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Differences in the Quality of the Photoplethysmograph Signal in Subjects with and without Nail Polish

Изменение качества фотоплетизмографического сигнала у субъектов с окрашенными и неокрашенными ногтями

Key words: polygraph, forensic psychophysiology, photoplethysmograph, plethysmograph, PLE, nail polish, signal quality

Abstract

Qualitative indicators are an important element in establishing truth in polygraph examinations. Considering this, a study of the change in the quality of the signal from the photoplethysmograph in subjects who have used nail polish is extremely relevant and requires a comprehensive qualitative study.

The paper uses general scientific and empirical methods of observation and experimentation, and is a comprehensive study of the effects of nail polish on the quality of the photoplethysmograph signal. It is the first time that this type of research has been conducted using a comparative analysis of subjects who did and did not use nail polish.

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Formulation of the problem

Qualitative indicators in conducting polygraph studies are an important element in the process of establishing truth or deception, and the person subjected to polygraph examination should be confident about the accuracy of the conclusions made by the examiner.

All negative factors that may distort the correct decision should be eliminated. The goal of good scientific research guarantees the correct resolution to these problems, one of which may be whether nail polish has a negative effect on data collection with the plethysmograph.

Relevance of research

The data from the photoplethysmograph is increasingly being used to assist in the determination of truth or deception in forensic psychophysiology. In some countries, the component is used to replace the traditional blood pressure cuff to monitor cardiovascular activity.

With this in mind, the aim of this research is to study the data from the photoplethysmograph in subjects who have used nail polish before undergoing a polygraph examination and compare it with the data from the subjects who did not use any polish on their nails, and thus provide relevant recommendations to polygraph examiners.

A great deal of research has been conducted in recent years to evaluate ad enhance the field of forensic psychophysiology. At the same time, a significant range of issues devoted to the operation of the polygraph remains unnoticed.

Research of the polygraph is a rather complicated process, and even minor trivialities can have a significant effect on its results. External factors are an important groups of circumstances that influence the work of the polygraph, a fact that needs very careful consideration by professional polygraph examiners. At the same time, individual cases of such factors influencing the process of polygraph research are disregarded by modern science. For instance, the impact of polish on the nails has not been mentioned in any research to date.

The accuracy of the polygraph procedure to assess the reliability of information communicated by a person is extremely important. The Polygraph Institute of the US Department of Defense conducted a large-scale comparative analysis on the accuracy and reliability of the use of polygraph in medicine and psychology. The sample consisted

of 5189 scientific and practical publications. The study demonstrated that the accuracy of the diagnosis with the use of the polygraph is by no means inferior to other methods of human diagnosis in the fields of medicine and psychology. [1]

Any method used to study a person, be it a diagnosis of certain medical conditions or the definition of psychophysiological qualities, cannot technically reach 100% accuracy as there is always a certain probability of errors in conclusions drawn from the data. With such methods being used for evidence before the court, and in screening for intelligence and business purposes, it is not hard to guess what the price of a mistake may be.

Let us note that there are two types of errors made in a polygraph examination in this regard:
- a false positive or a "false alarm" when, as a result of test, a truthful person is erroneously considered deceptive
- a false negative or pseudo-negative error when a person who is actually lying and was involved in the event being investigated is erroneously considered to be truthful. [2]

The use of countermeasures to distort the test results is a major concern in the polygraph field worldwide. Even a small set of countermeasures carries plenty of potential to change the outcome of the examination. There is therefore a need to develop ways to neutralise known methods of countermeasures.

In order to prevent deliberate or unconscious countermeasures that effect the accuracy of polygraph examinations we need to understand in detail what has a direct impact on the data collected by the polygraph, including the factors that influence changes registered by the photoplethysmograph.

We have recently seen a major increase [3] in the practical use of diagnostic methods based on the photoplethysmograph: a machine that illuminates biological tissue with an infrared beam, and records the radiation that passes through the tissue and is reflected from it. The recording is done by an optoelectronic sensor. Thanks to its non-invasiveness, simplicity of hardware implementation, miniature sensors, and efficiency the process has been used actively in medicine, especially to monitor the state of the cardiovascular system. The main elements of processing the biosignal time zone, whose shape is determined by certain steel structures, indicate: filtration, lump approximation; segmentation of time properties of signals; indication of the most characteristic points of the signals (extremum, points of inflection, points of intersection with the baseline, etc.); calculations of special points of heterogeneous derivative parameters; statistical analysis of sequences of classified fragments; and structural analysis [9, P. 165].

Digital finger photoplethysmography systems automatically represent accurate and objective information concerning changes in blood circulation and heart rate. In medical practice, the photoplethysmograph reflects the state of the cardiovascular system as a whole and is therefore used to predict occurrences of cardiovascular diseases and to evaluate the results of treatment.

For the research in question a computerised Lafayette LX4000 unit was used. The system can register thoracic and abdominal respiration, electro-dermal activity, and cardiovascular activity via a standard blood pressure cuff and/or plethysmograph (PLE) and physical movements.

It is obvious that low signal quality has a negative effect on the accuracy of the test. For that reason, it is extremely important to understand factors that may cause such results. Coating of the subject's nails may be a very important factor. Modern women often use nail polish and do not even think that it may significantly distort the results of polygraph examinations. That is why pre-test procedures informing the subjects about proper preparation for the examination is an important responsibility of the forensic psychophysiologist.

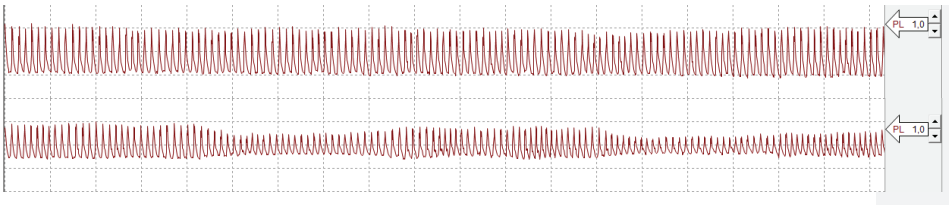
Results of the study

In order to investigate the effect of nail polish on the quality of the photoplethysmograph signal, we conducted a study involving 25 female subjects who participated in it in two stages. For the first stage, we removed the nail polish from the participant's middle finger of the left hand. Data from the photoplethysmograph was recorded and analysed. In the second stage, polish was applied to the nail of the same finger, and we collected plethysmograph data again.

