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"Believe your chart but don't ignore your nose"

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The intuitive mind is a sacred gift and the rational mind is a faithful servant.
We have created a society that honors the servant and has forgotten the gift.
Albert Einstein

Abstract

Contrary to the past when in addition to chart analysis out of chart information such as: case data, examinees behavior clues, and alike, were factored into the decision-making process of a polygraph test conclusion, today's approach render the decision based ONLY on numerical scoring analysis i.e., quantifying numerically the differences in the physiological responses between the relevant question and the comparison question. This article suggests that due to test's complexity along with the numerical analysis inherent weaknesses, that affect the decisions outcomes examiners should engage their intuition, which was found to be an accumulated subconscious information gained over life experience, as a quality observer mean in their decision-making process.

Key words: numerical analysis, numerical approach, test data analysis, intuition, inherent weaknesses, non polygraphic information, out of chart information, in chart information, thin slices

* Victor Cohen (Reid's student during 1958) quotes Reid.

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Polygraph examiners were often criticized for rendering their decision more on out of chart information rather than on the examinees' physical responses as displayed on the polygraph charts. Regardless of the claim validity, until 1961 it has some merit because, until then, examiners rendered their decision practicing the "Clinical Approach" (also known as "Global Evaluation or Global Analysis") which considered, in addition to the visual inspection of the polygraph charts, out of chart information such as: case data, examinee's behavior symptoms, etc. John Reid In addition to the introduction of the "comparative response" polygraph test question in 1947, the question type that is the cornerstone of the Comparison Question Technique (CQT), formulated the "Reid Technique"* which is not another polygraph test format but, it is a detailed test protocol that compile: The case data, case officer/investigator opinion and view, examinee's behavior symptoms as observed by the receptionist prior of entering the examination room (subject to a defined list of verbal and nonverbal cues), examinee's additional information regarding the case under investigation as well as examinee's background and views, examinee's behavior symptoms as observed by the examiner during the pretest (subject to a defined list of verbal and nonverbal cues), a structured test procedure, a structured test questionnaire, and chart analysis in addition to the examiners' profile and examination room. But in 1961 Cleve Backster introduced the "Numerical Analysis" method which rendered the polygraph test decision based **exclusively** on quantifying numerically the differences in the physiological responses between the relevant question and the comparison questions in a structured test (ZOC). Hence, creating a methodological objective quantification method allegedly free of examiners subjective bias. The method, which ignored any out of chart information became later known as the "Numerical Approach".

Despite the "numerical approach" advantage in 1984 more than twenty years after the numerical approach was introduced Wygant wrote: "... there are still many who believe that scoring is an unnecessary waste of time. Moreover, some have expressed the concern that scoring is a crutch for examiners who lack the courage to make a decision based upon their own best judgment ... What is it intended to accomplish ... Stripping away all of the misplaced concern that scoring requires examiners to relinquish personal judgment to an unthinking system of numbers, we must recognize that numerical scoring of polygraph charts is nothing more than a record

* For further reading of the "Reid Technique" go to: Reid, J.E & Inbau F.E., (1977), Truth and Deception The polygraph ("lie-detector") technique", The Williams & Wilkins Company, Baltimore. Prof. Frank Horvath's presentation "The Reid Polygraph Technique", 48th Annual APA Seminar, Orlando, FL, September 12, 2013 and Polygraph (March 1982) 11(1).

keeping system. At its heart, ... numerical scoring is simply a means for an examiner to keep track of what he observes on the charts, so that by the time he has gotten to the end of the last chart he has a means of recalling what judgments he made at the beginning of the first chart. It is a method of imposing uniformity of chart interpretation from the beginning to the end of an examination, and of preventing excessive reliance on isolated responses." (Wygant,1984: 263).

But accumulated body of research gradually changed the attitude. Such were for example: Raskin et al. (1978) that concluded that (23) (Raskin, Barland, Podlesny 1978): "The results of this project clearly indicate that numerical scoring of polygraph charts produces higher rates of accuracy and reliability of chart interpretation than other methods of chart interpretation.... The usefulness of behavioral cues was investigated ... The results were not supportive of the claims that behavioral observations are effective in assessing truth and deception. Similar results were obtained in Experiment II, and they showed that decisions based on behavioral cues produced more that 50% incorrect designations of innocent subjects as deceptive. Unfortunately, many examiners are taught to place great emphasis on gestures, verbal behavior, and mannerisms in arriving at a decision. At this time the evidence does not support such procedures, and examiners should restrict their basis for decisions to the physiological recordings on the polygraph charts". Szucko & Kleinmuntz (1981: 92-104) concluded that (92): "This study focuses on clinicians' interpretations of polygraph protocols and shows that clinicians perform less accurately than statistical analyses. Statistics outperformed human judges because they used information optimally and applied decision rules consistently, while clinicians tended to add error variance to their protocol interpretations. Unfortunately, current empirical evidence suggests that the prospects for improving clinicians' consistencies are not very promising: the authors therefore recommend the possibility of applying statistical methods to interpreting polygraph data."

