. For example, the adjustment of electrodermal tonic levels due to temperature changes, reduction of pulse rate between standing and reclining, and faster breathing that accompanies an increase in walking speed. Tonic responses take several seconds or minutes to occur, unlike phasic responses which tend to be very rapid. Some examiners consider changes in tonic activity as diagnostic information in Peak of Tension tests, where a change in the trend of tonic activity can signal that the critical item in the series has passed. Research evidence is lacking despite frequent anecdotal reports.

total chart minutes concept (TCMC)

A concept offered to consider possible variation in the rate of habituation for the individual physiological parameters recorded in PDD. Backster developed a habituation curve for each of the parameters for the amount of time these activities were recorded during testing and published his report in 1963. It has not received much attention among researchers and is not currently taught in the field. See: Backster (1963b; 2001b); Krapohl (2001).

tracing average

Section of the physiological tracing used as a comparative baseline, and in which there are no indications of physiologic arousal. Also referred to as the *baseline level*.

tracing distortion

Contamination of a physiologic tracing, typically by movements of an examinee. Also referred to as *artifact*.

track

Term relating to pairs of polygraph test questions that are used for evaluative purposes, and a concept central to the Quadri-Track Zone Comparison. See: Matte (1996).

transducer

Device for transforming energy of one type into energy of another type. In PDD a transducer is most often used in the context of converting pressure changes into electrical signals.

Traube-Hering-Mayer (THM) wave

Rhythmic low-frequency fluctuation in heart rate (~0.1 hz) linked to a blood pressure feedback loops and involving the carotid baroreceptors. The THM wave is a contributing component to the variability expressed in the respiratory sinus arrhythmia. See: *vagal tone*.

tremograph

Instrument for recording tremors and an early deception detection approach. In the 1930s Luria proposed that trembling could be used as index of emotional arousal, leading to possibilities in detecting lying. His hypothesis was based on his conflict theory (i.e., incompatible emotions affect bodily responses). See: *conflict theory*.

true negative

Correct decision that the variable of interest is not present (i.e., an accurate PDD outcome of innocence).

true positive

Correct decision that the variable of interest is present (i.e., an accurate PDD outcome of guilt).

two-stage rules

Two-Stage Rules function with the sequential use of the Grand Total Rule followed by Spot-Score Rules. Subtotal scores are not permitted to supersede the grand total score. Two-Stage Rules have been shown to reduce the occurrence of inconclusive results and with no decrement to the proportion of correct decisions. See: Senter Rules.

type I error

The probability of rejecting a true null hypothesis. Alternatively, it is the probability of incorrectly accepting the alternate hypothesis. Denoted as α and in PDD consider a false-positive test result.

type II error

The probability of not rejecting a false null hypothesis and denoted as β. In PDD it is consider a false-negative test result.

United States Army Military Police School (USAMPS)

Former polygraph instruction center for U.S. Federal PDD examiners from 1951 through 1986. Now called the National Center for Credibility Assessment (NCCA).

United States v Frye

James Alphonzo Frye was administered a deception test by Dr. William M. Marston in 1923 using Marston's discontinuous blood pressure method. Marston's opinion was that Frye was truthful in his recanting of a murder confession for the killing of a prominent Washington, DC, doctor. At Frye's trial his defense attorneys attempted to have the results entered into evidence but were unsuccessful (United

States v Frye 54 App D.C.46, 293 F 1013). The Frye Rule, as it came to be known, stated that "expert testimony based on a scientific technique is inadmissible unless the technique is generally accepted as reliable in the relevant scientific community." The Frye Rule was invoked thereafter in many jurisdictions to bar PDD evidence from admissibility. The Frye Rule has been superseded by Federal Rule 702, cited in Daubert v Merrell Dow Pharmaceuticals, Inc (1993), except in those states that do not follow the Federal Rules of Evidence. See: Daubert v Merrell Dow Pharmaceuticals, Inc (1993); Stern & Krapohl (2003).

Utah Probable Lie Technique (UPLT)

A technique developed by researchers at the University of Utah beginning in the 1970s, and was initially influenced by the Backster Zone Comparison Test. It differs from other ZCT formats in that the relevant questions are not bracketed by comparison questions. Other unique characteristics of the UPLT are: the inclusion of the photoplethysmograph; rotation of the probable-lie questions; recording of five charts when the test would be inconclusive at three charts; and symmetrical cutoffs of +/-6. The UPLT has been validated in mock crime analog studies and has more peer-reviewed publications supporting it than any other probable-lie technique. More recently the developers of the Utah technique have also endorsed the use of directed-lie questions in place of probable-lie questions. See: Handler (2006); Raskin & Honts (2002).

vagal tone

A measure of parasympathetic influences on the heart as measured by the variability of inter-beat intervals in heart rate (R-to-R wave intervals on an electrocardiogram). This variability, a function of respiratory sinus arrhythmia (RSA), fluctuates at the same frequency as respiratory activity. Characteristically, the inter-beat interval will begin with inhalation, and shorten with exhalation. It has been investigated as a possible alternative measure of stress in a PDD setting. See: Miller (1994).

vagus nerve

Tenth cranial nerve that provides parasympathetic innervation to the heart and other visceral organs.

vagus roll (or pattern)

See: respiratory blood pressure fluctuations (RBPF)

validity

Accuracy. There are several types of validity. The degree to which a test measures what it professes to measure is *construct validity*. *External validity* relates to the generalizability of the research results out of the laboratory. While there are other types of validity as well, these two types go to the heart of research in PDD.