The same polish was used on all the subjects and the conditions in which the subjects were tested did not change significantly. The time between the two successive studied of each individual was in the range of 5÷7 minutes, and all the subjects were tested in a room which eliminated the influence of external factors.

The charts of individual participants presented below show first the plethysmograph signal collected from the unpolished nail with the signal collected from the nail covered with polish below.

Participant 1



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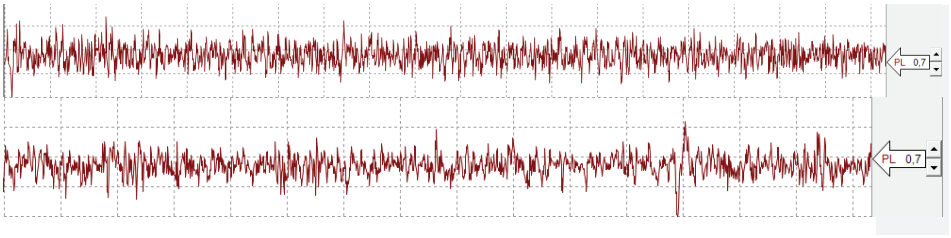

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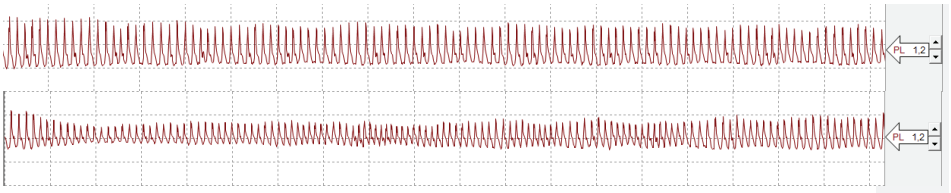

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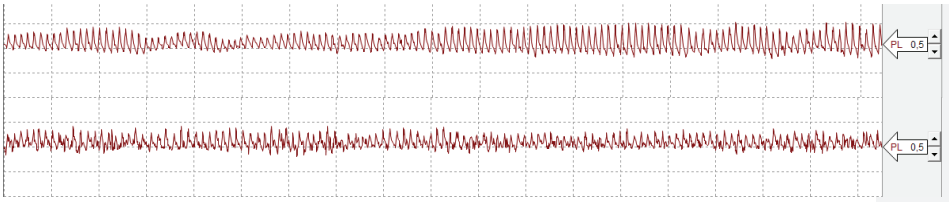

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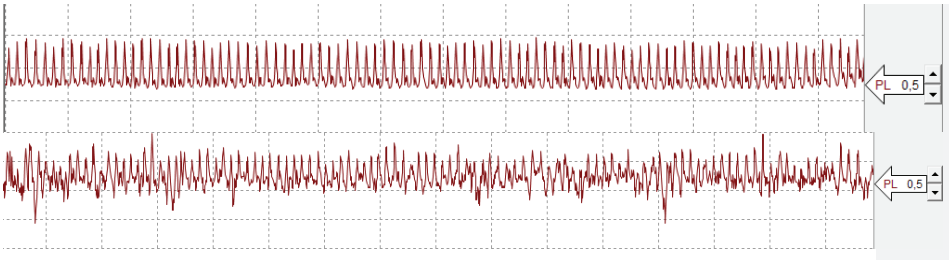

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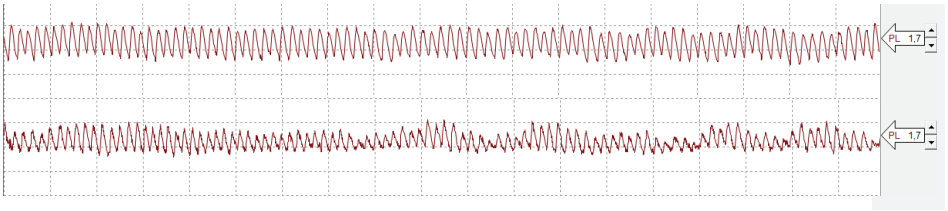

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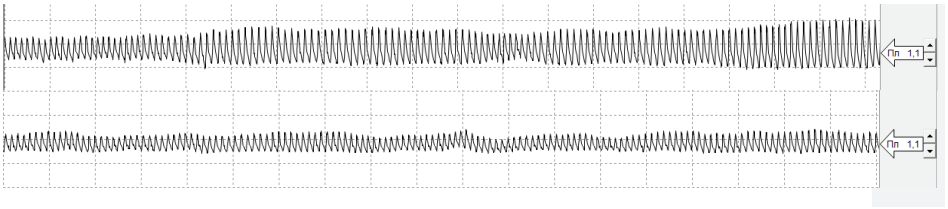
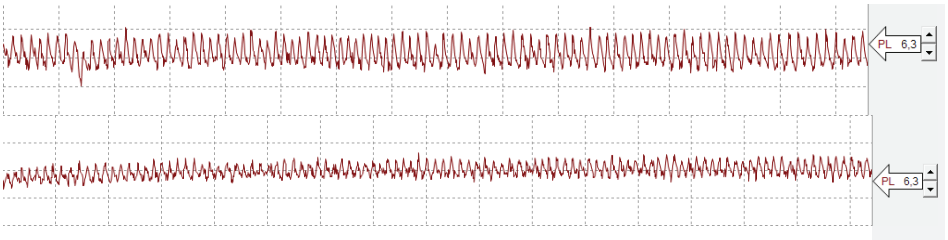


Data by face number 8



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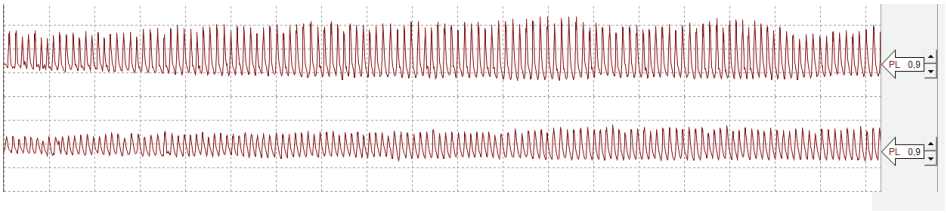