In spite of the unwelcome beginning the numerical approach gained more and more support. The manner in which the pendulum turned so extremely in favor of the numerical approach is being expressed in section 1.8 of the "Test Data Analysis: Numerical Evaluation Scoring System Pamphlet" (NCfCA 2017: 6) of the US National Center for Credibility Assessment (NCCA – the Federal Polygraph School) that states: "There is an **axiom in PDD and that axiom is** ... "Believe in your charts!" i.e., "Numerical Evaluation Scoring System"

The introduction of computerized polygraph instruments with its' various automated chart analysis programs such as the: Poly Score, OSS, ESS, and etc., created

a reality in were additional in chart and out of chart information was ignored and later abandoned. Current perspective and nowadays new reality of "believing your chart" is being interpreted by examiners as concentrating **ONLY and EXCLUSIVLY** on tallied numbers and calculated totals while totaly ignore: additional in chart information, charts' inherited weaknesses, out of chart information. And the examiners' intuition a.k.a. nose / guts is considered a banned practice.

The aim of the polygraph examiner's is to render a decision on whether the examinee is truthful or deceptive in their answers to the relevant questions. Can we base this significant decision solely on numerical calculation while ignoring the examiners proficiency which is an outcome of their gained knowledge, experience, observation and discretion compiled into a virtue named "INTUITION"? In 1982 Reid asked: "Are we less professional if we do take them (out of charts information) into account before submitting our final report? My answer is that we are less professional if we do not take behavior symptoms into account. Anyone who is in the business of examining another human being and knowing the fallacies of human nature, in order to be reasonably accurate must include all the information he is capable of collecting and that includes his observations of the subject's behavior." (Reid 1982: 37-45). But if the readers dismiss Reid for being old school read what a prominent researcher such as Ray Nelson who is a leading researcher in developing and improving various automated numerical scoring algorithms (OSS 3, ESS, Ipsative-Z) have to say about the examiner unique human proficiencies and importance alongside the automated numerical scoring. In his latest publication (Nelson 2024) he wrote: "Examiners possess a wealth of experience and expertise that algorithms alone cannot replicate. Their nuanced understanding of the examinee's behavior, context, and other variables can provide crucial insights that algorithms may overlook. Therefore, the correct integration of human expertise with automated or autonomous data analysis methods may entail polygraph professionals serving in the role of quality assurance supervisor, monitoring the algorithms and their outputs... Through active supervision of the algorithm, they can identify potential anomalies or irregularities in the data that warrant further investigation. Additionally, human examiners play a critical role in interpreting the results within the broader context of the examination. They consider factors that algorithms may not fully comprehend, such as the examination target issues, question formulation, and information discussed or reviewed during the polygraph interview, in addition to examining an examinee's functional or physiological anomalies. Furthermore, polygraph examiners play a critical role as a safeguard against algorithmic bias, ensuring that the technology remains impartial and free from any potential prejudices that might

arise from the incorrect use of testing or analysis methods. This oversight is pivotal in upholding the ethical integrity of the polygraph testing process. In essence, while algorithms are valuable tools, the role of the examiner as a knowledgeable and responsible overseer ensures that the human element remains at the core of the process. This balance between automation and expertise is foundational in achieving accurate and ethical polygraph examination results."

So, considering the fact that examiners' decisions are strictly based on "numerical analysis" in spite of not producing 100% accuracy, it is suggested, to let some room for intuition (gut feeling /hunch /nose). Contrary to the common labeling of intuition as being non-scientific / metaphysical / parapsychological / paranormal phenomenon it was established scientifically that intuition is actually a subconsciously gained knowledge based on past experience combined with current additional cues and signals producing an independent opinion isolated from our conscious awareness. Intuition will never overrule chart analysis which will always have the power of veto, but intuition can serve as a semaphore signaling the examiner to take a second look and reanalyze the different elements of the test prior of rendering a decision.

