

**Vitas Saldžiūnas\***

VIP Security Department  
Within the Ministry of the Interior  
Vilnius  
LITHUANIA

**Aleksandras Kovalenko\*\***

Police Department  
Under the Ministry of the Interior  
Vilnius  
LITHUANIA

## A Little About Memory Traces

We spent a long time preparing before joining the discussion about memory traces and their detection during a psychophysiological examination with a polygraph. According to Horvath (2008), this science has two sides. We are still not completely confident about the accuracy of our ideas, yet we believe that we have several thoughts that have not been expressed by other authors.

Currently there are dozens of varying theories (Kholodny 2005; Ogloblin 2004; Varlamov 2000; Kniazev 2009) that are used by polygraph examiners and theoreticians to explain what takes place inside a human when a question (i.e. an

---

\* [vitas.saldziunas@vad.lt](mailto:vitas.saldziunas@vad.lt)

\*\* [aleksandr.kovalenko@policija.lt](mailto:aleksandr.kovalenko@policija.lt)

external stimulus) is given to them, and a polygraph examiner uses a polygraph to record responsive physiological reactions under certain circumstances. We agree with Konieczny (2009) that there is not yet a psychophysiological process model that fully and clearly explains how symptomatic reactions are triggered during a polygraph examination and that is not open to criticism.

In our practical criminal investigation we apply the EKT (Event Knowledge Test) method (Saldžiūnas 2008a, b, c, 2009a, b, c), that was created based on the GKT (Guilty Knowledge Test), POT (Peak of Tension Test), CIT (Concealed Information Test), and GAT (Guilty Actions Test; Bradley 1992). Therefore we directed our attention to how Lewandowski (2005) applies memory trace theory in GKT (or POT) tests. Sometimes the memory trace theory has been called “emotional trace” theory (Krzyścin 2000), but based on Le Doux (1997) memory can be both emotional and cognitive.

The concept “memory traces” is used in medicine and psychology. According to Krzyścin (2000), a crime leaves long-term traces in a criminal’s memory that can only be detected during a psychophysiological examination with a polygraph. Let us recall what the traces are. We must agree with Trofimov (2006), that these traces, though called ideal, cannot absolutely truly (or objectively) reflect the image of real crime. First of all, we wrote (Saldžiūnas 2009d) that due to the real situation the participant in a crime captures only part of the details of the image of it. Secondly, as Dilts (1999) once said, they process part of the captured information in their mental activity, so secondary details or fantasies can affix onto primary details and distort the real information (*Figure 1*). Because of this reason Trofimov (2006) believes that it is inappropriate to use GKT, CIT and ECT methods in investigation before a trial. Despite this attitude, courts in all countries of the world accept witnesses’ testimonies, although it is known that they, too, are not absolutely truthful. According to our model (*Figure 1*), a subject’s memory can be weakened by the time that passed between the crime and the polygraph examination, as well as memory problems, such as illnesses.

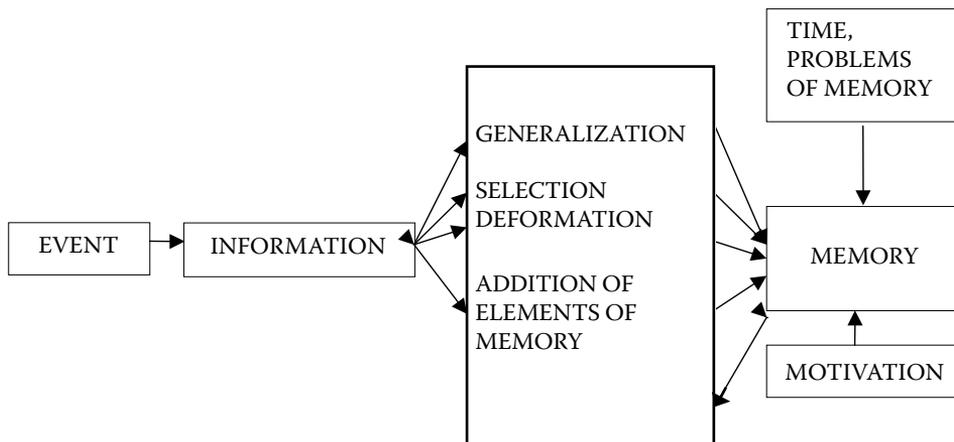
Lewandowski (2008) writes that peak of tension tests are used to define the evidential value of memory traces. This means that memory traces are measured (registered). The question arises: what units are used to measure memory traces: grams, meters, seconds, volts? Psychophysiological examination is done with a polygraph. And the polygraph is a medical device that registers the subject’s respiration, galvanic skin processes through conductivity, heart rate and blood pressure. So a polygraph is used to register several changing param-