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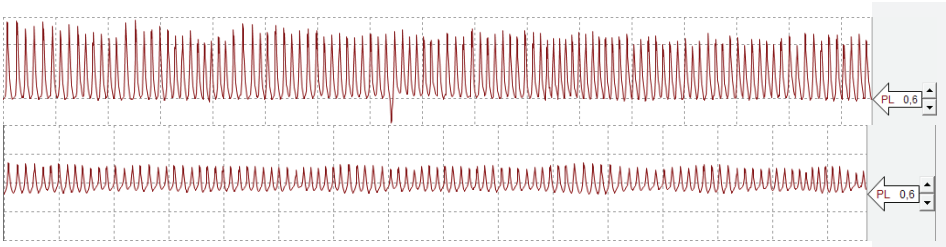

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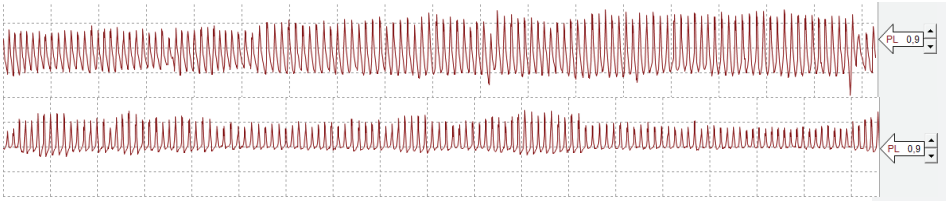

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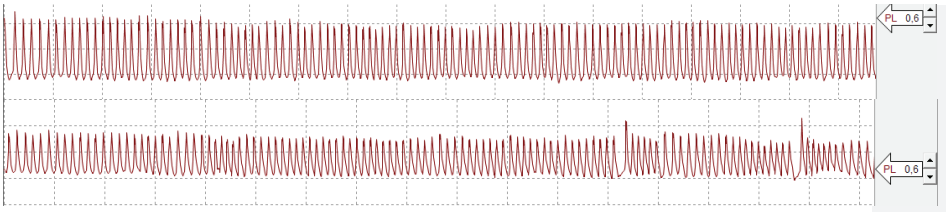

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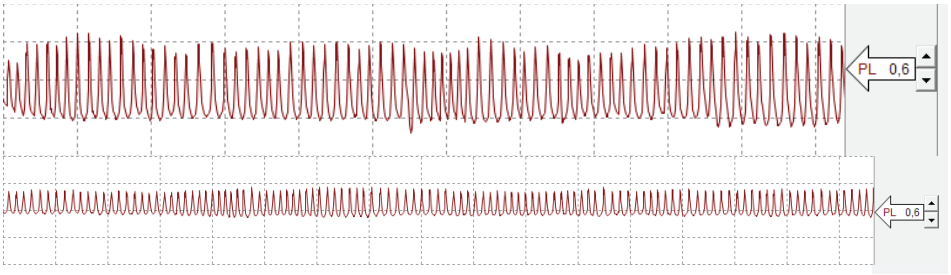

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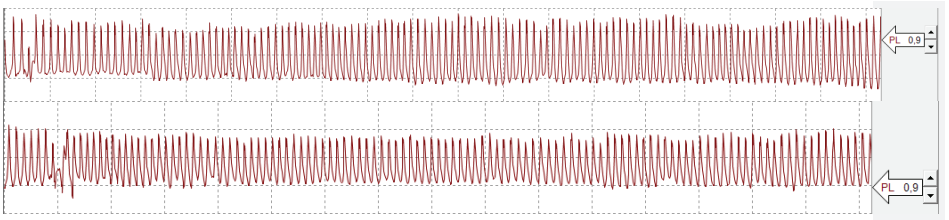

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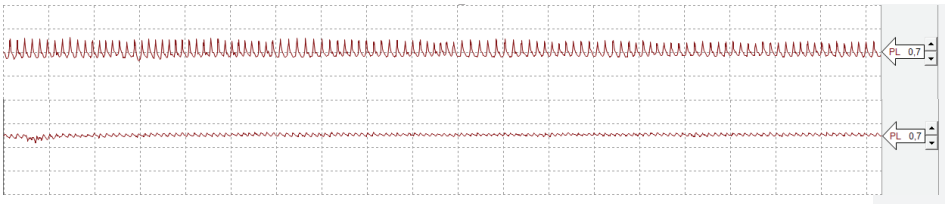

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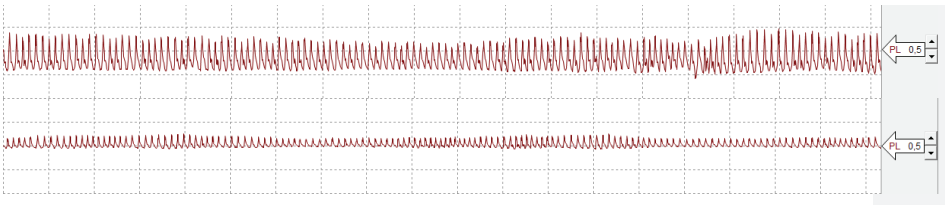

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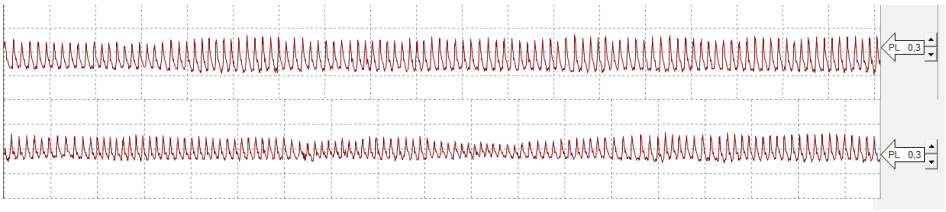

