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Contents

Articles

- **Avital Ginton:** *Essentials of the Relevant Issue Gravity (RIG) Strength: A Theoretical Framework for Understanding the Comparison Question Test (CQT)* 181
- **Jan Widacki:** *First Attempts at Practical Use of Instrumental Lie Detection* 203

Book reviews

- **J.W.:** *Izbrannye publikacii iz zhurnala "Evropejskij Poligraf"*
(*Selection of papers from [the journal] "European Polygraph".*
Vypusk 1, 2019 (No. 1, 2019), Moscow 2019.
Ocinka dostovirnosti: Naukovi doslidzhennia ta praktyka (in Ukrainian)
Assessment of credibility: scientific research and practice)
2019, No. 2, Kyiv, 2019 225

■ Certificate Impact Factor	227
■ The Basic Information for Authors	229
■ Rules and regulations concerning publishing papers in European Polygraph	231
■ Reviewers	233
■ Ordering Information.....	235

Articles



Avital Ginton*
Tel Aviv, Israel

Essentials of the Relevant Issue Gravity (RIG) Strength: A Theoretical Framework for Understanding the Comparison Question Test (CQT)

A detailed outline version

Сущность значения «Relevant Issue Dravity» (RIG): теоретические основы для понимания «Comparison Question Test» (CQT)

Key words: polygraph, deception detection, lie detection, Comparison Question Test, CQT, Relevant-Issue-Gravity, RIG

Abstract

The essentials of the Relevant Issue Gravity (RIG) theoretical framework for explaining the Comparison Question Test (CQT) (Ginton, 2009), is presented here in a detailed outline format. It is based on the notion that examinees who lie on the test in the relevant questions are attached psychologically to the relevant issue in a different way than the truth-tellers. An essential difference is the strength by which the suspect's attention is directed, focused, and bound to the relevant issue. These aspects of atten-

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tion in the context of polygraph examinations are coined, Relevant Issue Gravity (RIG) Strength. The RIG strength is assumed to distribute differently between the liars and the truth-tellers. There is reason to believe that liars hold a stronger RIG compared to the truthful subjects, and eventually, that affects the differential reactivity to the relevant vs. comparison questions. The following describes the rationale behind the RIG concept, some supporting data, and the theoretical as well as practical implications.

Preface

In 2009 Avital Ginton published an article in Polygraph, the American Polygraph Association scientific journal, under the title:

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, 2009, 38 (3)).

Over the years, the author has realized that there is a need to clarify, widen, and strengthen the RIG concept, and this is the aim of this paper. Since it is not clear how familiar the readers are with this concept and its rationale, the following presentation repeats some of the old stuff, including some basic material that helps to understand the context in which the RIG concept was developed.

Everything starts with the fact that although we would like very much to discern truth from falsehood, we have no reliable way to differentiate with no reservation or mistakes between liars and truthful people or detect the act of lying from telling the truth.

As Long As the “Pinocchio Effect”, which might differentiate with no reservations between liars and truth-tellers, exist only in fairy tales, the strategy that we must adopt is a **Probabilistic Approach**.

Two basic phenomena lie behind our search for a psychophysiological method of deception detection.

Fact 1 – People tend to react with phasic physiological changes when lying. This phenomenon stands behind almost any polygraph usage for lie detection.

Fact 2 – Many times, people react with similar phasic physiologically changes to questions posed to them also when they are not lying, and this stands behind the need to develop questioning methods based on comparing reactions to different questions. As very well known, in practice, the most common method that compares reactions to various questions is the **Comparison Questions Test**, the **CQT**.

In the **CQT** method, to make a call about the truthfulness of the examinee in a case under inquiry requires comparing responses to two kinds of questions: Relevant and Comparison. The basic premise suggests differentiation in the relative strength of reactions between these two categories of questions as follows:

- Deceptive Examinee $R > C$
- Truthful Examinee $C > R$

This is a basic premise of **CQT**, but by now, it is not only a premise but also a research-supported factual phenomenon (American Polygraph Association, 2011; Ginton, 2013; National Research Council, 2003; Raskin and Kircher, 2014). The observed phenomenon is that Deceptive subjects tend to react to the Relevant Questions with stronger reactions relative to their reactions to the Comparison Questions, and Truthful subjects tend to react in a reversed pattern. Thus, the differences in reactions' strength between the two types of questions distribute contrariwise in the two kinds of examinees, the Deceptive and the Truthful ones.

Understanding the **CQT** means first and foremost being able to explain the origin of this phenomenon, and my way to explain it starts by adopting a two-population paradigm.

The Two-Populations Paradigm in Polygraph Testing means that our task is to identify whether an examinee belongs to the truthful population or the population of the liars. (Not as a personality trait but concerning the relevant issues under inquiry).

Figure 1. Difference in Reactions Strength in two populations.

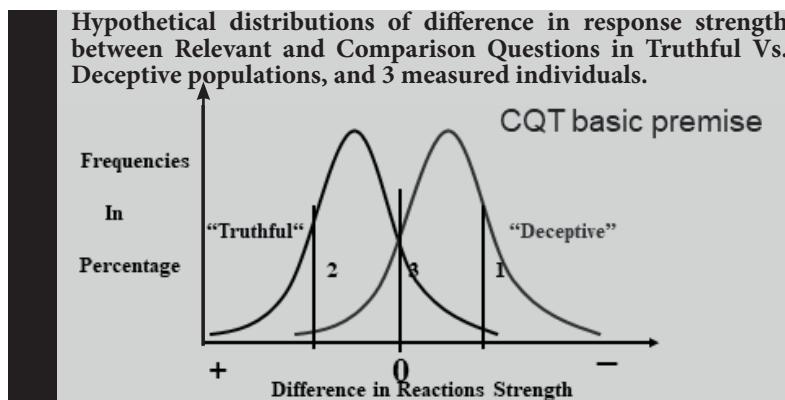


Figure 1: The above figure demonstrates the possibility to make probabilistic inferences about each individual's belonging to one population or the other. Roughly speaking, there is a 90% chance that person number 1 belongs to the RED population and number 2 belongs to the BLUE one, while number 3 has 50% chances to belong to either one of them.

The above figure demonstrates the possibility to make probabilistic inferences about each individual's belonging to one population or the other. Roughly speaking, there is a 90% chance that person number 1 belongs to the Deceptive population, and number 2 belongs to the Truthful one, while number 3 has 50% chances to belong to either one of them.

Based on the two population approach, there are two different strategies to make progress: **A sheer empirical evidence-based and theoretical-based approaches.**

The Empirical Evidence-Based Approach is a purely observational driven attitude that is characterized mostly in the belief that unless something is proven scientifically, we should not treat it as something to rely upon and practically better to ignore it. It heavily depends on statistical theories and methods for examining observed phenomenon to the very fact of its actual existence but pays no direct attention to understand the essence of the phenomena.

The Empirical Evidence-Based Approach in its extreme manifestation totally Ignores the WHY; WHY certain phenomenon shows up? While Concentrating on the WHAT in the sense of "Can we trust that WHAT we get is a reliable phenomenon"?

Opting for the Evidence-Based strategy means concentrating on the Criterion Validity and the Accuracy Rate, as was manifested by conducting Monte-Carlo computations (e.g., Nelson&Handler,2008; Nelson, 2011; Raskin, Honts, Nelson & Handler 2015) and a variety of Meta-Analyses (e.g., American Polygraph Association, 2011; Honts, 2004; Kircher, Horowitz, & Raskin, 1988; National Research Council, 2003). However, this approach ignores the Construct Validity. Thus, even if we get very good results from these sophisticated statistical analyses, it might increase our confidence and, to a certain degree, direct our practice but would not advance our understanding of the CQT.

Some practical people would say that as long as this approach improves our practice, they do not really care about better understanding the CQT, let alone that many examiners are sure that the theoretical framework they were taught in their training is **God's Truth** or at least **Scientifically Good Truth. IS IT?**

The following presentation is not about evaluating the kind of evidence that the Empirical Evidence-Based Approach has relied upon in its important work to validate the polygraph tests, but it is clear that everything depends on the quality of these pieces of evidence and unfortunately, some world-leading scientists have questioned them (e.g., Iacono & Ben-Shakhar, 2019). Rather, the subsequent presentation is dedicated to the other strategy, namely, the Theoretical-Based Approach, which to my sorrow, its status is no better and in some senses, maybe even worse than the Empirical-Evidence-Based one.

The Theoretical-Based Approach. In contrast to the Evidence-Based Approach, the **Theoretical-Based approach deals, first and foremost, with the WHY question.**

WHY does a certain phenomenon exist? Not in the metaphysical, philosophical sense but from a scientific point of view?

Then come the questions of “WHAT” and “HOW”; WHAT causes the phenomenon, and HOW does it happen?

Adopting the Theoretical-Based Strategy, I decided to tap briefly on Four Basic Why Questions.

Four Basic WHY Questions

Why and What triggers the Autonomic Nervous System reactions?

- **Premise 1** – The function of the ANS is to increase the prospects of survival.
- **Premise 2** – This is done by keeping internal Homeostasis and reacting to current or anticipated significant changes in the external world.
- **Premise 3** – Two kinds of changes in the external world are relevant and may be significant to the survival of the organism – beneficial and detrimental.
- **Premise 4** – Facing such significant changes results in involuntary reactions of the ANS, aimed to adjust to the changes, and improve the chances to survive.