Polygraph charts inherited weaknesses

The "Comparison Question Technique (CQT)" polygraph test is a complex process. The complexity of the test requires the examiners' inter-personal communication skills, the examiners' ability to successfully navigate between being focused and strive on the task ahead while being sensitive and reduce the examinees tension, nervousness and anxiety and deal with it, confronting or avoiding contaminating factors*, weighing the Relevant Issue Gravity (RIG) affect (Ginton 2009), the ability to phrase clinically precise relevant question that are not open to rationalization or misinterpretation, gain the examinees' trust in the effectiveness of the process, instrument and examiner's professionalism and objectivity, implementing the right test format and conducting a proper test. Last but not least is phrasing the proper comparison question. The CQT complexity is best demonstrated in the phrasing of the comparison question. Follows Krapohl and Shaw (2015) guide: "Probable-lie comparison (PLC) ... questions that are too weak or too strong can affect the numerical scores. and consequently, the ability to arrive at a definitive and accurate decision. Comparison questions operate on what might be called the "Goldilocks Principle" because they must not be "too hot" nor "too cold" but "just right" They must be carefully chosen and introduced to each examinee to achieve

* For an overview read Amsel, 2016: 151–157.

high accuracy. Shortcuts in PLC development and execution may lead to decrements in accuracy." So, not "too hot" or not "too cold" but "just right" is left to the examiners' discretion based on their ability to sense the examinees and assess the PLC efficiency. And how do we know that we were successful? And the "directed lie comparison question" is not any different because examiners will never know if the examinees just followed the instructions to lie without having any emotional attachment to the lie or not.

So, although the responses displayed on polygraph charts (the "OUTPUT"), are the physical manifestation of the examinees' cognition i.e., a psychological process. The process might significantly be affected by the variety of these described factors (the INPUT) apart of the examinees' veracity. Or in computer programmers' words: GIGO which stand for: "Garbage In, Garbage Out" meaning that regardless of how accurate a program's logic is, and how accurate are the analysis algorithm, the results will be incorrect if the input is invalid i.e., **the output quality of a system usually can't be any better than the quality of its' inputs**. "The solution is not just spending time on an application's algorithms which produces the output, but more important to spend time on validating the input and/or ensuring that the right sort of data goes into the system"[*].

Weaknesses of the common probabilistic models adopted for the Numerical Analysis

Numerical analysis is indeed an objective method of establishing the examinee's veracity. It is methodical and technical and less effected by human biases, yet when it is based on probabilistic models it comes with typical, sometimes inherent limitations that preclude their capability of being perfectly accurate in their outcome. The following are two of such existing limitations:

- **Base Rate issue**

The numerical scoring focuses on the results of the specific case and fail to factor in earlier measured probability data of such cases and/or individuals i.e., "base rate", pertinent information that may affect the rate of specific outcomes. Also, the probabilistic models used in the field assume base rate of 50% truthful and 50% lying examinee, which is far from representing the actual population from which the spe-

[*] R. Awati, *Garbage in, garbage out (GIGO)*, TechTarget, https://www.techtarget.com/searchsoftwarequality/definition/garbage-in-garbage-out (accessed: March 3, 2024, 18:48).

cific examinee is taken. See Ginton (2022) analysis concerning this issue in real life polygraph testing.

• **Prototype model vs. actual examinee discrepancy**

Apart from the problem of base rate, there is also a concern to what degree can one be assured that the specific examinee in the specific circumstances of the actual test resembles the common examinee prototype and the range of circumstances that comprised the database for estimating the validity of the test format and analysis that was used by the examiner. These limitations are inherent in the statistical paradigms used for assessing the validity of the test format.

In chart additional information

There is no doubt that examiners should render their decision based on chart analysis in spite of its' inherited weakness and in spite of the weaknesses of the common probabilistic models adopted for the numerical analysis. But chart analysis does not mean that the examiners ought to confine themselves strictly to the numerical scoring analysis and overlook additional in chart information. In addition to the measurement of the physiological response differences between the relevant and the comparison questions, information such as: chart clarity, erratic/nervous or calm responses, stability, and etc., should be considered. And of more importance consistency.