Valsalva's maneuver

Performed by forced exhalation against a closed glottis, thus increasing internal abdominal and thoracic pressure. This results in a short-term increase in blood pressure and frequently a phasic electrodermal response. Because Valsalva's maneuver can directly affect physiologic channels recorded with the polygraph, it is considered a type of physical countermeasures when used during testing. Named for eighteenth century Italian anatomist Antonio Maria Valsalva.

variance

A standardized measure of dispersion and is the average squared deviation from the mean. Mathematically, the variance of a sample or population is equal to the square of the standard deviation. Variance is a useful measure for tests of effects.

variable

Variables in the behavioral science context are those elements that influence or are influenced by something. For example, habituation is a variable that affects responsivity.

variograph

Term sometimes used in the Polish literature to denote the polygraph.

vasoconstriction

Narrowing of blood vessels, especially arterioles, thereby reducing blood flow to a region of the body. During sympathetic nervous system activation vasoconstriction takes place in some parts of the body, shunting blood supplies to major muscles in preparation for defense or flight. Some medications influence vasoconstriction.

vasodilation

Expansion of blood vessels, especially arterioles, which deliver increased blood flow to a region of the body. Vasodilation and vasoconstriction are regulated by the *autonomic nervous system* and can be affected by some medications.

vasomotor

Relating to the influences of the smooth muscles on the internal diameter of a blood vessel.

ventilation

Regular movement of the chest cavity during the act of breathing.

vertical scoring system

Numerical evaluation method in which spots are individually scored by relevant-comparison question assessments. Vertical scoring is used in the ZCT exploratory and S-K-Y tests. Term generally used in contrast to *rank order analysis*.

voice stress analysis

Any analytical technique implemented to determine whether changes in the vocal signal are indicative of changing levels of stress. Most techniques assess the frequency or amplitude modulation of the vocal signal in one or more frequency bandwidths. Emphasis is often placed on modulation in the 8–10 Hz frequency bandwidth, otherwise known as *microtremors*. Numerous voice stress analysis devices have been introduced since the first was made available in 1971. All purport the ability to detect deception. Today, this genre of credibility assessment devices enjoys a wide

distribution, possibly due to their low cost and brief training requirements relative to the polygraph. However, no independent scientific assessment has validated the use of voice stress analysis for credibility assessment. Because of this, these devices are prohibited from use by the US Department of Defense. Brand names include C*omputer Voice Stress Analyzer (CVSA), Lantern, Psychological Stress Evaluator (PSE), TiPi, VSA Mark, Vericator, and Layered Voice Analysis (LVA).*

voir dire

French term meaning "to say the truth." It is the process of questioning jurors for the purpose of excluding those with biases. Pronounced "vwa dear."

Wheatstone bridge

Early electrical circuitry used to detect electrodermal activity. It employed a null-type resistance-measuring circuit in which the examinee's resistance was continually compared to that of known resisters.

Winter, John

Earliest known developer of a scoring system used to interpret polygraph recordings in the detection of deception. His method did not come into wide use and is of historical interest only. See: Winter (1936).

Yerkes-Dodson Inverted U

Yerkes and Dodson proposed in 1908 that an inverted U characterized the relationship between arousal and performance. The level of performance increases with arousal until it reaches some optimum level, beyond which performance experiences a decrement. This model implies that a subject who is under-aroused will not respond sufficiently on a PDD examination, while a subject who is over-aroused will also not respond adequately.

Yes-No Technique

First reported by this name by Richard Golden in 1969, this technique is similar to the Positive Control Technique. Also *Positive Control Technique*.

Yes Test

PDD test series attributed to John Reid in which all comparison questions are omitted from the question list, and an examinee is told to answer "yes" to all remaining test questions. It is preceded by special instruction so to invite physical countermeasures from guilty examinees. The Yes Test is especially useful in identifying examinees who wish to defeat the polygraph test and is generally used only when the examiner has reason to believe that the examinee is attempting countermeasures.

You Phase

One of the most commonly used of the formats in the Backster Zone Comparison Technique. The standardized test addresses a single issue and single degree of involvement in the issue. The format provides for two or three relevant questions, worded slightly differently from one another, addressing the single issue and degree of involvement. It also requires a repeat of the relevant question wording in the sacrifice relevant question. The You Phase ZCT is a very powerful test because it is so highly focused on essentially one question. An example of You Phase question wording is: sacrifice relevant—"Regarding whether or not you shot Henry Jones, do you intend to answer truthfully each question about that?"; relevant 1—"Did you shoot Henry Jones?"; relevant 2—"Did you fire the shot that caused the death of Henry Jones?"; relevant 3—"Last Friday night, did you shoot Henry Jones?" At this writing the technique has been inadequately researched.

zone

Concept coined by Cleve Backster. A zone is a 20- to 35-second block of polygraph chart time initiated by a question having a unique psychological focusing appeal to a predictable group of examinees. In his ZCT, Backster used color-coding to identify the three zones in the ZCT: *red*, *green*, and *black*. Respectively, the red zone for relevant questions, the green zone for comparison questions, and the black zone for symptomatic questions.

Zone Comparison Technique (ZCT)

PDD technique developed by Cleve Backster that contains three Zones (red, green and black), with comparison of responses between two of the Zones (red and green)

for a determination of truth or deception. There are several variations, including the You Phase, Exploratory, Federal Zone Comparison, Integrated Zone Comparison and Utah Probable Lie Test. The ZCT was the first modern PDD technique in general use to incorporate numerical analysis. The ZCT is probably used more often in forensic applications than any other format.

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