eters of the human organism. Based on the method of question (i.e. stimuli) formation and measured parameters, a polygraph examiner can determine whether the examinee is possibly open in the limits of given questions.

Let us analyze the examples of psychophysiological examination with a polygraph given by Lewandowski (2008), where, in the authors' opinion, a memory trace is registered.

#### *First criminal event*

Lewandowski (2008) writes: at around 11:00 a.m. on August 13, 1997, two men entered a jeweler's shop. Its owners, Henryk and Leonarda S., were present in the shop at the time. The men pulled out items which looked like firearms and demanded money. Leonarda S. tried to escape to the shop's backroom, and Henryk S. tried to activate the alarm system whose switch was situated under the desk. At that time, one of the men – Marek L., according to the testimonies of the victims – began to chase Leonarda S. and stopped her. The other assailant – Michal W., as the victims testified – hit Henryk S. on the chest with the pistol and then led him to the shop's backroom. The assailants made their victims lie on the floor. When Henryk S. tried to talk to the attackers, one of them hit him on the head with the gun. Leonarda S. was also repeatedly hit with the gun. The attackers bound the victims with plastic tape and gagged and blindfolded them. They then stole gold jewelry and other objects of value they found in the shop.



*Figure 1.* Model of probable event information restoration suggested by the authors

Of significance here is the information that on February 7, 2006 the regional court in Gdynia found Marek L. guilty and sentenced him to five years' imprisonment. Polygraphic examination was conducted at the request of the defendants' lawyer, after recourse to the appellate court. At the time, the examinee was on leave from the detention center.

Lewandowski (2008) further writes that the examinee – accused in this case of violent robbery – denied being at the scene of the crime at the critical time, and could not remember where he had been when it was perpetrated. The examinee was arrested a few months after the robbery and was never able to reconstruct the course of the critical day. He claimed that he had met the victim for the first time in his life in court in 1999 when the trial began.

Lewandowski (2008) determines that, as the typical form of the test to check the alibi of the examinee could not be used in the examination, a decision was reached that the examination was to clarify when he had first seen Henryk and Leonarda S. It was assumed that participation in such a brutal robbery should leave very clear mental and emotional traces in the perpetrator. The fact that the examinee had previously been repeatedly convicted for crimes against property was of no importance here.

1. Did you see Henryk S. for the first time in 1994?
2. ... in 1995?
3. ... in 1996?
4. ... in 1997?
5. ... in 1998?
6. ... in 1999?
7. ... in 2000?
8. Did you see Henryk S. for the first time later than the times I mentioned?

After the examination (*Figure 2*) Lewandowski (2008) writes that it is perfectly visible that the largest emotional changes followed question 6, which gives grounds to assume that, to the best of his knowledge, the examinee saw Henryk S. for the first time in 1999.

After we reviewed the diagram (*Figure 2*), the question that arose first of all was: why were the reactions to questions 3 and 8 ignored? We believe that the polygraph examiner should have given some thought to what these reactions meant, what could have triggered them and how to explain them to the court. From the article (Lewandowski 2008), we understood that these are not artifacts, because they repeated the second time when the examinee did not answer the questions.



*Figure 2.* A diagram of Marek L.'s polygraph readings. The examinee answered all questions negatively (Lewandowski 2008).