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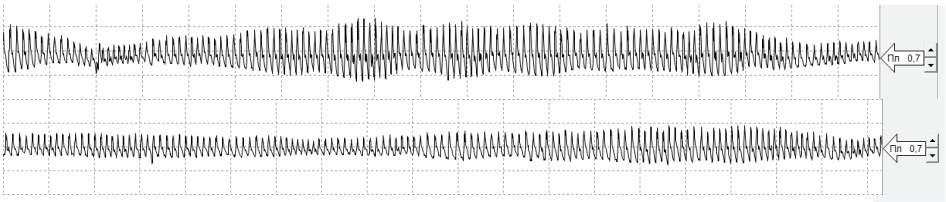

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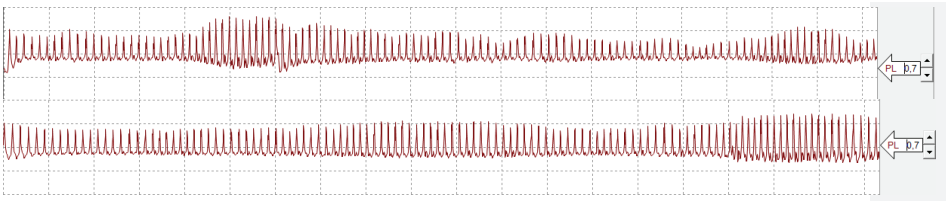

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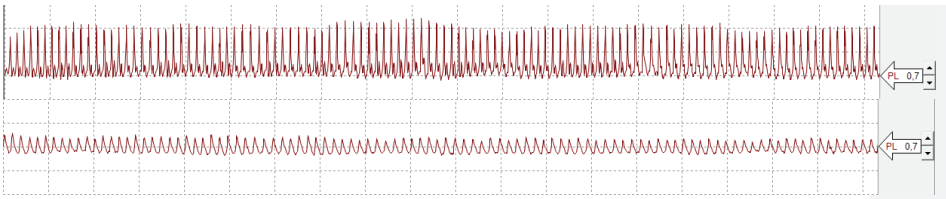

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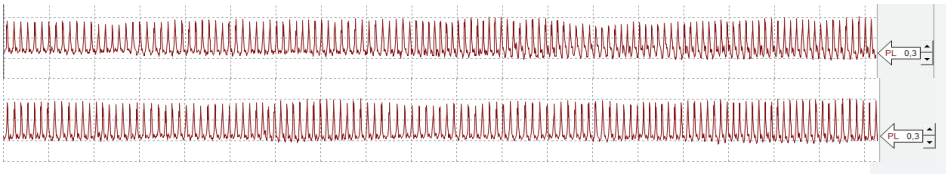

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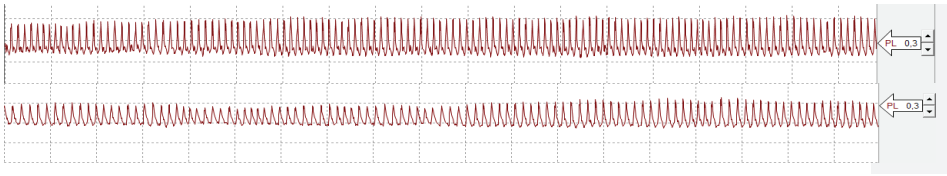

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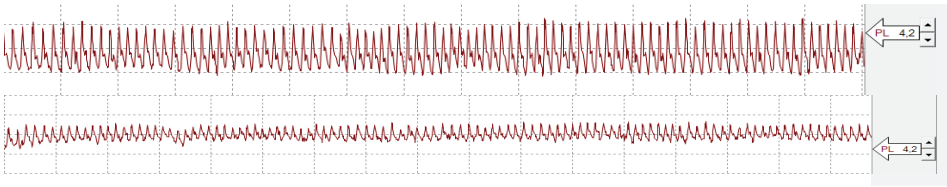

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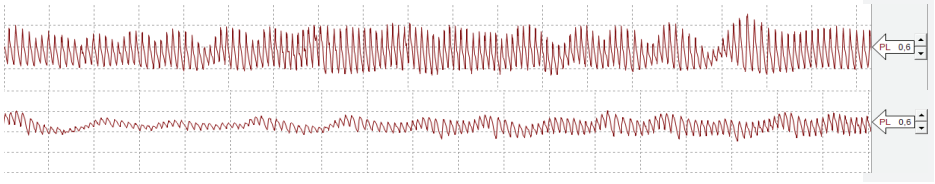

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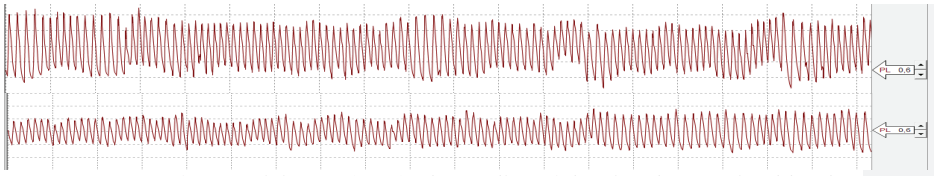

In 23 out of 25 participants (92%), the quality of the signal transmitted by the photoplethysmograph sensor deteriorated after polish was placed on the nail. In two participants (Nos 19 and 21), the quality of the signal before and after covering the nail with polished showed no or little difference.

Conclusion

Our research clearly shows that applying nail polish has a negative effect on the quality of data that can be obtained from the photoplethysmograph (PLE).

A polygraph examiner sometimes encounters cases when a subject, whether knowingly or not, has done something that negatively affects the quality of the data that can be obtained. The polygraph examiner should exert maximum care to remove any reasons of possible distortions and factors that may negatively affect the collection of data and cause inaccuracies.

As the results of the study demonstrate, there is a significant change in the quality of the photoplethysmograph signal in most people who apply nail polish. In this case, the negative effect is often achieved without the subject's intent to influence the results of polygraph examination. Unfortunately, such changes can cause significant hurdles to the correct determination of the person's veracity.

With this in mind, it can be pointed out that the polygraph examiner is obliged to warn individuals who undergo a polygraph examination to avoid the use of nail polish prior to the test, in order to establish the most accurate photoplethysmogram index. We hope that this research will contribute to a better quality of data and minimise the number of possible errors in determining whether the subjects are true or deceitful.