Why do people react with Autonomic Nervous System activity changes to Psychological stimuli?

- **Premise 1** – Other than pure physiological functions, attaching significance to stimuli is a psychological process, and most occurred or expected changes in the environment gain their significance from psychological functions and processes such as perception, memory, learning, feeling, etc.
- **Premise 2** – Two kinds of processes are involved in attaching significance to stimuli, Bottom-Up, and Top-Down. While Bottom-Up processes are mainly affected by the physical qualities of the stimuli, the Top-Down processes are driven by the individual state of mind and the psychological qualities of the stimuli.

Why do people respond with the Autonomic Nervous system when they Lie?

- During the years, several theories have been suggested to address this question. The following are some of them:
- CONDITIONING and other LEARNING EXPERIENCES.
- INTERNAL CONFLICTS – COGNITIVE and/or MOTIVATIONAL.
- PERFORMANCE APPRAISAL APPREHENSION – The accompanying tension of evaluating the success of the lying act to deceive.

- AROUSAL THEORIES (Increased cognitive arousal level) – OR; Vigilance; Meaningfulness; Salience; Cognitive load, etc.
- EMOTIONAL THEORIES – Fight, Flight or Freeze (FFF); Threat of potential exposure; Fear of consequences; Shame or embarrassment

Note 1 – The above are not necessarily mutually exclusive.

Note 2 – “Psychological set” targets the differential responses and not the mere response while lying.

And this my way to answer the question of why do people react with Autonomic Nervous system Changes when they Lie?

- **Premise 1** – The default in communication between people is transmitting the truth.
- **Premise 2** – Any act of communication that deviates from the default is a change that needs to be addressed by adjustment of the ANS activity, i.e., physiological reaction.
- **Premise 3** – Thus, in general, lying is a significant event that affects/changes the mind of both parties.
- **Premise 4** – Lying put the liar in a risky situation due to possible adverse rebound from the surroundings.
- **Premise 5** – All of the above are relevant to survival.
- **Premise 6** – Note however, that telling the truth might also be risky sometimes and certainly, significant on many occasions.

Let us turn to the forth WHY Question

Why do we witness the phenomenon that Deceptive Examinees tend to react to the Relevant questions with greater reactions than to the Comparison ones, whereas it is the opposite for the Truthful examinees?

- **Premise 1** – The reversed differential strength of reactions between Relevant and Comparison questions in Deceptive Vs. Truthful subjects depends primarily on the different states of mind between the two kinds of subjects that affects their perception of the questions as significant to their survival.
- **Premise 2** – There is a positive correlation, though far from being a perfect one, between the degree of salience and the importance of the stimuli to survival.
- **Premise 3** – For the Deceptive subjects, the relevant questions seem to be more salient/significant than the Comparison ones whereas, for the Truthful subjects, the relative salience order is reversed, though the “objective salience” stays the same for both groups.

OK, But Why?

While intuitively it seems logical to expect the deceptive subjects to perceive the Relevant questions to be more salient or more significant to their well-being than the Comparison questions, it is quite puzzling, why is the opposite hold for the truthful examinees?

Since it is not directly due to the act of lying (NRC, 2003; Vrij, 2008; Krapohl & Shaw, 2015), a rational way to look for the origin of this phenomenon is to identify related variables that it is sensible to expect them to form similar differential distribution in these two populations. Such similarity, if found, may point at a plausible origin of the reversed pattern of responses in Deceptive and Truthful examinees.

A reasonable candidate for this role may be “Attention” as a mental process or a state of mind and, in particular, the strength by which the suspect’s attention is directed, focused, and bound to the Relevant Issue at the expense of other issues or stimuli.

Upon arrival, and even before that, both the Guilty and the Innocent are busy consciously and pre-consciously in cognitive and emotional mental activity related to the Relevant Issue. It is frightening for both of them, and they are very much under its influence in a way that entraps their attention. This mental and emotional preoccupation with the forthcoming examination, regarding the relevant issues, involves much more than just the fear of the test’s possible consequences. It also contains memories, images, a stream of associations, elevated motivations, etc.

The higher the intensity of this on-going preoccupation of the mind (cognitively & emotionally), with the Relevant Issue, the more compelling the attention invested in it, which in turn increases the preoccupation of the mind in a positive feedback loop. The more you think about it, the more your attention is stuck in; the more your attention stuck in, the more you think about it.

It is a trap for attention resulting from what I’ve termed: The **Relevant Issue Gravity (RIG)**.

The more vital this on-going preoccupation of the mind, the higher the strength of the **RIG**.

The **Relevant Issue Gravity (RIG)** is a psychological force induced by aggregation of qualities that the relevant issue possesses, which attracts and binds the examinee’s attention to it.

This is the product of some general qualities that the relevant issue always possesses due to the very fact of being a relevant issue on the test, plus more specific, case-related characteristics, interacting with circumstantial and personal factors.

The journey of the examined person in polygraph testing always starts in the relevant sphere.

The relevant issue attracts and binds the attention of any normal examinee, whether deceptive or not, and as a by product causes considerable neglect of other issues or stimuli.

In order to pay attention to the comparison question one should first detach himself to a certain degree from the relevant sphere

The RIG strength indicates the degree to which the suspect's attention is attracted to and stuck in the relevant issues, and it is a product of many circumstantial and personal factors.

The RIG can take various levels of strength, and there are good reasons to assume that, on average, the RIG strength for the deceptive subjects is stronger than for the truthful ones.

A major reason for this relates to the existence or absence of relevant memories

In a regular case, Truth-tellers, have no episodic memory of the investigated event, since they were not involved with it. Contrary to that, Liars carry with them traces of memories and genuine emotions from their involvement in the actual occurrences.

Other reasons for the Increased level of RIG in Deceptive Subjects:

- **The “Soft-Underbelly” factor** – The circumstances put the deceptive subjects in a situation in which their weakest and the most vulnerable point is by far the Relevant issue, resulting in a heightened self-focus on it and elevated RIG.
- **The Emotional factor** – On average deceptive subjects experience higher levels of emotions and motivations concerning their involvement with the relevant issue, and that increases the RIG strength for them.
- **The Cognitive factor** – Due to their effort to avoid detection, Deceptive subjects experience a higher cognitive load, which attracts their attention and binds it to the Relevant issue; thus, increases the RIG strength. The increased cognitive load when lying is spread from the actual act of lying to cover the whole situation in which a person has to keep his alertness to prevent exposure. This intensifies the RIG strength in the liars, resulting in less free resources for paying attention to the comparison questions or, for that matter, to any irrelevant stimuli”.

A few more words on the cognitive load factor

Deceptive subjects experience high Cognitive Load. The basic process of formulating a plausible lie may be cognitively difficult. Liars assuming that their credibility is suspected will monitor and attempt to control their appearance so that they appear truthful. Liars are also likely to monitor the examiner's reactions more carefully in order to assess their success in lying. Liars may focus on the task of acting and role – play as truthful. Moreover, liars must suppress the truth while they are lying, since speaking the truth often happens automatically. Finally, as compared to telling the truth, producing a lie is more intentional and deliberate and thus requires mental effort.

Under the two-populations-approach, the difference in RIG strength between the deceptive and truthful subjects is manifested in two different distributions of RIG strengths with some overlapping area, as shown in Figure 2.

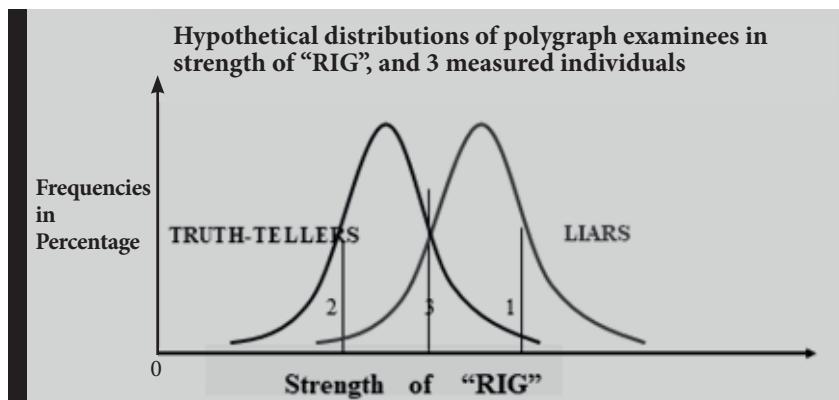


FIGURE 2: Hypothetical distributions of strength of “Relevant Issue’s Gravity” (“RIG”) in Truth-tellers and Liars, with values of 3 individuals. It is assumed that the RIG’s strength is higher for the population of liars and roughly speaking there is 90% chances that #1 is a Liar and #2 is a Truth-teller while #3 has equal chances to belong to either one of the populations.

Assuming the different distributions of RIG's strength between the Liars and the Truth-tellers, to assess the probability that a certain person in a certain circumstance belongs to one distribution or the other, one needs to find a way to measure the RIG's strength value for the examinee.

One way to measure the strength of the RIG for a certain suspect is to find, how much does it takes to distract the examinee's attention away from the relevant issue. The harder it is, the stronger the RIG that the examinee holds.

This shift or change in focus can be achieved by introducing baits to attract the attention of the examinee.

In principle, the baits can take various forms with different levels of attractions.