We understood that Lewandowski (2008) based his conclusion on two silent assumptions:

1. If the examinee possesses all information about the event (i.e. has a memory trace), a psychophysiological reaction will ALWAYS be recorded during a polygraph examination;
2. Only the biggest psychophysiological reaction is valued in examination diagrams.

Let us discuss these assumptions. Krzyścin (2000) wrote, that, in order for psychophysiological reactions to be registered with a polygraph, the examinee must not only possess information (memory traces), but also be afraid. Varlamov (2000) and Trofimov (2006) accentuate the examinee's motivation as a compulsory condition. We agree with the opinion of these authors and tend to use the term "motivation". We believe that motivation is a more general and comprehensive phenomenon that can include fear and stress.

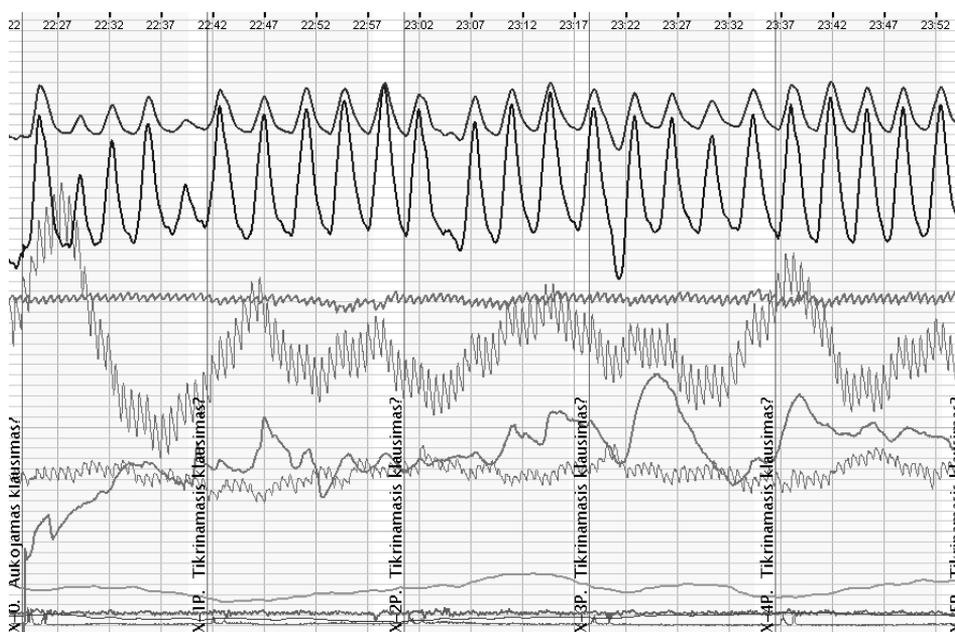
We will illustrate our statements with examples. Let us presume that you are a polygraph examiner. You invite your colleague, friend or acquaintance, connect polygraph sensors to him and, according to the EKT system, form a question and answers to it:

### Where did you spend last night?

0. in a bar
1. in a casino
2. at a friend's place
3. at a girlfriend's place
4. at home
5. in an airport

During the conversation before the polygraphic examination the examinee tells you that he spent the night at home. During the measurement, the examinee answers “yes”, “no” or stays silent after every question. We are sure that after the answer “at home” you will not register such a distinguishing psychophysiological reaction as is depicted in *Figure 2*.

Another example. Two dead bodies were found near Vilnius. The police found citizen D., who claimed that citizen O. had told him how he had murdered those two people. The police found no further murder evidence, and both citizens were examined with a polygraph. *Figure 3* presents citizen D.'s psychophysiological measurement diagram to the question:



*Figure 3.* Citizen D.'s psychophysiological diagram to the answers to question IX.