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[2] Medvedev A.Y., *Polygraph – Nostalgia for "Analog" Quality*, http://daily.sec.ru/2011/07/07/Poligraf---nostalgiya-po-analogovomu-kachestvu.html.

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The Effectiveness of fMRI Data when Combined with Polygraph Data

Эффективность сочетания данных фМРТ с данными полиграфа

Key words: Integrated Zone Comparison Technique, Polygraph, ASIT PolySuite Scoring Algorithm, Horizontal Scoring System, fMRI, Pneumo, Electro-dermal Response, Cardio

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Abstract

The Integrated Zone Comparison Technique (IZCT) was utilized with computerized polygraph instrumentation and the Academy for Scientific Investigative Training's Horizontal Scoring System ASIT PolySuite algorithm, as part of a blind study in the detection of deception. This paper represents a synergy analysis of combining fMRI only deception data with each of the three individual physiological parameters that are used in polygraph. They include the electro-dermal response (EDR), pneumo, and cardio measurements. In addition, we compared the detection accuracy analysis using each single parameter by itself. The fMRI score and each individual polygraph parameter score on individual subjects were averaged to establish an overall score.

Method

As originally reported in the "Integrated Zone comparison polygraph technique accuracy with scoring algorithms" (Physiology and Behavior 2006, 87, 251–254), a blind study to assess the accuracy of the fMRI and polygraph in the detection of deception was set up using procedures developed in the polygraph profession. In that study, using random selection, half of the group was told that someone had fired a gun in the hospital and that a video in the area showed someone resembling them may have done it, the other half was instructed to actually fire a gun. Both groups were given an initial monetary payment for participating in the study, and informed that they would receive an additional monetary bonus if they were determined to be truthful when denying that they fired the gun. Thus, both the truthful and deceptive suspects were motivated toward a truthful outcome, which is consistent with real life examinations; both truthful and deceptive suspects desire to come out truthful.

A synergy analysis of combining fMRI only deception data with each of the three individual physiological parameters from the polygraph (Electro-dermal Response, Pneumo and Cardio) was performed.

Since the data from the ASIT PolySuite scoring algorithm uses cutoff thresholds of a +13.5 or higher for truthful determinations and a -13.5 or lower for deception, which amounts to parameter input of a +/-4.5, the fMRI was assigned equal input, and the following cutoff thresholds were used:

fMRI alone: +/-4.5
fMRI and single Polygraph parameter: +/-9
fMRI and all three Polygraph parameters: +/-18

Table 1. fMRI+EDR*

Sub	Ground Zero	EDR Score	fMRI Score	fMRI Alone Determination	Total Score fMRI+ EDR	Combined fMRI +EDR Determination	Total Score fMRI+ Poly	Combined fMRI+ POLY (EDR, P, C**) Determination
PD	DI	0	-71	DI	-71	DI	-110	DI
KS	DI	0	-95	DI	-95	DI	-135	DI
JR ♦♦	**NDI**	**+13**	**-6.75**	**DI**	**6.25**	**INC**	**+19.25**	**NDI**
JB ♦	NDI	-11	+21.6	NDI	10.6	**NDI**	+26.6	NDI
LH†	**NDI**	**+21**	**0**	**INC**	**+21**	**NDI**	**+46**	**NDI**
MC	DI	-13	-63.45	DI	-76.45	DI	-87.45	DI
NM†	**DI**	**-23**	**0**	**INC**	**-23**	**DI**	**-58**	**DI**
SM	DI	-12	-108	DI	-120	DI	-131	DI
BB	DI	-15	-139.05	DI	-154.05	DI	-171.05	DI
SP	NDI	+17	+28.35	NDI	+45.35	NDI	+82.35	NDI

(Galvanic Skin Response* = Electro-dermal Response); (** P = Pneumo, C = Cardio)
DI: Deception Indicated; NDI: No Deception Indicated; INC: Inconclusive.

Important findings for Table 1

1. When comparing fMRI data (Table 1), our data demonstrated that two subjects (†) of the ten showed that fMRI alone was clearly inconclusive for the determination of truth or deception 20% of the time. In these subjects when we combined all three polygraph parameter scores (EDR, Pneumo, and Cardio) with the fMRI score the final determination of truth and deception was changed from inconclusive to concordance with ground zero fact (NDI, DI) in both of these cases. This increased accuracy by 20%. These findings show that fMRI alone is not sufficient in 20% of the time for an accurate determination of truth (NDI) or deception (DI).

2. In one (♦) out of the 10 subjects, combining fMRI with EDR alone changed the status of determination of truth or deception from conclusive (NDI) to inconclusive. This data shows that in 10% of the time adding EDR score alone to fMRI score is detrimental to an accurate determination of truth and deception.

3. In one (♦♦) out of the 10 subjects, using fMRI alone made a determination of deception which was erroneous with ground zero fact.

4. The synergy of all three polygraph parameters combined with the fMRI data increased the accuracy of the test procedure by 20% over the combination of just fMRI and EDR data, and 30% over fMRI data by itself.

Table 1. Summary

Based on our research it is vital to use fMRI data combined with all three polygraph parameters to achieve the most accurate determination of truth or deception. This was our primary claim of our patent.

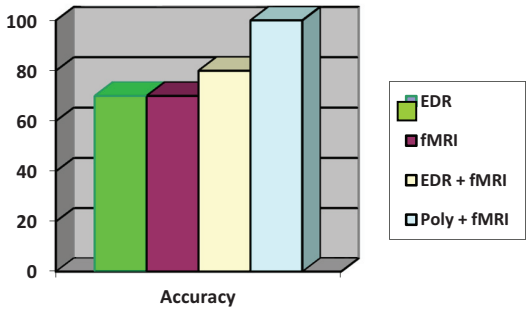


Table 2. fMRI + Pneumo

Subject initials	Ground Zero	Pneumo Score	fMRI Score	fMRI Alone Determination	Total Score fMRI + Pneumo	Combined fMRI + Pneumo Determination	Total Score fMRI + Poly	Combined fMRI + POLY (EDR, P, C**) Determination
PD	DI	-20.5	-71	DI	-91.5	DI	-110	DI
KS	DI	-10	-95	DI	-105	DI	-135	DI
JR ♦♦♦♦	**NDI**	**+8**	**-6.75**	**DI**	**1.25**	**INC**	**+19.25**	**NDI**
JB	NDI	-4	+21.6	NDI	17.6	NDI	+26.6	NDI
LH ▲▲, †	**NDI**	**0**	**0**	**INC**	**0**	**INC**	**+46**	**NDI**
MC	DI	+2	-63.45	DI	-61.45	DI	-87.45	DI
NM ▲, ▲▲	**DI**	**-23**	**0**	**INC**	**-23**	**DI**	**-58**	**DI**
SM	DI	-14	-108	DI	-122	DI	-131	DI
BB	DI	+5	-139.05	DI	-134.05	DI	-171.05	DI
SP	NDI	+17	+28.35	NDI	45.35	NDI	+82.35	NDI