Within the set of polygraph examinations, the baits are introduced by the examiner in the form of what is known to be the comparison questions and the pretest interview that leads to their formulation. Since the RIG strength for deceptive subjects is high, it is hard to detach their attention from the relevant issue sphere and shift it to the comparison one, while it is much easier to succeed in this with truthful examinees whose RIG strength is weaker.

The most important task the polygraph examiner has in the CQT is managing the diversion of the truthful examinee's attention from the relevant sphere to the comparison ones with minimum effect on the deceptive examinees. A matter which is impossible to standardize without giving room to the existing variability among cases.

Whether the baits were successful in attracting the examinee's attention and divert it from the Relevant Issues to the issues covered by the Comparison Questions, is something to be found by comparing between the psychophysiological responses to the Relevant and the Comparison Questions.

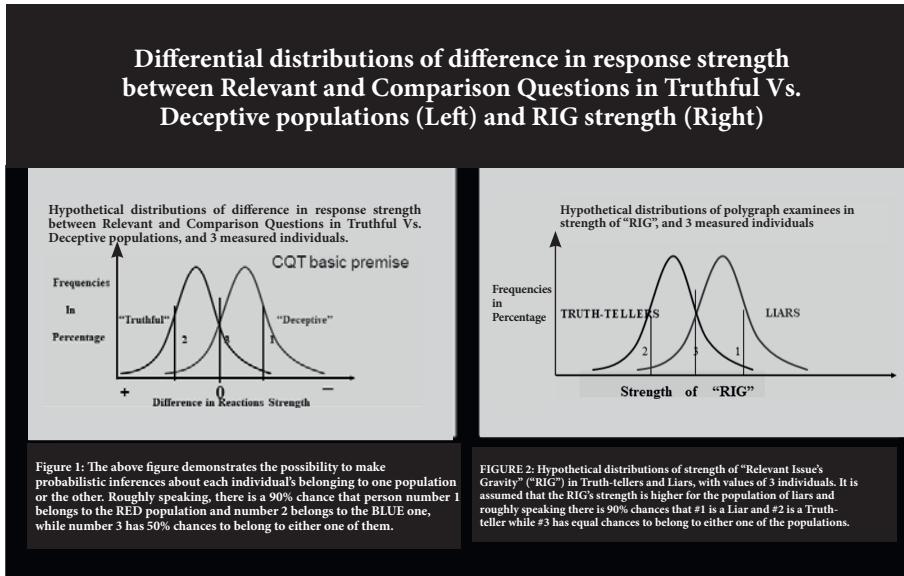
The higher the success of these baits to attract the attention, the stronger will be the impact of the comparison questions and the psychophysiological reactions to them.

According to the RIG strength theory, stronger reactions to the comparison questions indicates a lower level of RIG strength and, therefore, a higher probability that the examinee belongs to the truth-tellers distribution, i.e., he/she is probably a truthful subject and vice versa.

Note however, that if the baits are too big/strong, they might attract almost any person's attention and shift it to the comparison sphere in almost any circumstances. The opposite holds for too small or too weak baits that might fail to attract attention at all. It is just a matter of dosage that a professional examiner must take into account, and the preferred dosage of the Attention-Attracting-Baits should follow the Goldilocks Principle.

Before getting into the Goldilock Principle, let us have a look at the association between the RIG strength proposition and the basic premise of the CQT, which is manifested in the following illustration:

Figure 3. Similarity between the distributions of Response strength in CQT and RIG Strength



The distribution of the observed phenomenon in CQT that Deceptive subjects tend to respond to the Relevant Questions with stronger reactions relative to their responses to the Comparison Questions, and Truthful subjects tend to react in a reversed pattern looks similar to the expected hypothetical distributions of RIG strength.

Back to the Goldilocks principle. It is derived from a children's story "The Three Bears" in which a little girl named Goldilocks finds a house owned by three bears. Each bear has its own preference for food, beds, etc. After testing each of the three items, Goldilocks determines that one of them is always too much in one extreme, one is too much in the opposite extreme, and one is "just right".

Whatever the polygraph case is, this principle stays the same, but the actual values of the "just right" level of the attention-attracting-baits must be changed to fit the individual subject and the specific circumstances.

Not adjusting the size or the degree of the baits to the case means discarding the real meaning of the Goldilocks Principle.

The wise meaning of the Goldilocks principle for CQT

- “Too strong” or “Too weak” baits are not fixed objective values, but rather case-dependent matters, and so is the “Just Right.”
- The examiner should adjust the size or the degree of the baits to the case.
- The difference between typical and great examiners lies in their capability to master this delicate matter.
- “One size fits all or else we lose standardization”, is the motto of the Evidence-Based devotees in our profession, who, in the name of science, worship zealously the strict standardization that prevents chaos but also adversely affects flexibility and creativity. That means that one should not play with the amount or level of the Attention-Attracting-Baits from case to case, from one examinee to another.

Conversely, in line with the RIG strength rationale, it is recommended not be satisfied in following the Evidence-Based standardization blindly but rather keep some flexibility and invest in deepening our understanding of the CQT by asking “WHY”, developing new hypotheses, try them and put them into objective tests by unbiased open-minded researchers.

RIG and the Case of the Screening Tests

Many times for the truthful subjects in screening tests, there is no RIG at all since they can not identify any specific outstanding relevant issue, whereas the deceptive subjects identify their own relevant topic/s spontaneously and develop the RIG to them. For the truthful subject, in this case, we might say that there is a pseudo general RIG that revolves around passing or failing the test as a whole.

In some circumstances, when it is clear to the subjects that a certain issue is outstanding in its importance, a specific RIG can be developed around it also for truthful subjects.

Essentials of the RIG Construct and its Dynamic Role in CQT

1. The journey of the examined person in polygraph testing always starts in the relevant sphere.
2. The relevant issue attracts and binds the attention of any normal examinee, whether deceptive or not, and as a byproduct causes considerable neglect of other issues or stimuli.
3. In order to pay attention to the comparison question one should first detach himself to a certain degree from the relevant sphere.
4. The psychological force generating the attraction to the relevant issue was termed by me “Relevant Issue Gravity” (RIG).

5. The RIG is the product of some general qualities that the relevant issue always possesses due to the very fact of being a relevant issue on the test, plus more specific, case-related characteristics, interacting with circumstantial and personal factors.
6. The RIG's strength indicates the degree to which the suspect's attention is attracted to and stuck in the relevant issues, and it is the product of many circumstantial and personal factors.
7. There are good reasons to assume that, on average, the RIG strength for the deceptive subjects is stronger than for the truthful ones.
8. It is more difficult to detach deceptive examinees from the relevant issue and divert their attention to the comparison questions due to their stronger RIG effect and vice versa.
9. The attempt to divert the attention from the relevant sphere to the comparison one is done by the dynamic of formulating and introducing the comparison questions to the subject.
10. The degree of success in diverting the attention from the relevant sphere to the comparison one is manifested in the difference between the strength of the physiological responses* to the two categories of questions.
11. Success in diverting the attention indicates relatively weak RIG which characterizes a truthful subject and vice versa.

Figure 4. The RIG construct and its dynamic role in CQT



* The origin of the ANS responses and general activity are fundamental living mechanisms “designed” to increase the prospect of survival

Since we assume that it is not the mere act of lying that produces the reversed pattern of reactions strength between Relevant and Comparison Questions in the two populations, the RIG strength is introduced as the missing link that explains this phenomenon.

Some Operational and Empirical Supports for the RIG Strength Theoretical Framework

- The need for having a reasonable time gap between the occurrence of the investigated events or the suspect's interrogation and the CQT test. Otherwise, the RIG is too strong for any examinee and produces Ceiling Effect, which interferes with the differentiation.
- It explains the success of the DLC which functions as a compatible bait for diverting attention from the relevant issue to the comparison sphere.
- Testing alleged victim – High rate of errors due to strong RIG for the truthful victim who carries traces of episodic memories from the event and relatively weak RIG for Deceptive examinee who does not have that memory traces (Horvath, 1977, Ginton, 2013).
- A higher proportion of FP in heavy criminal offenses compared to weak offenses (Elaad & Shterzer. 1985) – Explained by the difference in RIG strengths.
- The bizarre “Blue question” (Ginton, 2016) – Successful bait for diverting attention from the Relevant sphere to the Comparison one without using lie questions.