### IX. Do you know who murdered X?

0. Ben
1. John
2. Mike
3. O.
4. Silver
6. Robert

Figure 4 presents citizen D's psychophysiological measurement diagram to the question:

### X. Do you know who murdered Y?

0. Karen
1. Walter
2. O.

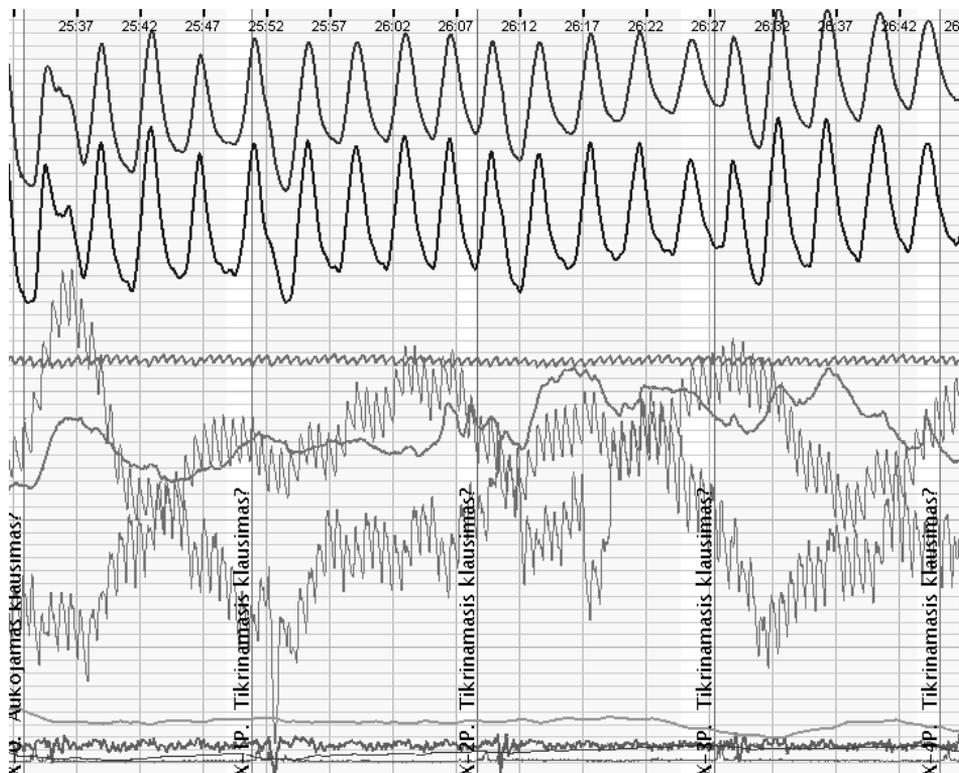


Figure 4. Citizen D's psychophysiological diagram to the answers to question X

3. Bert
4. Simas
5. Ilmar

For all answers (excepting answers IX-3 and X-2) citizen D. said “no”, and for IX-3 and X-2 answers he said “yes”. Visually in both diagrams (*Figure 3 and 4*) no strong distinguishing reactions are seen. Based on these two diagrams and other diagrams from the investigation, the polygraph examiner informed the police that citizen D. was open, i.e. not hiding anything according to the answer versions to the given questions.

Let us summarize:

- A. Citizen D. had information that citizen O. murdered citizens X and Y;
- B. Citizen D. had no motivation to hide this information from the investigators.

Because of these reasons the investigators failed to record very distinctive symptomatic reactions with the polygraph. It is known that universities (Saldžiūnas 2010) in Canada, Belgium, Israel and Germany, when carrying out laboratory psychophysiological examinations with students, use certain amounts of money to motivate them.

We had an investigation when citizen L. (witness) claimed that his neighbor V. had murdered a young woman. The prosecutor already intended to present the case to the court because all other material evidence weighed against suspect V. According to the lawyers, citizen V. would have been acknowledged guilty based on the material of the case. For some reason the police investigator decided to check the testimonies of citizens L. and V. with a polygraph. We carried out the polygraphic investigation by applying EKT. Witness L. had to answer this question:

**n. Is it known to you who murdered the young woman?**

0. Karl.....no
1. Maks.....no
2. Ivan.....no
3. John.....no
4. V.....yes
5. Nikol.....no
6. Frank.....no

Witness L.'s statements after the answers given to him are presented on the right. A reaction was registered after answer N4 and the statement "yes". Since at that time we were not yet highly experienced, we could not at first interpret this reaction correctly. A questionnaire to suspect V. was drawn up using the EKT method. This questionnaire was a little different from the questionnaire intended for witness L. After reviewing the suspect's reactions to the versions of the answers to the questionnaire, there were no signs that suspect V. knew the details of the women's murder. Then the investigators reviewed the witness's examination diagrams more attentively and noticed that more reactions were recorded that did not meet the version of the investigators of criminal event. The polygraph examiners told their assumption to the criminalists that witness L. was not open by saying "yes" after the answer version N4 – V. to question "n". During further investigation the detectives, thanks to additional evidence, made the witness confess. Witness L. said that he had lied because he had wanted to save his relative D., who was the real murderer. Later the court declared citizen D. guilty.

In our later works we ascertained that such a reaction was not accidental. If an examinee says "yes" after an answer version, and a symptomatic reaction is recorded with the polygraph, we are sure that reasons for such a reaction need to be found.

According to the memory trace theory, a symptomatic reaction should not exist in this example, as no memory trace formed in witness L. about the murder committed by citizen V. According to our theory (*Figure 1*), the witness added a made-up version to the information he possessed about the crime during a "creative" process. During the examination with the polygraph the witness experienced stress (fear, motivation) because:

- Despite his education or knowledge about psychophysiological examination with a polygraph, he cannot be sure that the polygraph examiner will not reveal the made-up version in some way.
- A person who has not been intentionally trained cannot control his psychophysiological reactions.

Based on the above, we believe that Lewandowski's first assumption (2008), that if the examinee possesses information about the event (i.e. has a memory trace), then during polygraphic examination a psychophysiological reaction will ALWAYS be recorded, is erroneous.

Is it necessary to evaluate only the biggest psychophysiological reaction in polygraph diagrams? Fiedler (2002) raised the question whether truly a stronger question can provoke a stronger psychophysiological reaction than is recorded with a polygraph. We have still not found scientific works to confirm this assumption. On the other hand, we believe that everything is relative: if the examiner assumes that one question is the strongest for the examinee, the examinee can assume otherwise. Therefore, we believe that the division of symptomatic reactions into stronger or less strong should be done very carefully. We are convinced that, if there are distinguished and other reactions, it is necessary to ascertain for what reasons they could have been recorded.

Let us come back to the discussion of Lewandowski's (2008) described criminal event. Let us recall: Lewandowski decided that "the examinee saw Henryk S. for the first time in 1999". We suggest explaining the diagrams given in *Figure 2* differently. It can be assumed that the examinee first saw the victim in 1996 – there is a distinguished symptomatic reaction to question N3. Based on the above, we can assume that the symptomatic reaction to question N6 exists because it is a version of the examinee and his lawyer, and the examinee is afraid that it will be revealed. Since the questions concern the first time, there is no distinguished symptomatic reaction in the diagram to question N4: Did you see Henryk S. for the first time in 1997? As we do not know the details of this criminal story, it is difficult to explain the reaction to question N8. We do not recommend making a final conclusion from this one group (test) questions. However, Lewandowski (2008) draws up the second group (test) of question types in this examination: "Did you see Leonarda S. for the first time in ...?" While examining Henryk S., symptomatic reactions to questions regarding the year 1996 and 1999 are registered. These reactions can be explained analogically. Therefore, we believe that, if the examination had been carried out fully according to the EKT method, the psychophysiological examination with a polygraph would confirm that the court had sentenced Henryk S. reasonably.

In order that the explanation of diagrams received during our examination be clearer, let us review *another example* given by Lewandowski (2009). This case refers to a suspicion of insurance fraud. The examinee notified the police on 6<sup>th</sup> January 2008 that somebody had stolen his car from the parking spaces by the house where he lived. At about 2 p.m. the day before, he had left the car in the parking spaces, and he had seen it for the last time at about 9 p.m. on 5<sup>th</sup> January. He was convinced that the car had been stolen from him, and did not know who had done it.