Consistency

Validated test formats require repetition of the test questions for at least three times. The logic behind repetitions is that they tend to nullify chance effects and leave the effects that bear consistency. But take the following test data analysis for example: most versions of numerical scoring will render an inconclusive result if the grand total of three to five charts, is ±3. Thus, for instance, if the first chart results in -2, second chart +1 and third charts +1 it totals zero which is a perfect inconclusive. Running two additional charts of +1 each, still leaves the grand total inconclusive. Looking at this from the consistency perspective, show that four charts have pointed in the same direction and only one to the opposite side. So, although not statistically significant under the traditional alfa of 0.05, it strengthens the confidence that the direction of the result is correct and is not a matter of pure chance of random fluctuations. The importance of the consistency factor was demonstrated by Gin-

ton (2013) showing that relying on the consistency factor gives as accurate results and sometimes even more accurate than the numerical analysis per-se.

Sharing intuition in the decision-making process

The Cambridge Dictionary define "Gut Feeling"* as: "a strong belief about someone or something that cannot completely be explained" and "Intuition"**: as: "an ability to understand or know something immediately based on your feelings rather than facts". The instant connotation of gut feeling and intuition is of being a non-scientific / metaphysical / parapsychological paranormal phenomenon. However, researches, portrait a different perspective. In her 2022 book "Switch Craft: The Hidden Power of Mental Agility" Prof. Elaine Fox, a cognitive psychologist by training who founded and directed the Oxford Centre for Emotions & Affective Neuroscience (OCEAN) at the University of Oxford and now is the Head of the School of Psychology at the University of Adelaide, Australia, describes intuition as a very real process where the brain makes use of past experiences, along with signals and cues from the environment, to help us make a decision. This decision happens so quickly that it doesn't register with our conscious mind. In other words, intuition is no psychic parapsychological hocus pocus but rather a decision-making process in where subconsciously knowledge gained through past experience combined with current additional cues and signals make an independent decision which is isolated from our conscious awareness. Furthermore Hurteau et al. (2020) emphasis that intuition is developed through a long, complex, and demanding process in which reflective analysis of experiments, successes, and failures, trial and error play an essential role. Furthermore Prof. Gerd Gigerenzer vice president of the European Research Council (ERC) and the ex-director of Max Planck Institute for Human Development, and the director of the Harding Center at the University of Potsdam propose in his book "The Intelligence of Intuition" that intuition is a form of unconscious intelligence based on experience. His conclusion is based on scientific studies which shows that intuition is not an irrational impulse but rather based on smart heuristics.

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* *Gut feeling/reaction*, Cambridge University Press & Assessment, https://dictionary.cambridge.org/dictionary/english/gut-feeling-reaction?q=gut+feeling%2Freaction (accessed: March 3, 2024, 16:33).

** *Intuition*, Cambridge University Press & Assessment, https://dictionary.cambridge.org/dictionary/english/intuition (accessed: March 3, 2024, 16:35).

Intuition and Detection of Deception

As described, research clearly promotes the use of intuition in the decision-making process. It was found to be an effective tool in the process that improve decisions. Furthermore, some prominent researchers conclude that **intuition can significantly improve humans' detection of deception abilities:**

- DePaulo et al. (2003) found that while direct cues (e.g., various verbal and non-verbal indicators) tend to yield small effects, cues that are assessed more "subjectively" (e.g., vocal immediacy, facial pleasantness, or level of narrative detail) showed significantly greater discrimination.
- DePaulo et al. (2004) concluded that:" ... studies suggest that asking participants to render more holistic or "indirect" judgments regarding a sender can better discriminate truths vs. lies when compared with direct assessments of veracity"
- Albrechtsen et al. (2009) conducted two experiments and reported that: "... both experiments converge to suggest that intuitive processing can significantly improve deception detection performance".
- Ten Brinke et al. (2014) conclude that: "... conscious judgments of veracity are only slightly more accurate than chance. However, findings in forensic psychology, neuroscience, and primatology suggest that lies can be accurately detected when less-conscious mental processes i.e., intuitive are used. In two experiments, we demonstrated that indirect measures of deception detection are significantly more accurate than direct measures".
- Stel et al. (2020) concluded that: "... deliberative conscious information processing hinders the ability to detect deception, while intuitive information processing is beneficial, at least when it comes to detecting the truth."