A word on the bizarre “Blue question” (Ginton, 2016)

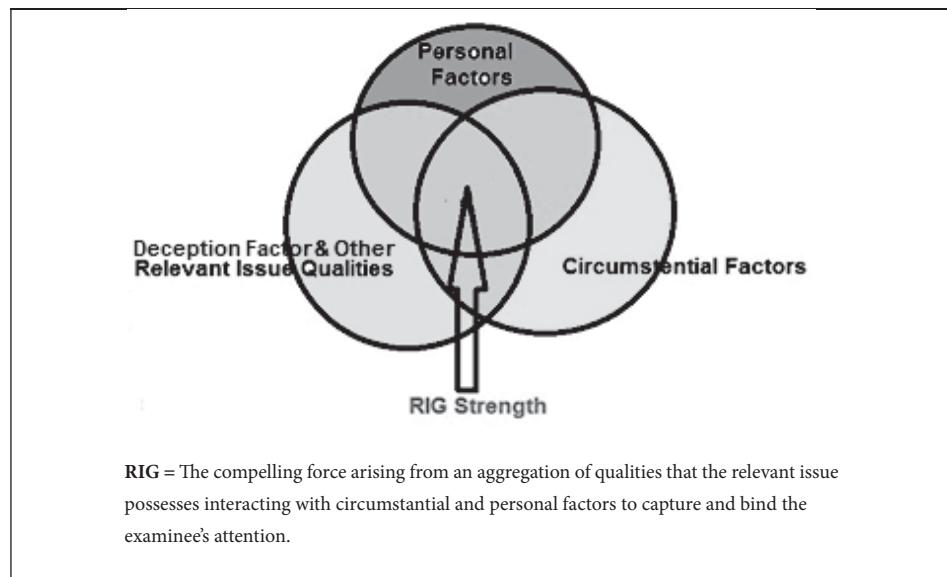
- In a serial arsons case back in the 1980s, I used next to conventional comparison questions also the following one: “Do you like Blue Color in particular?”. However, before I introduced the question, I made the following introductory remark:

“Look Ron; I am about to ask you a question that might look a kind of bizarre to you. But, believe me, it is a highly important question; otherwise, I would not waste my time asking it. So, think very carefully before you answer me, – Do you like the blue color in particular ?”
- Now, regardless of the examinee's answer, the interview went on to discuss the “blue” issue for another few minutes, relating to his/her habits and personality traits and, by so doing, increased the salience of this question. In case the examinee answered that blue is his favorite color, the examiner asked him whether he

considered his attraction to blue to be abnormal or pathological in its nature. The final phrasing of the question was in accordance with this conversation, aiming to get a "NO" answer. Thus, either it was "Do you like the color of blue in particular?" or "Do you consider your attraction to blue to be abnormal?" and eventually, the chosen answer by the examinees was always "NO". All of them turned out to be truthful subjects, as the real arsonist was caught. The point is that this question was as effective as the more conventional ones in indicating True NDI.

It should be stressed that the Deception Factor is not the only factor affecting the strength of the RIG, and there are a variety of personal and circumstantial factors that also affect it, as shown in the following illustration:

Figure 5. Factors affecting the RIG strength



We should be aware of the existence of such factors in each case, and when we encountered a heavy loaded factor in a certain case, we must not ignore it in the name of objectivity and standardization, rather we should relate to it and adjust the pretest interview to suit that specific situation.

In particular, we should maneuver the level or the size of the bait that we are presenting in our effort to divert the examinee's attention from the relevant to the comparison sphere. That is to say, that the examiner should play with the amount of emphasis we/she put on the Comparison vs. the Relevant questions to balance the assumed effect of the identified extra factor on the RIG strength. In fact, this is the meaning of how to use the Goldilocks principle wisely, in presenting the "Just Right" bait for optimizing the CQT outcomes.

This might be a seed for developing in the polygraph profession a scientific-based approach that does not refer to all sorts of variability as something to ignore or "fix" statistically as if it were noise. Rather, variability should be recognized as a phenomenon that has to be treated with what I have termed "ADAPTIVE POLYGRAPHY", in which the polygraph testing procedures and dynamic will not be "one size fits all" but "Different Things to Different People and Different Circumstances".

Examples of Factors other than Lying Vs. Telling the Truth, that might affect the RIG strength

Issue's Factors

- Severity in terms of formal consequences (e.g., the expected punishment)
- Objective Emotional loads (e.g., minor sexual offense Vs. minor theft)
- Personal Factors
- Personality type or traits (e.g., Obsessive Vs. Scatterbrained)
- Previous criminal experience
- Previous polygraph experience
- Social status (e.g., a teacher Vs. a mechanic; celebrity Vs. "no-body")

Circumstantial Factors

- Strength of Existing evidence
- Depth and length of prior interrogation
- Public profile of the case (e.g., no one heard about Vs. daily headlines)

Concrete examples

- Alleged victim case
- Witness to a traumatic event
- Recidivist criminal
- High profile case
- Reexamination

- ADD/ADHD –Attention Deficit (Hyperactive) Disorder
- OCD subjects

For several decades, the theoretical framework for CQT suggested by Cleve Backster in the Sixty's – **The Psychological Set** – was almost the sole theory of CQT in the field of polygraph practice. In the last decade or so, several other theoretical frameworks have been suggested and spread among the polygraph examiners and researchers.

Proposed Theoretical Frameworks to the CQT

- Psychological Set
- Differential salience
- Relevant Issue Gravity – RIG strength
- Preliminary Process
- Cognitive Load

This article is dedicated to the RIG strength theory, but it is worthed to say a few words about the others.

A Note on Psychological Set and Survival Mechanisms

- The tendency to approach beneficial stimuli or options and avoid detrimental ones is not a psychological set but rather an innate, instinctual underlying mechanism of survival. Examples of such tendencies include responding to a good or bad smell, responding to sexually arousing stimuli and responding to dangerous situations.
- In psychology, the term Set mostly relates to an acquired, context-sensitive tendency or readiness (sometimes built upon pre-wired mechanisms), to perceive or act in a certain way. In its active state, it may serve the basic survival mechanisms but not limited to that.
- Within the psychology realm, the expression Psychological Set should be taken as an overall umbrella term for a variety of Sets in psychology, which use different prefixes (e.g., Mental/Perceptual/ Response/Defensive/ Behavioral / Motor, etc.)
- Backster might have been wrong in using the term Psychological Set to explain the innate tendency to respond to the most threatening stimuli while ignoring the others, but was right in pointing out the phenomenon and also that identifying certain stimuli as more threatening than the others depends on the specific Sets that one holds.

A Note on Salience, Psychological Set and Survival Mechanisms

- Reacting to salient stimuli is also an underlying survival mechanism; however, determining which stimuli are more salient depends a lot on the specific psychological set that the person holds at the time.
- A main problem with the Differential Salience Theory for explaining the CQT is the existing of tautological reasoning as follows:
 - **Question:** What causes the difference in the relative strength of reactions to questions?
 - **Answer:** The relative salience of the questions.
 - **Question:** How can you tell the existence of differential salience between the questions?
 - **Answer:** By looking at the difference in the relative strength of reactions to the questions?
 - **Question:** What causes the difference in the relative strength of reactions to questions?
 - **Answer:** The relative salience of the questions.
- In order to solve this tautological reasoning, Salience must be defined independently, outside the loop.

In what respects the RIG theoretical framework presents an alternative to the Psychological Set, the Differential Salience, the Preliminary Process, and the Cognitive Load Theories?

- **Backster's Psychological Set** theoretical framework suggests that people respond with FFF kind of reactions to the most threatening stimuli during the test
- Threat causes physiological reactions.
- **Psychological Set** determines which category of questions presents the most threatening stimulus to the individual subject.
- Other prominent figures in the polygraph field promote the **Differential Salience Hypothesis** suggesting that People respond Physiologically to the Salience of the stimuli in direct relation to its degree.
- **Salience** attracts attention and causes physiological reactions.
- Differential Salience mechanism (it is not clear how it works in CQT) defines the relative salience of the two types of questions to the individual subject.

- The **Preliminary Process theory** deals primarily with the nature of the internal responding processes that affect the kind of physiological responses produced by lying. However, it fails to deal with the difference found in the pattern of responding between truthful and deceptive examinees (Ginton, 2015).
- The **Cognitive Load theoretical framework** attributes the physiological reaction to the amount of cognitive load invested in lying.
- Lying requires cognitive efforts, and cognitive effort stimulates the ANS activity.
- Truthful examinees do not lie on the relevant issue so, no cognitive load due to lying is developed when they face the relevant questions. However, they lie or being uncertain about the comparison questions, and that involves cognitive efforts that are manifested by the increased physiological reactions.
- In contrast, the main effect that the RIG framework attributes to the cognitive load is increasing the RIG strength and by that affecting the amount of free attention available to the comparison issues sphere.
- **RIG** is not a generator of reactions neither a direct stimulator or inhibitor of them.
- Reactions are triggered by survival-pertinent-stimuli (internal & external).
- **RIG** attracts and binds attention to the relevant issue, and its strength affects the balance of physiological responses between the two question categories by modulating the level of free attention available to the Comparison sphere.

The RIG strength offers a psychological mechanism by which the differential crossing of reactions strength that we see between the Relevant and the Comparison questions in the two populations – deceptive and truthful – occurs. Whereas the other theoretical frameworks concentrate on what causes the reactions, be it Salience, Threat, Cognitive Load, or Psychophysiological Processing, and claim that these factors affect the strength of the reactions in such a way that differentiates between the two populations, without suggesting the mechanism through which it occurs.

The current state of the RIG Strength theoretical framework needs proactive research support, and I call upon researchers to put their minds, efforts, and money in this challenge.

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First Attempts at Practical Use of Instrumental Lie Detection

Первые попытки практического использования инструментального выявления лжи

Key words: history of polygraph examination, history of instrumental lie-detection, development of lie-detection

1. William Moulton Marston. Attempt at lie detection based on measuring blood pressure

The first recorded attempt at using an instrumental method of lie detection for practical purposes was, as is generally known, Lombroso's use of the hydroplethysmograph to detect a lie in an actual investigation (see above).