The police officer conducting the preliminary proceedings issued a decision to terminate the investigation concerning the theft of the car, due to the lack of a date sufficiently substantiating the actual crime. One of the basic reasons for undertaking such a decision was an official note which claimed that the police had “operational evidence” to prove that W.T. had submitted a false claim to obtain damages under false pretenses, and actually sold or abandoned the car.

Lewandowski (2009) composed question N3 – Did you abandon your car?, question N5 – Was your car stolen from you?, and question N7 – Did you sell your car? W.T.’s examination diagrams are presented in *Figure 5*. Lewandowski (2009) evaluates only the reaction to question N5; the reactions to N3 and N7 are ignored. Therefore, he thinks that the police was wrong to suspect that W.T. was illegally claiming an insurance payment.

As we wrote earlier, we consider the symptomatic reactions to questions N3 and N7 to be important. We have two assumptions:

1. If W.T. is open and tells the truth, the reactions to questions N3 and N7 could have appeared because of the straightforwardness of these questions. The reactions could have been triggered because W.T. was afraid to be wrongfully accused (Ekman 1992). However, why is a reaction to question N5 also recorded?
2. If W.T. is not open and is trying to deceive the police and insurers, he created a version of car theft and is afraid that this version might be revealed. Then all symptomatic reactions become explainable.
3. Two years ago we performed an analogous examination applying EKT. After our examination the insurer did not pay money to the “victim”.

Before closing we will analyze *one more* of Lewandowski’s (2009) examples. This case concerns a false accusation. The examined man was accused by an acquaintance of forcing her with violence and threats to have sexual intercourse. Question N4 was “Was the sexual intercourse the initiative of your acquaintance?”, and question N5 was “Was the sexual intercourse your initiative?”

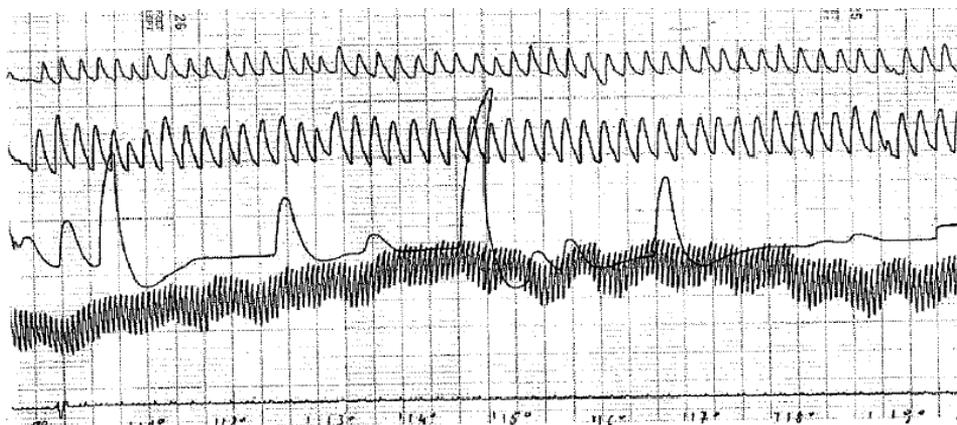


Figure 5. The case about suspicion of insurance fraud (Lewandowski 2009)



Figure 6. The case about alleged rape (Lewandowski 2009)

One diagram from this man's examination is presented in *Figure 6* (Lewandowski 2009). Lewandowski makes a decision – decisively stronger emotional changes were present after asking the question N4, which gives reasons to assume that the sexual intercourse of the examinee with the slandering woman

occurred on her initiative. Further, he writes – this excludes the element of threats and use of force to coerce her to sexual intercourse.

We directed our attention earlier to the fact that there is no proof that a stronger stimulus (question) must necessarily trigger a stronger symptomatic reaction. After reviewing the diagram (*Figure 6*), we had additional questions:

1. Is the symptomatic reaction after question N4 stronger than after question N5? We think that the man held his breath (apnea) more strongly after question N5.
2. How should the contribution of breathing and GSR ( ) changes to the reaction evaluation be valued? Which of these changes is more important and why?