An additional consideration: Evidence Based Practice

The APA take pride in being "Dedicated to the use of evidence-based scientific methods for credibility assessment"*. The "evidence-based-practice" was introduced as a medical diagnosis decision-making model by Sackett et al. (1996). The model combined three different elements: 1. "Individual clinical expertise, i.e.,

* American Polygraph Association, https://www.polygraph.org (accessed: March 4, 15:42).

the proficiency and judgment that individual clinicians acquire through clinical experience and clinical practice. 2. Patients' predicaments, rights, and preferences in making clinical decisions about their care. 3. Best available external clinically relevant research...." (p. 71). The "evidence-based-practice" considers **the practitioners' proficiency and judgment** which are based on his clinical experience and practice i.e., intuition, as a key component in the decision-making process. Why should we as evidence-based practitioners ignore it?

Conformation bias

One of the strongest arguments against importing out of chart information into the decision-making process is the "conformation bias" which defined by the American Psychological Association[*] as: "the tendency to gather evidence that confirms preexisting expectations, typically by emphasizing or pursuing supporting evidence while dismissing or failing to seek contradictory evidence." While the risk of the confirmatory bias exists, to a lesser degree, in the test data analysis as well (either by overlooking or overweighting or underweighting data) it is hypothesized of an increased affect upon importing out of chart data. Elaad & al. (1994) found that: "Prior expectations affected the examiners' judgments when the polygraph charts did not include clear indications of guilt or innocence, but when the objective physiological evidence included strong indications which clearly contradicted the examiner's expectations, judgments were not affected by these expectations." Although Krapohl & Dutton (2018) found that: "on average, polygraph scores and decisions were shifted in the direction of the biasing information. The shift was evident for both clear and ambiguous data. Not all scorers were affected by the biasing information." They concluded that: "The two studies taken together support the conclusion that when the polygraph data are unclear scorers appeared to be affected by expectations". These researches indicate that prior expectations and/or prior information may affect the examiners' decision making.

Nevertheless, it should be accentuated that these researchers examined the impact of prior expectations and/or prior information on examiners **who evaluated charts blindly and not on the examiners that conducted the actual test**. In other words, their intuition was not engaged in the decision-making process which might have assisted and/or rejected or zeroed the prior expectations. The assumption that if it effects blind chart evaluator it will obviously effect examiners was rejected in Elaad

[*] *Confirmation bias*, APA Dictionary of Psychology, https://dictionary.apa.org/confirmation-bias (accessed: April 23, 2024, 20:40).

& al. (1998) research that concluded that: "No relationship was found between the final judgment of the examiners and their prior expectations." In Wicklander et al. (1975) research six polygraph examiners achieve an average accuracy of 88.33% correctly identifying the 20 verified truthful and deceptive subjects based only upon global chart evaluation. Two months later they were asked to analyze the same charts but this time they have received additional information such as: case data, examinees' personal background, verbal and nonverbal cues as has been displayed in the actual tests and the relevant questions which increased their decisions to an accuracy average of 92.5%.

Since it is a fact that whether we like it or not confirmatory bias exist in any inter-personal engagement and in any human activity. The practical concern is not its existence but rather **to what degree it affects the outcome? What is the magnitude of its' effect**[*] (Ginton 2019)**?** Does it have a small effect or a medium effect or a large effect? Does it affect all examiners or only few examiners? Does it play a role in specific cases or circumstances and/or etc.? As long as the magnitude effect is unknown its' existence should serve (as in traffic) as a "Warning Sign" to the examiner to be cautious, to be alert as with other sensitive issues. But it undoubtedly cannot be argued as a reason to undermine the CQT as claimed by some respectful professors. Because as Hitchens razor states: "What can be asserted without evidence can be dismissed without evidence." And why should we ignore the fact that: "It is biased to claim that bias has only negative effect, in many instances it has positive effect."

Blink: The Power of Thinking Without Thinking (Gladwell 2007)

In the ongoing pursuit to reach accurate test decisions the profession focused on validated test procedures i.e., test protocols, test formats, and test data analysis abandoning practices which were unvalidated or unsupported by research. What we witness nowadays is examiners that base their decision **ONLY** on numerical calculation or even worst only on computerized algorithms, in spite of their inherited weakness, resulting in false results or high rate of inconclusive results. This paper recommends using the examiners' intuition as a mean of quality observer signaling the examiners to take a second look into the different segments of the test.

[*] Ginton (2019) showed that, from an applied perspective rather than a basic science one, based on the current research concerning polygraphs, the estimated rate of tests to be affected by prior expectations of the kind used in the research is only about 3% of the total volume of specific polygraph tests.