In 1915, William Moulton Marston had already experimented with lie detection based on observations of changes in blood pressure, as described above. In 1917, conducting a research programme of the Psychological Committee of the National Research Council, Marston examined 20 people accused in criminal cases, and directed by the court or the probation authority to medical and/or psychiatric examinations. The guilt or innocence of 16 women and 4 men was judged on the grounds of material evidence,

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medical examinations, testimonies, and lawyers' beliefs. Marston used his method, that is tested blood pressure in non-continuous manner, to examine them. His conclusions were consistent with the conclusions resulting from the remaining body of evidence in all the 20 cases. He found eight subjects to be non-deceptive, and the remaining 12 as partially or fully lying (Marston, 1917).

As the testimonies of Marston's closest collaborators including his wife, Elizabeth Holloway Marston and psychophysiologist Olive Richard (Ansley, 1992; Matte, 1996), demonstrate, the researcher used a test similar to what later became known as relevant/irrelevant test and measured the blood pressure before and after the questions, as he had no device capable of continuous recording of changes in blood pressure (and heart rate) at his disposal. Matte (Matte 1996) believes that Marston was also the precursor of the guilty knowledge test. Marston himself called what he used "an elimination test" and described an example of its application. If it is known that the subject is a member of a gang that killed a man, and names of other members of the gang are also known, while the subject doesn't want to name the other members of the gang who perpetrated the murder with him, he can be asked: "Was Jones with you on the night of the killing?", "Was Smith with you?", "Was Doe with you? (Matte 1996, Marston 1938). Contrary to what Matte claims this is evidently not a test of the Guilty Knowledge type, but a Peak of Tension test in the so-called variant "with an unknown solution" (Widacki 2018).

During the First World War, the aforementioned Psychological Committee suggested applying this method of lie detection for counterintelligence purposes, and recommended the method to the then US War Secretary as 97% efficient. It was then, in 1917–18, that Marston used his method to perform the world's first examinations on spies (Matte 1996, Ansley 1992). As described above, the Japanese used the psychogalvanometer to examine spies in the 1930s.

2. John Augustus Larson and his polygraph

In 1921, a 29-year-old doctor of philosophy with a degree obtained at Berkeley University a year before, and a year's experience as a police officer in Berkeley still unknown to most, published an article entitled *Modification of the Marston Deceptive Test* (Larson 1921) in *Journal of the American Institute of Criminal Law and Criminology*. His name was John A. Larson. The idea he proposed in the article was an advancement of Marston's method, which primarily consisted in the introduction of continuous recording of the operation of the cardiovascular system, as well as of others physiological changes recorded in parallel. Moreover, he proposed formalising the way the subject is asked questions, so that they could be answered shortly

“yes” and “no”. Moreover, the questions were to be asked in a relaxed, monotonous voice. On top of that, Larson constructed a device that made it possible to record simultaneously and in parallel the pulse and the relative oscillations of blood pressure, and record breathing functions. The changes in blood pressure and pulse frequency were recorded with the cardiograph, a developed form of sphygmograph. Connected to kymograph, the latter recorded, as has been mentioned before, only the pulse rate. To record the breathing functions, Larson made use of a previously known method, which required connecting the pneumograph to the kymograph. He recorded these functions on a band of smoke-blackened paper installed on a drum, whose clock mechanism made it revolve at a constant rate.

Thanks to the interest and support of August Vollmer (1876–1955), head of Berkeley Police (California), Larson could use his method and device in practice.

A series of thefts haunted a dormitory inhabited by a hundred female students. All the circumstances suggested that the thefts had been performed by one of the residents, as, taking the evidence into consideration, it seemed hardly possible that the perpetrator could come from outside. Police investigators singled out the residents they considered the most likely suspects for Larson to examine. He used a device that at the time was still unnamed (Krapohl, Shaw 2015), although Larson would sometimes call the machine colloquially called “sphyggy” (short for sphygmomanometer) the “cardio-pneumo-psychogram”. He also decided to use the “sphyggy” on some other residents, subjecting altogether 12 people to the tests. After conducting the introductory interview, which corresponded to a part of what we call today “pre-test interview” he individually connected them to the device and asked a list of 18 questions constructed so that all the questions concerning the theft could be answered “yes” or “no”. The device recorded the physiological reactions (the pulse, relative oscillations of blood pressure, and breathing) during the test, that is while the questions were asked and the answers obtained. Some questions concerned the theft and others, which Larson called “control questions”, did not. However, not all of them were control questions in the sense assigned to the term later by John Reid (see below). Some of Larson’s “control questions” were for example “How much is 30×40 ?” and there were also questions of the type: “Do you always lie when someone or yourself needs protection?” The complete battery of questions Larson asked in the case was:

1. Do you like the college?
2. Are you interested in the course of this examination?
3. How much is 30×40 ?
4. Are you afraid of something?
5. Will you obtain higher education this year?

6. Are you now dancing?
7. Are you interested in mathematics?
8. Was it you who stole the money?
9. The test demonstrates that you stole it. Have you spent it?
10. Do you know where the stolen money is?
11. Did you take the money while others were eating lunch?
12. Did you take Miss Taylor's ring?
13. Do you know who took Miss Benedict's money?
14. Do you know who took Miss Shreder's case?
15. Do you always lie when someone or yourself needs protection?
16. Do you talk in your sleep when nervous?
17. Do you remember perhaps when you talked in your sleep during the last few nights?
18. Would you now like to change any of your answers concerning the theft?

One of the women reacted vehemently after the questions connected to the thefts (critical, "relevant" questions). After the finished test, she jumped up from the chair, looked at the curves, and darted out of the room in fury. A few days later she admitted to the thefts (Larson, 1922; Larson, 1932). Interestingly, one of the students Larson examined was his future wife, Margaret Taylor, who fell victim to the theft of a ring.

For many years Larson conducted polygraph examinations in criminal cases, and investigations of murders, robberies and sex crimes, becoming spectacularly successful. One of the cases was that of William Hightower, accused of murdering a priest. The results of examination suggested that subject was lying, and consequently Hightower was considered guilty and sentenced to death.

Larson's polygraph is recognised one of the greatest inventions in history. *Encyclopaedia Britannica Almanac* lists it among 325 greatest inventions, and its prototype can be seen at the Smithsonian Institution in Washington. In this way, Larson was counted among the greatest inventors in the history of humanity alongside Torricelli, the inventor of the barometer (1643), Volta, who invented electric battery (1800), the Wright brothers who constructed the first aeroplane (1903), Oppenheimer – the creator of the first nuclear bomb (1942), developers of the first computer – Atanasoff and Berry (1939), Einthoven, who devised the electrocardiograph (1903), the discoverer of the individual DNA code, Jeffreys (1984), and the people behind the first laser – Gould, Townes and Schawlow (1958), to name only a handful of other inventions and inventors on the list (www.i-dineout.co./pages/2003/inventions1.html).

In turn, the Smithsonian Institute, situated in Washington DC, is today the world's largest complex of museums and educational and research centres. It was incorporat-

ed as a foundation on the power of the testament of a British scholar, James Smithson, in 1846. The Smithsonian Institution complex comprises among others the Natural History Museum, and the Air and Space Museum.

Appreciating the significance of John A. Larson in the history of polygraph examinations, or of detection of deception as such, one needs to note that his services for the humanity and even the very detection of deception are strongly exaggerated. He was neither the constructor of the pneumograph, which he used in his device, nor of the kymograph that recorded the reactions. All he did was advancing the sphygmograph, which now not only recorded the pulse, but also relative oscillations in blood pressure. For the recording of the reactions monitored by devices that had been in use for decades, Larson used a band of smoke-blackened paper installed on a rotating drum of the kymograph, even though more modern methods of recording the curves were already known, for example in ink on moving band of paper (see for example Mackenzie's "ink polygraph") and with a ray of light aimed at photosensitive paper (Kabes, 1967). Nor did he include in his device the psychogalvanometer, known for many years, which would let him observe the galvanic skin response, a very sensitive indicator of emotions.

Moreover, Larson was not the first to perform instrumental lie detection in authentic cases. In that he was preceded not only by the Italian Cesare Lombroso, but also by his compatriot William Marston (see above). What Larson did significantly develop and formalise was the technique of such examinations. He introduced the pre-test interview: an interview or interrogation, during which the reactions of the examined subject were only limited to a battery of test questions, which basically only required "yes" or "no" answers. There were only certain "control questions" which the subject could answer in a different manner, one of them being, for example, "How much is 30×40 ?" where the result of the multiplication was expected. The researcher divided the questions into relevant, irrelevant, and control, however, understanding the last somewhat differently than John Reid did later, constructing the Control Question Test.

Rather than question Larson's success in detecting the thief in the dormitory, a success that allowed regular employment of the polygraph in investigations, it is worthwhile to remember that it was not the interpretation of polygraph curves that resulted in naming the culprit, but her nervous breakdown at the test that had her revealed.

Certainly, the activity of John A. Larson contributed to the popularisation of polygraph examinations for investigative purposes, and he also had his share in improving both the examination technique and the device itself, but in all the recognition of

his activity and with all the fellow feelings, it is hard to agree that he was an inventor of the magnitude of Volta, Eindhoven or the Wright brothers, and the polygraph he constructed was at par with the aeroplane, laser, radar, and computer.