Important findings for Table 2

1. In one (▲) out of the 10 subjects, combining fMRI with Pneumo alone to fMRI alone, changed the status of determination of truth or deception from inconclusive to a concordant ground zero fact (DI) which represents a 10% increase in accuracy over fMRI alone.

2. When combining fMRI with all three polygraph scores to fMRI alone, it changed two (▲▲) inconclusive to concordant truth (NDI, DI), and one (♦♦♦♦) incorrect deceptive (DI) conclusion to concordant truth, which represents a 30% increase in accuracy over fMRI alone.

3. When combining fMRI with all three polygraph scores to fMRI plus pneumo alone, we changed both (†) inconclusive results to concordant truth (NDI) which represents a 20% increase in accuracy.

Table 2. Summary

Combining the fMRI data with polygraph data showed the greatest increase in accuracy compared to fMRI alone or fMRI combined with Pneumo.

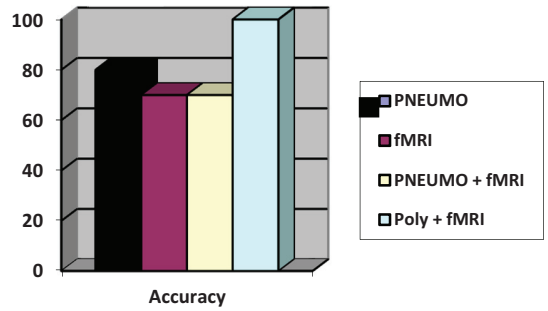


Table 3. fMRI + Cardio

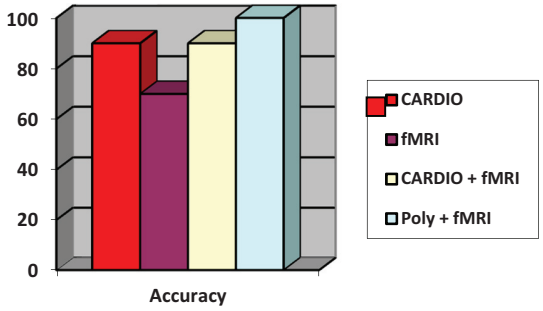
Subject initials	Ground Zero	Cardio Score	fMRI Score	fMRI Alone Determination	Total Score fMRI + Cardio	Combined fMRI + Cardio Determination	Total Score fMRI + Poly	Combined fMRI + POLY (EDR, P, C**) Determination
PD	DI	-19	-71	DI	-90	DI	-110	DI
KS	DI	-27	-95	DI	-105	DI	-135	DI
JR ■	**NDI**	**+2**	**-6.75**	**DI**	**+4.75**	**INC**	**+19.25**	**NDI**
JB	NDI	+8	+21.6	NDI	+29.6	NDI	+26.6	NDI
LH ▲ †	**NDI**	**+25**	**0**	**INC**	**+25**	**NDI**	**+46**	**NDI**
MC	DI	-13	-63.45	DI	-76.45	DI	-87.45	DI
NM †	**DI**	**-9**	**0**	**INC**	**-9**	**DI**	**-58**	**DI**
SM	DI	-7	-108	DI	-115	DI	-131	DI
BB	DI	-8	-139.05	DI	-147.05	DI	-171.05	DI
SP	NDI	+23.5	+28.35	NDI	51.85	NDI	+82.35	NDI

1. In two (▲) out of the 10 subjects, combining fMRI with cardio alone to fMRI alone, changed the status of determination of truth or deception from inconclusive to a concordant ground zero fact (NDI) which represents a 20% increase in accuracy over fMRI alone.

2. When combining fMRI with all three polygraph scores to fMRI alone, we changed the two (†) inconclusive results to concordant truth which represents a 20% increase in accuracy over fMRI alone.

3. When combining fMRI with all three polygraph scores to fMRI plus cardio alone, we changed one (■) inconclusive to concordant truth (NDI) which represents a 10% increase in accuracy.

4. When combining fMRI with all three polygraph scores to fMRI alone, we changed the one (■) incorrect deceptive (DI) results to concordant truth which represents a 10% increase in False/Positive accuracy over fMRI alone.



Once again this shows the importance of combining fMRI data with the data of all three polygraph parameters.

Looking at the individual accuracy of each of three polygraph parameters alone we found that the EDR had 70% accuracy (2 Inconclusives and 1 False/Positive), the Pneumo had 80% accuracy (2 Inconclusives) and the Cardio had 90% accuracy (1 Inconclusive).

Conclusion

Based on these results of this study it appears vital to use fMRI combined with all three polygraph parameters to achieve the most accurate determination of truth or deception.

In addition, it raises a serious question about the validity of weighting one polygraph parameter such as the EDR over the other two parameters (Cardio and Pneumo), as in the case of some computerized algorithms and some manual scoring systems.