The instant connotation of intuition is of being a non-scientific parapsychological, paranormal phenomenon and, it is not considered to be a valid mean of decision-making tool or aide. But current researches prove the opposite. Intuition is a subconscious process utilizing our past experience and knowledge to process surrounding stimuli faster than our conscious mind. And "thin slices" of information demonstrates this capability.

The term "Thin Slices" was coined by Harvard psychologists Ambady & Rosenthal (1992) and it refers to the procedure of making an instant judgment about an individual with minimal amounts of information and within a minimal amount of time based on the individual's thin slices of expressive behavior. Research participants were asked to watched either a 3 or a 4- or a five-seconds video segments of a target (teacher or university professor) entering the class and evaluate the target's internal state, personality, or other social attributes. The participants' evaluation was compared to evaluation made by observers of the full video (5 or more minutes) or end of semester's student evaluation. Research has found that brief judgments based on thin-slicing are similar to those judgments based on much more information. Judgments based on thin-slicing can be as accurate, or even more so, than judgments based on much more information. As accurate as the observer are they are not able to report the factors that influence their judgments probably because intuition is a subliminal perception. Their accuracy refers to: trust, nervousness, expressiveness, and more. Furthermore Ambady (2010) suggested: "that brief, evaluative, thin slice judgments are made relatively intuitively ... such judgments are efficient and can be processed in parallel with other cognitive tasks: Introducing a parallel distraction task demanding attentional resources did not dilute the accuracy of judgments.... such judgments are more accurate ... when they are made without deliberation".

The decisions that polygraph examiners make has a significant influence on an examinee's life. Therefore, examiners have a tremendous responsibility to avoid giving a false result. Being aware of the practice's weaknesses require examiners to be very cautious when rendering a decision. Chart analysis including numerical scoring and additional in chart information should be pivotal to the decision-making process but examiners intuition, which is based on the examiner's prior experience as well as the current cues that have been collected during the examination process, should also be considered as a type of quality observer.

Reference

Albrechtsen, J.S., Meissner, C.A. & Susa, K.J. (2009), Can intuition improve deception detection erformance? *Journal of Experimental Social Psychology, 45*(4), 1052–1055, https://doi.org/10.1016/j.jesp.2009.05.017

Ambady, N. (2010), The Perils of Pondering: Intuition and Thin Slice Judgments, *Psychological Inquiry* 21(4):271–278.

Ambady, N. & Rosenthal, R. (1992), Thin slices of expressive behavior as predictors of interpersonal consequences: A meta-analysis. *Psychological Bulletin, 111*(2), 256–274.

Amsel, T. (2016), Polygraph Examinations Contaminating Factors, *European Polygraph*, 4(38), 151–157.

DePaulo, B.M. & Morris, W.L. (2004), Discerning lies from truths: Behavioral cues to deception and the indirect pathway of intuition. In Pär-Anders Granhag & Leif (Eds.), The detection of deception in forensic contexts (pp. 15–40). New York: Cambridge University Press.

DePaulo, B.M., Lindsay, J.J., Malone, B.E., Muhlenbruck, L., Charlton, K. & Cooper, H. (2003), Cues to deception. *Psychological Bulletin*, 129, 74–118.

Elaad, E., Ginton, A. & Ben-Shakhar, G. (1994), The effects of prior expectations and outcome knowledge on polygraph examiners' decisions. *Journal of Behavioral Decision Making*, 7(4), 279–292, https://doi.org/10.1002/bdm.3960070405

Elaad, E., Ginton, A. & Ben-Shakhar, G. (1998), The role of prior expectations on polygraph examiners' decisions, *Psychology, Crime and Law*, 4(1), 1–16.

Fox, E. (2022), Switch Craft: The Hidden Power of Mental Agility, HarperOne, HarperCollins Publisher, NY.

Gigerenzer, G. (2023), The Intelligence of Intuition, Cambridge University Press, Cambridge, UK.

Ginton A., (2009), Relevant Issue Gravity (RIG) Strength – A new concept in PDD that reframes the notion of Psychological Set and the role of attention in CQT polygraph examinations. *Polygraph*, 38 (3), 204–217.

Ginton, A. (2013), The Importance of the Consistency Factor in CQT and Other Polygraph Tests. *Polygraph,* 42, 146–162.