It is also worth realising that Larson later took a critical attitude at the practical use of the polygraph spreading in America, even more so as it escaped any academic or scientific control. Polygraphers, not all of them properly educated, performed examinations not only for the investigations but also for businesses and assorted private commissions, persuading the clients that the machine and examinations performed with it are 100% dependable. Larson said that he expected that instrumental lie detection would become a sanctioned part of police sciences. Yet the polygraph examinations performed all over the place by people who in many cases when not properly qualified for that, were verging on charlatanry, becoming a way to enforce admission, not unlike beating in bygone times. He believed the practice to be just a psychological "interrogation of the third degree". Which is why Larson regretted to have had his fill in the development of instrumental lie detection (Skolnik 1961, Lykken 1981, Larson 1938).

Indeed, the wild pace of development of practice went unaccompanied by scientific research capable of verifying it and providing it with proper tools. As far as lie detection of the late 19th and early 20th centuries in Europe was dominated by scientific research, and the transfer of its result to practice was all but marginal and wary, the proportions were strongly reversed in America. Larson might have been, as is sometimes emphasised, the first American policeman with a doctoral degree, yet his followers were no more than practitioners without major scientific ambitions. The best testimony to the abandonment of the scientific foundations for the extensively developing practice of polygraph examinations is a look into current literature. There are very few experimental works and even analyses of practical results concerning that scope in the US at the time. A notable exception, and therefore often quoted in literature, is the master dissertation of Alice I. Bryan, defended at the Department of Psychology of Columbia University in 1930 (Bryan 1930). The situation, however, changed after the establishment of the centre in Chicago and science taking over, at least for a time, control over the practice of polygraph use (see below).

Larson, who in the meantime completed his medical studies, left the police finally to get involved in psychiatry. He reached the position of superintendent at Tennessee's Maximum Security Mental Hospital in Nashville, where he died of heart attack in 1965.

3. Clarence D. Lee and Leonarde Keeler: successors to Larson. The “Californian era” of the polygraph continues

California, or more strictly speaking, Berkeley, of the 1920s remained the cradle of the polygraph. This merit should quite likely be attributed to August Vollmer, the head of the local police, who let his officers experiment with the polygraph. Larson’s work in Berkeley was continued by Clarence Lee and Leonarde Keeler.

Captain Clarence D. Lee was Chief of Detectives in Berkeley police force (Krapohl, Shaw 2015). He constructed a three-channel polygraph, which he called “psychograph” (the Berkeley Psychograph). He constructed the first model in 1926 to monitor breathing functions (with the pneumograph) as well as pulse and relative oscillations in blood pressure (using the cardiograph). Besides these, the device featured the stimulus marker that made it possible to indicate the moment when a question was asked and when the respondent answered. The pneumograph, the cardiograph, and the marker were connected to a recording device that used ink markers to chart the reaction curves on paper unwound from a roll at a constant rate. Developing his polygraph, Lee worked with Leonarde Keeler, Larson’s assistant, under the patronage of August Vollmer. In 1937 Lee retired and opened a factory of polygraphs (“psychographs”) that catered for both the police and private polygraphers. Lee not only constructed what at the time was a modern machine but also improved the examination technique. Krapohl and Shaw (Krapohl, Shaw 2015) believe that he was also a tenacious promoter of the Peak of Tension (POT) test, which proved its upper hand over the (classical) relevant/irrelevant tests that were generally used at the time (Lee 1953, Krapohl, Shaw 2015).

In 1924 Leonarde Keeler (1903–49) constructed his first polygraph, which he called “the emotograph”. Keeler completed Larson’s and Lee’s project, and advanced it greatly, patenting his solutions.

Forced by the motions of the chest or diaphragm caused by breathing, the changes of pressure in the rubber tubing of the pneumograph resulted in the changes of volume of metal bellows installed in the device, to which the pneumograph was connected with an air tube. The cuff of the cardiograph, transferring the beats of the pulse and relative oscillations of blood pressure was identically connected to a similar device. The movements of the bellows, the increases and decreases in its volume, were transferred to the markers that charted the breathing curve and the cardiographic curve on a strip of paper moving at a constant pace. Keeler patented the mechanism in 1925, and used it in the machine he constructed and improved in 1926 (Reid, Inbau 1977).

He later furnished his polygraph with a psychogalvanometer to measure and draw the ectodermal reaction curve. There are different opinions in literature on when this actually took place. Stanley Slowik and co-authors (Slowik and all, 1973) believe it took place in 1935. According to Trovillo (Trovillo 1939, Trovillo 1939a), it was Charles Wilson, Keeler's colleague who helped him construct the new device so that their polygraph was capable of simultaneous recording of three variables, including the galvanic skin response, as early as in 1936. In turn, Matte (Matte 1996) states that the device was constructed in 1938, but Reid and Inbau (Reid, Inbau 1977) claim that Keeler complemented the previously two-channel polygraph with a psychogalvanometer only later "in 1949, the year of his death, the 'Keeler polygraph' had an extra unit. Besides those recording blood pressure and pulse and changes in breathing, it had a galvanometer for recording the so-called galvanic skin response, or electrodermal reaction, generally presented as GSR" (Reid, Inbau 1977).

Perhaps all this information is still coherent, as Trovillo might have meant a prototype while Reid and Inbau referred to "Keeler polygraphs" in serial production. However, it was, the polygraph Keeler had patented at the US Patent Office had two channels (US patent Office 1925). Moreover, rather than covering the whole polygraph, the patent extended to the manner of recording reactions on the strip of paper and the aforementioned method of recording the cardiographic reactions (the pulse rate together with the relative oscillations in blood pressure).

It is, however, uncontroversial that it was Keeler who complemented what used to be a two-channel polygraph with the third one: the psychogalvanometer. From that time on the channel has been considered standard in all the world's serially produced polygraphs.

Keeler also improved the technique of polygraph examination. It is he who created the relevant/irrelevant technique, today called classical and based on the tests composed of "relevant", that is critical, questions and irrelevant ones, all constructed so that the subject could provide short answers "yes" or "no" to all of them. As far as one can have doubts whether the Peak of Tension tests were invented by Keeler or Lee (or perhaps Marston?), it goes without saying that Keeler was not only the author of the "searching peak" variant of the POT but was also the first to use it successfully in practice as early as in 1929, while looking for the body of a missing Navy officer in Seattle (Washington).

Still in the 1930s, three variants of POT (Peak of Tension) test were used in the US. In the first, fundamental, one, the correct answer ("the key") is known to the polygrapher and the subject, if the latter is the perpetrator, but cannot be known to an innocent

suspect or subject. The second is the so-called “POT – searching peak”, in which the polygraphers does not know the key (i.e. the correct answer) that can be a name, a place, or a value. The third is the stimulation test that for example, includes a card, a number, or a name (Ansley 1992).

4. The beginning of the “Chicago era” of the polygraph

The 18th Amendment to the Constitution of the United States was passed in 1919, and came into force on 17 January 1920. It implemented the Noble Experiment, colloquially and more generally known as the prohibition. Production, sales, and transport of alcohol was banned in the whole territory of the United States.

The “experiment”, that gives food for thought to sociologists and criminologists even today never reached the intended goal. It is estimated that the number of illegal bars, clubs, and alcohol selling ventures functioning in New York only in the 1920s was between 20,000 and 100,000. The situation was similar in all the US metropolises. All these illegal points of sales and speakeasies required the supply chain built of illegal breweries, distilleries, and wineries. The system also needed an organised network for smuggling alcohol from abroad and a distribution network. Gigantic underground alcohol operations developed. The business, as big as illegal, required protection and division into zones of influence, which necessarily had to lead to conflicts between its participants. As part and parcel of the “noble experiment” the US got itself a vast, perfectly organised criminal demimonde. Soon the situation was aggravated by the Great Recession of 1929–33. The increase in crime rate accompanying the illegal production, smuggling, and sales of alcohol was huge. The gory gang warfare became part of everyday life of major American cities until the St Valentine’s Day Massacre in February 1929. Al Capone’s hitmen killed seven members of a competing gang of Bugs Moran. The massacre made Americans aware of the true results of prohibition, and especially its side-effects. That was when the first steps to withdraw from prohibition were taken, until finally, on 5 December 1931, the 21st Amendment to the Constitution nullified the 18th Amendment, and the entire prohibition together with it. What was left in its aftermath was gigantic, organised crime, which soon began to feed on the drug business.

The 1930s were a decade of difficult fight against organised crime in America. Gangs made their home primarily in the big cities, especially in Chicago and in New York. Little wonder therefore that Chicago became the centre of combating crime. This is where the Bureau of Prohibition of the Department of the Treasury, a section of the Federal Police known as The Untouchables and commanded by the legendary Eliot Ness (1903–57), started its efficient operation. It was also here, that the Scientific

Crime Detection Laboratory was organised at the Northwestern University. Later, in 1938, it would become an organisational unit of the Chicago Police Department. The laboratory was organised in 1929, after St Valentine's Day Massacre to help police fight gangs. It was America's first such laboratory, modelled on similar developments in Europe. The scope of research (expertise) of the laboratory included testing blood and its traces, ballistic expertise including identification of firearms based on the traces left on the ammunition, identification of fingerprints and footprints, identification of handwriting, typescripts and inks, studies of traces left by vehicles, as well as chemical and toxicological investigations. Besides its permanent personnel, the laboratory employed a large bevy of consultants in different fields. Individual labs served not only investigations, catering for the police and courts, but also organised a plethora of practical courses in methods of conducting investigations. One of its founders and the first director (until 1934) was an eminent expert in firearms identification, Calvin H. Goddard (Goddard 1976).