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Inconsistent Polygram

Непоследовательный полиграф

Key words: polygram, inconsistent polygram

The psychophysiological responses monitored by and during a polygraph test are recorded and displayed on the Polygram (polygraph chart) and later evaluated and analyzed by the examiner, either by global evaluation or by numerical analysis. While the global analysis tend to **subjectivity**, the numerical analysis which is a: "Systematic assignment of numbers to physiologic responses, along with decision rules, so that PDD (polygraph) data analysis **is more objective** and standardized…" [1] The numerical chart analysis is a: "Method of rendering polygraph decisions that are based exclusively on numeric values that have been assigned to physiological responses recorded during a structured polygraph examination. The numerical approach does not consider extra-polygraphic information such as case facts or examinee behaviors. The numerical approach has four primary components. They are: feature identification, numerical value assignment, computation of the numerical values, and decision rules. Current numerical approaches include the Backster, Federal, Matte, Horizontal, and Utah method, and the automated computer algorithms." [2]

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Polygraph charts numerical analysis became a standard practice with most examiners. The systematic assignment of numerical value to the physiological response standardized the analysis. Numerous researches demonstrated its superiority over the global approach. Yet, some critiques expressed their concern that the numerical analysis turns the examiner into a calculator that ignores information such as: case data, examinees' verbal and nonverbal clues and alike or as Richard Arther wrote: "The polygraph expert who has been taught to depend l00% upon the charts and totally ignore gestures is a technician and not a polygraphist." [3]

While my training as well as my experience taught me to "believe my charts" and give a very little consideration to other information, in some instance, charts are confusing to the point that rendering a decision is impossible. For example: in a case in where an analysis spot of the first chart totaled – 2, the second chart + 1 and the third chart totaled +1 as well, totaling the three charts to zero, a grand total representing an inconclusive test result.

What causes this phenomenon and what should the examiner do in such cases is the concern of this article.

Chart anomalies

Confusing or contradicting charts appear in various ways, such as:

- In the spot analysis of a single chart we witness contradicting responses between the different channels, for example: the EDA response is positive while the Cardio or Respiration response is negative.
- An analysis spot sub total of one chart is positive while the analysis spot of one or of the other two charts are negative.
- A combination of the two.
- A contradiction between the sub total and the grand total of two different analysis spots that have the same meaning such as: "Have you taken that money from the envelope?" (-4) and "Have you taken that money?" (+1).

Anomalies' Sources

Some plausible explanations to chart anomalies are:

- Lack of correlation between the spot questions, in where one question represents a bigger threat to the examinee than the other,
- One of the spot questions is phrased in a broader manner and it triggers association to some other somehow related issues.

- One of the spot questions may have a double meaning to the examinee,
- The enveloping comparison questions of one spot are less or more effective than the other,
- Mental distraction occurring during a single spot because of word association,
- A remark made by the examiner between charts that impacted the examinee in later charts,
- An artifact (such as: deep breath, yawn, etc.) that was identified as a reaction,
- The examinee is "dragging" a response from prior question (lack of homeostasis i.e. tonic level or physiological norm).

Some scholars will use these examples as the reason to why we should not rely ONLY on the numerical analysis and the necessity to integrate into our final opinion "out of chart data". Regardless of the validity of this claim, and I personally consider it as invalid, there are some remedies that the examiner should practice in order to reduce chart anomalies to minimum.

Remedies

- The "wonder pill" to most difficulties that we face, is conducting a proper and comprehensivepretestin where the relevant and comparison questions are thoroughly discussed and understood by the examinee (This can be achieved by asking the examinee to explain the meaning of the questions).
- During the test, before asking a question make sure that the examinee has recovered and returned to his physiological norm ("chart purity").
- Before starting to numerically score the charts take a global look at the chart in order to identify unique individual patterns such as: deep breath before every answer, etc. in order to avoid scoring them as a reaction.
- Scoring the charts apart of the test.
- Re scoring the charts the following day after the test.
- Asking another examiner to score your charts.
- Make sure that you have not analyzed an artifact.
- Make sure that the respiration channel had not effected other channel (deep breath tend to impact other channels and "draw" artificial reactions).
- Make sure that you have only scored the reaction within the scoring window which start once the question was identified by the examinee and ends 5 seconds after the answer.
- Run additional charts.
- Rephrase the relevant or the comparison question before running an additional chart or charts.

- Adding an extra chart in where the spot question is enveloped with different comparison questions.
- Do not restrict yourself to the spot grand total; consider the general TENDENCY/ TREND toward where the score is pointing. As in the example in where a spot analysis of the first chart totaled – 2, the second chart +1 and the third chart totaled + 1 as well, totaling the three charts to zero, a grand total representing an inconclusive test result. To ignore the **tendency** that erupted, which clearly point toward a truthful examinee, would be unjust. It seems like the examinee's responses in the first chart could be attributed to his or her anxiety, which gradually lessened as the test developed.
- Use your discretion and keep in mind that none of the examinees are "text book" models so you should adopt yourself to him and not vise versa.
- Retest the examinee by another examiner.

Discussion

Critiques may argue that the suggestion to use discretion support the global analysis followers. Thou on the surface it might seem so, it is not, simply because the suggested discretion is relying on **"in chart data"** rather than on **"out of chart data"** that is being applied by the global analysts.

Keep in mind that we are examining human beings and not "text book" model robots which call for a more flexibility and if needed improvising approach rather than being a rigid technician who follows the "text book" instruction to the dot. Yet, in spite of the need to be more flexible your decision should exclusively rely on your charts.

References

[1] Krapohl D., Handler M., Strum S. (2012), *Terminology Reference for the Science of Psychophysiological Detection of Deception*.

[2] *Ibidem*.

[3] Arther R.O. (1980), *Observing Gestures, Part 4*, The Journal of Polygraph Science, 14, 5.

Book and research review

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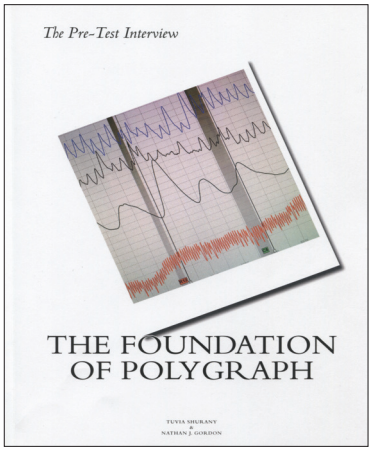

Tuvia Shurany, Nathan J. Gordon: The Foundation of Polygraph. The Pre-Test Interview, Columbia SC 2018, 78 pp.