Ginton, A., (2019), Basic vs. Applied Psychology perspectives lead to different implications from the same data; reevaluating the impact of prior expectations on polygraph outcomes, *Social Sciences & Humanities Open,* Volume 1, Issue 1, 2019, 100005.

Ginton A. (2022), Calculating the Base Rate in Polygraph Populations and the Posterior Confidence in the Obtained Results in the Comparison Question Test, Built upon the Proportion of Outcomes: The Case of Israel Police. *Journal of Police and Criminal Psychology* (2022), http://doi.org/10.1007/s11896-022-09526-6

Gladwell, M. (2007), Blink: The Power of Thinking Without Thinking, Little, Brown & Co., NY

Hurteau, M., Rahmanian, J., Houle, S. & Marchand, M.-P. (2020), The Role of Intuition in Evaluative Judgment and Decision. *American Journal of Evaluation*, 41(3), 326–338.

Krapohl D.J. & Shaw P.K. (2015), *Fundamentals of Polygraph Practice*, Academic Press, USA.

Krapohl, D.J. & Dutton, D.W. (2018), Believing is seeing: The influence of expectations on blind scoring of polygraph data. *Polygraph and Forensic Credibility Assessment*, 47(2), 91–107.

Matte, J.A. (1996), *Forensic Psychophysiology Using the Polygraph*, J.A.M Publication, NY, 42–43.

National Center for Credibility Assessment (NCfCA 2017) PDD 503-ANALYSIS II, (August 2017) Test Data Analysis: Numerical Evaluation Scoring System Pamphlet, Aug 2017 p. 6.

Nelson, R. (2024), Practical Polygraph Integrating Automated Data Analysis Algorithms with Human Expert Decision Making, *APA Magazine*, 57 (1), 40–43.

Raskin, C.D., Barland, GH. & Podlesny, J.A. (1978), Validity and Reliability of Detection of Deception, National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U. S. Department of Justice.

Reid, J. (1982), Behavior symptoms of polygraph subjects, *Polygraph*, 11(1) 37–45.

Reid, J.E & Inbau, F.E. (1977), Truth and Deception The polygraph ("lie-detector") technique", The Williams & Wilkins Company, Baltimore. Prof. Frank Horvath's presentation "The Reid Polygraph Technique", 48th Annual APA Seminar, Orlando, FL, September 12, 2013 and Polygraph (March 1982) 11(1).

Sackett D.L., Rosenberg W.C., Muir Gray J.A., Haynes R.B. & Richardson W.S. (1996), Evidence based medicine: what it is and what it isn't. *BMJ, 3*12, 71–72.

Stel, M., Schwarz, A., Van Dijk, E. & Van Knippenberg, A. (2020), The Limits of Conscious Deception Detection: When Reliance on False Deception Cues Contributes to Inaccurate Judgments, *Frontiers in Psychology*,11.

Szucko, J.J. & Kleinmuntz, B. (1981), Statistical versus clinical lie detection, *Polygraph*, 10(2), 92–104.

Ten Brinke, L., Stimson, D. & Carney, D.R. (2014), Some Evidence for Unconscious Lie Detection, *Psychological Science* 25(5), http://doi.org/10.1177/0956797614524421

United States Government (2011), Federal Psychophysiological Detection of Deception Examiner handbook. *Polygraph*. 40(1), 1–66, p. 33.

Wicklander, D.E. & Hunter, F.L. (1975), The Influence of auxiliary source of information in polygraph diagnosis", *Journal of Police Science & Administration*, 3 (4), 405–409.

Wygant, R.J. (1984), Rationale for scoring, *Polygraph*, 13(3), 263–266.

Confirmation bias, APA Dictionary of Psychology, https://dictionary.apa.org/confirmation-bias (accessed: April 23, 2024, 20:40).

Gut feeling/reaction, Cambridge University Press & Assessment, https://dictionary.cambridge.org/dictionary/english/gut-feeling-reaction?q=gut+feeling%2Freaction (accessed: March 3, 2024, 16:33).

Intuition, Cambridge University Press & Assessment, https://dictionary.cambridge.org/dictionary/english/intuition (accessed: March 3, 2024, 16:35).

American Polygraph Association, https://www.polygraph.org (accessed: March 4, 15:42).

Awati R., *Garbage in, garbage out (GIGO)*, TechTarget, https://www.techtarget.com/searchsoftwarequality/definition/garbage-in-garbage-out (accessed: March 3, 2024, 18:48).

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