In 1930 Leonarde Keeler moved to Chicago and began his work for the Institute for Juvenile Research, where he promoted polygraph, and conducted experiments with the use of the psychogalvanometer for eight years (Trovillo 1939). Moreover, as we know, he actively cooperated with the Scientific Crime Detection Laboratory.

As Goddard recalled many years later, in the autumn of 1921, Professor Wigmore mentioned to him that he had met a remarkable young man of the name Keeler at a seminar of the Chicago Bar Association, and that that Keeler demonstrated "a mysterious little black box" that he used to guess numbers selected by people participating in an experiment. Goddard found Keeler at the Institute for Juvenile Research and let him set up a section of polygraph examinations at the laboratory of the Northwestern University that he was about to open (Goddard 1976).

Leonarde Keeler now stood at the helm of the newly established section of psychology, which conducted polygraph examinations and, beginning with the mid-1930s, trained the first agents of the Bureau of Investigations, soon to be transformed into the Federal Bureau of Investigation (FBI), in polygraph techniques (Department of Defence 1984).

The laboratory began to publish a journal entitled *The American Journal of Police Sciences* that merged with the *Journal of Criminal Law and Criminology* in 1932. A year earlier, that is two years after its incorporation, the laboratory had won the renown of "scientific to the highest degree, unparalleled throughout the United States" (Goddard 1976).

Since the 1920s Chicago was also home to the aforementioned Institute for Juvenile Research, dealing with the various aspects of juvenile delinquency (currently, the Institute is a part of the Department of Psychiatry, College of Medicine, University of Illinois at Chicago). It goes without saying that Chicago of the 1930s became an important centre for criminology and forensic sciences, while the mutual ties that connected science and practice seem to be of model nature even today.

One of Keeler's collaborators in the first years of his work at the Northwestern University, was Fred Inbau. In the experimental research they conducted, the two scientists obtained even 85% of correct results, and in authentic cases, the people considered deceptive confirmed the correctness of their conclusions in 75% of cases (Keeler 1930, Inbau 1935). Experiments involving volunteers were also made with the "truth serum" based on scopolamine. Despite the allegedly interesting results, Keeler never published any of his studies on the subject (Stevens 1994). His primary focus, however, remained polygraph examinations for investigative purposes.

Trovillo (Trovillo 1939), quoted frequently above, reports that 2171 people were subjected to polygraph examinations at the Scientific Crime Detection Laboratory of the Northwestern University in Chicago from the 1 January 1935 to 1 June 1938.

Fred E. Inbau (1909–98) is one of the most important figures in the history of polygraph examinations. Having obtained his advanced degree from the Northwestern University in 1933 he began working for the Scientific Crime Detection Laboratory of his alma mater. When the laboratory was transferred to the Chicago Police Department in 1938, Inbau was made its director. From 1941 to 1945 Inbau was a trial lawyer in one of the most prestigious legal offices of Chicago, yet he returned to the Northwestern University as a professor of the law faculty in 1945. Soon he was nominated Chair of Criminal Law. Inbau's prime scientific interest was evidence in criminal procedures, and especially the interrogation tactics. His books on the subject, to mention *Criminal Interrogation and Confession*, are certainly classics recognised worldwide.

Inbau perfectly well combined the knowledge of criminal procedures and criminal sciences. He obtained the honorary title of John Henry Wigmore Professor of Law, was made President of the American Academy of Forensic Sciences, and was the founder and long-term editor-in-chief of *Journal of Criminal Law, Criminology and Police Science* published to this day. The area of his interests included the polygraph. It is to a great extent thanks to Inbau that scientists took a renewed interest in the polygraph, and that again, albeit only for a time, science took control over the spreading practice of polygraph use, at least defining the standards for examination.

For Fred Inbau, a professor of criminal law and criminal procedure, and President of the American Academy of Forensic Sciences, polygraph examinations evidently belonged among such sciences, hence they had a place at the Scientific Crime Detection Laboratory. This beyond doubt raised the prestige of such examinations. It is quite characteristic that – actively supporting the development of forensic sciences, whether as an employee, and later director of America's first modern criminalistic laboratory and the President of the American Academy of Forensic Sciences – Inbau paid most attention to the tactic of interrogation and polygraph examinations.

Keeler trained not only the first FBI polygraphers, but also, some years later, their colleagues from the Secret Service and – during the Second World War – from the US Army (Department of Defence 1984). He founded the first school for polygraphers in the US, and also in the world, where experts were trained according to a formalised program, accounting for state-of-the-art achievements of science and practical experience. From that time onwards, these were primarily the graduates of Keeler's school that embraced the posts of polygraphers in federal institutions, and polygraph examinations became a staple practice in a plethora of federal institutions in the US. The aforementioned report (Department of Defence 1984) states that such examinations were routinely conducted in 15 federal agencies and departments. Therefore, it can be claimed that polygraph examinations were also broadly used outside criminal investigations after the Second World War. However, it must be remembered that polygraph examinations had been used for interrogating prisoners of war and spies even earlier, during the first (Marston) and second world wars. Their scale was strongly expanded both by Americans and the Japanese (see below).

As soon as the Northwestern University sold the Scientific Crime Detection Laboratory to the city of Chicago, which included it into its police Department, Leonarde Keeler left to set up his own company, Keeler Laboratory. It had its registered seat in LaSalle Street in Chicago. Both Keeler himself and his collaborators continued performing polygraph examinations for investigated purposes and to private commissions, and also trained polygraphers for the police. The course of the training was as follows: first, participants were intensively taught examination technique for a fortnight, so that they could later return to their units, where they had to perform experimental examinations, to return again to Keeler Laboratory for the following stage of the training. The whole cycle lasted altogether for six months.

One of Keeler's first trainees was Colonel Ralph Pierce from the US Counterintelligence School in Chicago: the first polygrapher trained for the US Army. Several other officers followed in his footsteps, and polygraph examinations were introduced in various units of the armed forces. In 1935, the head of the FBI laboratory, E.P. Coffey was

trained by Leonarde Keeler at the laboratory of the Northwestern University in Chicago. In April 1936 FBI purchased its first polygraph unit (Keeler polygraph), and used it in the first extermination in an authentic criminal case a year later. The FBI research programme in polygraph examinations opened in 1936 (Ansley, Ferguson 1987).

In the 1930s there were already a number of companies in the US offering polygraphs they produced. Besides Lee's polygraphs (psycho graphs) marketed by a small producer Clarence Lee & Sons in San Rafael, California, first Keeler devices (Keeler, polygraphs) were produced by Western Mechanical Company: the first serial production of polygraphs. In the three months since the launch of production, the company sold several dozens of devices. They were designed by Keeler, with improvements introduced by William Scherer. Apart from the two channels (cardiograph and pneumograph) the device featured a questions marker that allowed to indicate the moment when the question was asked on the tape driven by an electric motor, on which ink markers charted the cartographic and graphic curves. The sensor of the pneumograph was an elastic rubber tube installed around the chest, identical to what is currently practiced. The whole was encased in a mahogany box reminding a travelling suitcase. The later (post-1930) models of Keeler polygraphs were produced by Associated Research Inc. in Chicago.

In 1935 C.H. Stoelting Company based in Chicago and specialising in medical (physiological) and psychological measurement devices set up in 1886 produced its first polygraph. It was a two-channel (cardio and pneumo) device. However, in the 1930s, Stoelting produced a certain number of Darrow's photopolygraphs that monitored breathing functions, pulse rate, and the relative oscillations of blood pressure as well as the galvanic skin response (GSR), and optionally additional channels, for example, the plethysmograph. The device also made use of a questions marker, the peculiarity of that particular model was the recording performed with a ray of light on photosensitive paper, which gave origin to its name. Darrow's device was used among others, by the US Bureau of Prisons, the Narcotic Farm (punitive institution for drug addicts) in Kentucky, as well as the University of Chicago and University of Kentucky for the purpose of scientific research. A single piece was sold to China. Interestingly, a single Darrow device was purchased by the Institute of Psychological Hygiene in Warsaw in Poland before the Second World War (Trovillo 1939). However, it can be claimed with all certainty that it was not used for research on lie detection. The Institute's primary field of interest was child psychiatry. There are no works connected to lie detection on the list of works published by its staff. The device was in all probability only used for diagnostic purposes, while examining emotions (Widacki 2014).

In the 1930s polygraph examinations were also object of scientific research undertaken at American universities. Besides the Northwestern University in Chicago, such re-

search was also conducted at the Catholic Fordham University in New York. Founded in 1841 by the Diocese of New York as St John's College and managed by the Jesuit Order (whose graduates by the way include William Casey (1913–87) head of CIA from 1981 to 1987 and (sic!) Donald Trump), the university conducted experimental studies on lie detection in the 1930s. Fr Walter Summers, a Jesuit and head of the Chair of Psychology of the University used the “pathometer” of his construction and based on a psychogalvanometer to perform around 6000 experimental examinations and over 50 further in authentic criminal cases, reaching an exceedingly high accuracy of verdicts in the range of 98%–100% (sic!) (Summers 1936). Summers used a proprietary examination technique, consisting in conducting three tests that contained relevant and irrelevant questions as well as ones that he called “emotional standard” and which in fact were just control questions (Summers 1939). The tradition of polygraph examinations at the university was continued after the war, as proven by the valuable works of Kubis from the 1960s and 1970s (Kubis 1962, 1974).