Two experienced polygraph instructors of international renown have published a manual with instructions on conducting the pre-test interview. Contrary to what the name may suggest, the pre-test interview preceding of the polygraph examination proper is a difficult procedure that requires skill as well as personal predispositions on the one hand, as on the other it is exceptionally important and often decisive for the success of the entire examination or its lack. Motivation of the subject certainly comes to the fore among the purposes whose attainments such an interview serves. If the subject is not properly motivated to the examination and/or is not convinced that the examination can actually prove whether he is a deceptive (DI) or non-deceptive (NDI) individual, the polygraph examination can hardly succeed.

The manual is extremely useful for all polygraph examiners, especially inexperienced. It can also be successfully used for training purposes.

J.W.

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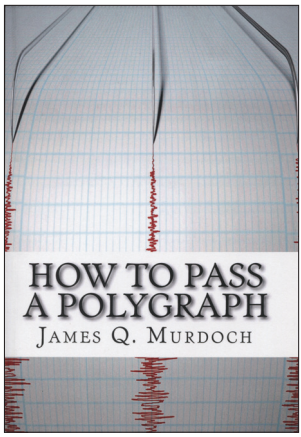

James Q. Murdoch:
How to Pass a Polygraph,
San Bernardino 2018, 23 pp.

The author is a retired policeman and veteran. In How to pass a polygraph, he discusses how to deceive the polygraph. A question that immediately bears an explanation: a polygraph is only a machine, a thing that at polygraph examiner (polygraphist) makes use of. Can a thing be deceived? You can possibly cheat or trick the human who uses the thing, that is the polygraph.

Since the polygraph began to be applied in the 1920s, some subjects have tried to cheat the examiner running the examination. Some tried to suppress reactions to critical questions, others to induce it artificially after the irrelevant and/or control ones. Identification of interferences in the recorded curves, when present with certain regularity and intensity, was a proof that the subject has something to hide, and wants to render the process of examination difficult. Countermeasures were devised against interfering with the reactions and their recording, as special sensors were construed to measure the examinee's intentional muscular tension, observe the behaviour with cameras, etc.

James Q. Murdoch is certainly experienced as a policeman and veteran. As far as I know, he is not a polygrapher, at least not an author of any major publication in the field. The methods of "cheating the polygraph" he describes are perhaps the ones that are most often endeavoured. Usually, by the way, with no result. The work is valuable not as much for those who would like to "cheat a polygraph examination" but the people who run them. It is to them that the author presents the most frequent ways of attempted "cheating the polygraph". And this is where I perceive the value of his work.

J.W.

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N. Klein Sellea, B. Verschuereb, M. Kindt, E. Meijer, T. Naharia, G. Ben-Shakhar, "Memory Detection: The Effects of Emotional Stimuli", Biological Psychology 2017, 129, pp. 25–35

There is a common assumption that highly emotional events tend to be remembered more clearly and with more details because of its strong impact on the individual. If so, this assumption should affect the Concealed Information Test (CIT) – a type of Recognition (polygraph) test thus produce increased psychophysical responses during the CIT. The CIT aims to detect the presence of crime-related information in memory "In a CIT used for a murder case, the polygraph examiner might assess whether or not the examinee reacts physiologically to the murder weapon as compared to a series of possible weapons which investigators are certain were not used in the crime." [1]

In order to examine the likelihood of the assumption two experiments were carried out to examine whether and how emotional stimuli influence concealed information detection.

In the first experiment 136 participants (91 women), age range 18 to 32 were exposed to a fabricated police case-file concerning a hypothetical murder. The case-file

contained a description of the crime, and a set of four pictures: two face pictures (i.e., face of victim 1 and face of victim 2 and two scene pictures (i.e., crime scene and location of murder weapon), which differed in arousal level and emotional force impact. One of the face pictures and one of the scene pictures were neutral and the other two pictures were either negative arousing or negative non-arousing, depending on the experimental condition. These pictures later served as crime-related items in the CIT and were chosen from five different sets of pictures, such that each set served as the crime-related set for 20% of the participants. The four other sets of pictures served as control items in the CIT. An experimenter familiarized participants with the case-file and instructed them to visualize the situation and imagine that they themselves were the murderer. Then, all participants were requested to take a few minutes to carefully go over the case-file and memorize the pictures. When ready, participants were assigned to 4 groups: arousing immediate group who were showed arousing images and were CIT tested immediately, non-arousing group who were not showed with arousing images and were CIT tested immediately, arousing delayed group that took the CIT test after one week and non-arousing delayed group that took the CIT test after one week.

The CIT test results were subject to a one-way ANOVA comparing the motivational level in the four groups (arousing immediate vs. non-arousing immediate vs. arousing delayed vs. non-arousing delayed) yielded no statistically significant effect. In all conditions, participants reported high motivation during the experiment. Further, there was no significant difference between conditions in the number of subjects who reported using countermeasures.

In the second experiment 39 participants (29 women), age range 19 to 20, were exposed to a double amount of pictures (from 4 in the first experiment to 8 in the second experiment) that were displayed for a short time of 10 seconds thus not giving them enough time to memorize the pictures thoroughly. All participants were subject to the CIT a week later.

Analysis of this experiment showed that all three rating-types revealed a significant main effect of arousal indicating that the negative arousing pictures were considered more negative, more arousing and more significant than the neutral pictures. Further, a significant main effect of item type was revealed for the significance and arousal ratings indicating that the crime-related pictures were considered more significant and arousing than the control items. Finally, the arousal ratings revealed a significant Item indicating that the arousal difference between crime-related and control pictures was smaller when these pictures were negative arousing compared to when they were neutral. All other effects were not statistically significant.

Applied implications of the two experiments findings support practitioners' intuition and provide preliminary evidence that emotional stimuli do not deteriorate and may in fact improve CIT detection efficiency.

Reference

[1] Krapohl D., Handler M., Strum S. (2012), *Terminology Reference for the Science of Psychophysiological Detection of Deception*.

Tuvya T. Amsel

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For example (in references):

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

Abrams S. (1973), *Polygraph Validity and Reliability – a Review*, Journal of Forensic Sciences, 18, 4, 313.

and (Reid, Inbau, 1966), (Abrams, 1973) inside text.

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