Laboratory experiments with the Peak of Tension (PoT) tests with participations of students were performed by Christian Ruckmick at the University of Iowa (Ruckmick 1938), while C.E. Obermann tried to use the EEG for lie detection with good results (Obermann 1939).

Not only psychological or psychophysiological grounds for lie detection were a subject of academic research but so was lie detection itself. The achievements of American science of the 1930s were significant and played a range of functions. They provided new solutions for practical examination, nobilitating it in a way but also providing criteria for assessing practice. It must not be forgotten either that, beginning with the 1920s, also Japan conducted experimental works on lie detection with the use of the psychogalvanometer (see above). It can be said that by the outbreak of the Second World War instrumental lie detection had already been a field well developed in the US on fairly good scientific grounds. Moreover, it won the trust of political decision-makers, which resulted in applying it in new areas during the war.

5. The polygraph during and immediately after the Second World War

As has been said before, convinced by Marston, the Psychological Committee of the National Research Council proposed US War Secretary the use of Marston's lie detection for counterintelligence purposes during the First World War, arguing the allegedly very high diagnostic value of the method reached 97%. In 1917 the method of instrumental lie detection was applied for the first time in the investigation into the theft of the secret code book from the safe of the Surgeon-General of the US Army (Department of Defence 1984). In 1917–18 Marston with Harold E. Burtt (since 1923 professor of psychology at Ohio State University, the author of the famous

hand-book "Applied Psychology") are believed to have tested an unknown number of prisoners of war or people suspected of espionage (Matte 1996). Also during the First World War, the US Army began training a group of psychologists in lie detection techniques for counterintelligence purposes at Camp Greenleaf, however, the end of war meant that their skills were never put to practice (Department of Defence 1984). It has to be remembered that the level of instrumental lie detection at the time was very low, with the highly imperfect Marston's method, whose diagnostic value was certainly far below the declared 97%, still being in the use. That, however, still predated Larson's first experiments. Irrespective of the level of the tests and examinations, and their efficiency, it is worthwhile to note that attempts at instrumental methods of lie detection for counterintelligence purposes in America preceded the attempts at its application for investigative purposes in criminal cases.

During the Second World War Americans already had far more developed techniques of lie detection at their disposal. Yet first of all, they already had a wealth of practical experiences from the 1930s, and polygraph examinations were based on experimental scientific work. US military forces, and especially their special and investigative sections, relied on units performing polygraph testing and a corpus of polygraphers, mostly trained by Leonarde Keeler.

Early in the 1940s Americans, ordered by President Roosevelt, embarked on the implementation of a secret research and scientific construction programme codenamed Manhattan Project, whose purpose was to construct a nuclear bomb. People running the project in Oak Ridge laboratories in Tennessee were subjected to polygraph screening (Department of Defence 1984). The repeated screening was conducted in 1946. At the time Leonarde Keeler personally examined 850 members of Oak Ridge staff, including scientists of the highest class and order (Stevens 1994). Enough to remind that the project involved participation of many Nobel Prize winners, as six of them participated in the programme at the time, and further seven joined after 1946.

In 1944 when the outcome of war was already evident, President Roosevelt ordered commencing a project aimed at denazification of post-war Germany. One of the sections of that broadside programme was training of ancillary staff for the Allied occupation forces, notably the police, recruited from among the German prisoners of war. A special camp was organised for that purpose in Rhode Island. Opinions whether the camp was in Fort Getty (Stevens 1994) or Fort Wetherill (Linehan 1978) differ in literature. The prisoners of war who declared eagerness to return to Germany after the end of war and to serve in the police or administration, or cooperate in any other form with the Allied occupation forces, had to undergo polygraph examinations. The head of that operation was Lieutenant-Colonel Ralph Pierce, the first

military counterintelligence officer to have been trained by Keeler, even before the outbreak of war. The POWs were examined by Leonarde Keeler and a large group of polygraphers that included, besides the aforementioned Lieutenant-Colonel Ralph Pierce, James Austin, Russell Chatham, David Cowles, Alex Gregory, Paul Trovillo, and Charles Wilson (Stevens 1994). A great majority of them were experienced polygraphers from the territory of the entire US (Linehan 1978). Altogether 17,883 German prisoners of war were subjected to preselection. During the first eight days, from 10 to 18 August 1945, 276 POWs were examined, with priority for the ones intended to work as interpreters.

They all underwent examination in the classical (relevant/irrelevant) technique, with identical critical (i.e. relevant) questions being asked, namely:

1. Were you ever a member of the Nazi Party?
2. Do you believe in Nazi principle now?
3. Would you commit any acts to sabotage any Allied peace plans?
4. Do you advocate Communism for Germany?
5. Do you plan on joining anti-Allied underground upon returning home?
6. Were you ever a member of the Gestapo?
7. Do you believe in religious freedom?
8. Have you been a member of the SS?
9. Have you been a member of the SA?
10. Do you intend to cooperate fully with American Forces?
11. Have you committed a crime?
12. Do you know any Nazis among your comrades here?
13. Are you faking your attitude in order to make it easier for you to be sent back to Germany?
14. Have you been truthful in all answers to American Officers? (Linehan 1978).

After the examination of the first 276 prisoners of war, 156 were recommended to be sent back to the country, to help to maintain order in Germany, as they were deemed non-deceptive. A cohort of 110 were not recommended, and in the case of the remaining no opinion was issued, as the result of their examinations was considered inconclusive. The people who were given tasks requiring special trust were additionally examined (Linehan 1978). Thanks to polygraph examinations, 24 members of the NSDAP, two members of the SA, one of the SS, and three communists were discovered among the volunteers who wanted to work with the occupation administration and serve in the police of the new post-war Germany. One of the thus discovered NSDAP members was a high-ranking party functionary in 1933–38.

A spectacular success of Keeler and Pierce was the detection of perpetrators of the Hesse Crown Jewels robbery from the treasury in Kronberg Palace (Schloss Friedrichshof), north of Frankfurt. American forces captured Kronberg in April 1945, and opened an officers' club in the castle of the Princes of Hesse. Three American officers found and pilfered the hidden treasury of the family of Prince Wolfgang of Hesse, which contained jewels worth around \$2.5 million. Some of the stolen gems were removed and sold in Switzerland, some in Ireland, and some were smuggled to the US. The perpetrators were caught and court-martialled (Linehan 1978).

No other projects of American intelligence and counterintelligence using polygraph examinations during the second world war have been described in literature. It can, however, be expected that the polygraphers of these services trained before the war did perform some examinations.

Not only Americans resorted to the polygraph to examine POWs and spies during the Second World War. The Japanese resorted to instrumental lie detection as well, using the psychogalvanometer for the purpose. Togawa, who participated in experimental studies in the field in the 1930s used the method to examine people suspected of espionage (Fukumoto 1982). However, the available literature contains no further information on the subject.

As can be seen, the time of war resulted in expanding the scope of polygraph examinations. Especially the examinations that had previously been performed mostly for investigation purposes were included into the work of intelligence and counterintelligence services (examination of prisoners of war, and those suspected of espionage) as well as for the protection of the most closely guarded state secrets.

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Book reviews



*Izbrannye publikacii iz žurnala
"Evropejskij Poligraf" (Selection
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Centre for Applied Psychophysiology (Moscow) published Russian translations of selected papers published in European *Polygraph* in 2011–15.

The book contains the following papers:

- 1) Papers by Polish authors: Jan Widacki: EP 2011, vol. 5, No. 1 (15); Jerzy Konieczny: EP 2012, vol. 6, No. 1 (19); Marcin Gołaszewski: EP 2012, vol. 6, No. 4 (22)
- 2) Papers by American authors: James A. Matte: EP 2013, vol. 7, No. 2 (24) and EP 2015, vol. 9, No. 2; D. Krapohl, J. Godson: EP 2015, vol. 9, No. 4 (34); R. Nelson: EP 2015, vol. 9, No. 2 (32); N. Gordon, W. Fleisher EP 2012, vol. 6, No. 1; C. Patton: EP 2013, vol. 7, No. 3 (25)
- 3) Paper by Israeli author: T. Amsel: EP 2013, vol. 7, No. 1 (23).



*Ocinka dostovirnosti: Naukovi doslidzhennia ta praktyka
(in Ukrainian) Assessment of credibility: scientific research and practice) 2019, No. 2, Kyiv, 2019*

Association of Ukrainian Polygraphers (Kolegiya Poligrafologov Ukrayny) published the new issue of their official journal.

The issue contains articles by Ukrainian and foreign authors (among others V. Shapovalov, O. Motliach, R. Nelson, B. White, M. Kormoš) as well as translations from foreign literature (e.g. excerpts from books published in Poland and in the Polish language: one chapter of the book by J. Widacki (*Historia badań poligraficznych* – literally: “The history of polygraph examination”, see: EP 2018, 12, 3 (45) p. 125) and the book Courses in the development of instrumental and non instrumental lie detection [in Polish] (ed. by Jan Widacki, see: EP 2018, 12, 4 (460, p. 163.)

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Reid J., Inbau F. (1966), *Truth and Deception: the Polygraph ("Lie-detector") Techniques*, Williams & Wilkins, Baltimore.

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