Therefore, we believe that the questions were very straightforward, so it is impossible to make decisions about the man's openness according to them. We suggest drawing up a completely different questionnaire. Generally, it is very difficult to investigate sexual crimes with a polygraph. In such cases we seek to examine both participants of the intercourse.

#### ACKNOWLEDGEMENTS

The authors would like to thank Arūnas Valančius (private practice) for technical assistance.

#### References

Bradley M.T. & Rettinger J. (1992): *Awareness of Crime Relevant Information and the Guilty Knowledge Test*, *Journal of Applied Psychology*, 77, 1, 55–59.

Dilts R.B. (1999): *Sleight of Mouth*, Meta Publications, Capitola.

Ekman, P. (1992): *Telling Lies*, Norton and Co., New York.

Horvath F. (2008): *Is the Lie Detector an American Obsession? A Response to K. Alder*, *European Polygraph*, 1, 3, 5–19.

Kholodny Y. (2005): *Opros s ispolzovaniem poligrafa i ego estestbenno-nauchnyje osnovy*, *Vestnik Kriminalistiki*, 1 (13), 39–48; 2 (14), 1–21 [text in Russian].

Kniazev V. (2009): „*Detektor lzi*“ *na straze istiny*, Minsk [text in Russian].

Konieczny J. (2009): *Badania poligraficzne*, Wydawnictwa Akademickie i Profesjonalne, Warszawa [text in Polish].

Krzyścin A. (2000): *Charakterystyka nowej koncepcji psychofizjologicznego badania poligraficznego*, *Problemy Kryminalistyki*, 228, 5–18 [text in Polish].

Krzyścin A. (2000): *Podstawy psychologiczne kryminalistycznego badania poligraficznego*, cz. 2, *Problemy Kryminalistyki*, 229, 7–16 [text in Polish].

LeDoux L. (1997): *Parallel Memories: Putting Emotions Back into the Brain*, [http://www.edge.org/3rd\\_culture/ledoux/ledoux\\_p1.html](http://www.edge.org/3rd_culture/ledoux/ledoux_p1.html).

Lewandowski E. (2005): *Sprawdzanie alibi w badaniach poligraficznych (war-iograficznych)*, *Problemy Kryminalistyki*, 247, 19–21 [text in Polish].

Lewandowski E. & Lewandowski L. (2008): *Alibi Testing Potential in Poly-graphic Examination*, *European Polygraph*, 1 (3), 31–47.

Lewandowski E. & Lewandowski L. (2009): *Forensic Examination of Memory Traces (Part 1)*, *European Polygraph*, 3–4 (9–10), 153–165.

Ogloblin S. & Moltshanov A. (2004): *Instrumentalnaja “detekcija lzi”*, Jaroslavl [text in Russian].

Saldžiūnas V. & Kovalenko A. (2008a): *The Event Knowledge Test*, *European Polygraph*, 1 (3), 21–29.

Saldžiūnas V. & Kovalenko A. (2008b): *The Event Knowledge Test (EKT) in Poly-graph Examination (in case murder)*, *European Polygraph*, 2 (4), 137–142.

Saldžiūnas V. & Kovalenko A. (2008c): *The Event Knowledge Rest (EKT) in Polygraph Examination (Common Notice of Tactics)*, *European Polygraph*, 3–4 (5–6), 209–220.

Saldžiūnas V. & Kovalenko A. (2009a): *Problems of Questions in Event Knowledge test*, *European Polygraph*, 3 (2), 69–75.

Saldžiūnas V. (2009b): *EKT lub test wiedzy o zdarzeniu*, [in:] *Wykorzystanie wariografu (poligrafu) w badaniach kryminalistycznych oraz kadrowych*, Wydawnictwo Wyższej Szkoły Policji w Szczytnie, Szczytno, 21–23 [text in Polish].

Saldžiūnas V., Kovalenko A. & Soshnikov A. (2009c): *Probability Assessment of the Value of Psychophysiological Stimuli*, *European Polygraph*, 1 (7), 25–31.

Saldžiūnas V., Kovalenko A., Gaidarov K. (2009d): *The Problems of Truth Perception During Psychophysiological Examination*, *European Polygraph*, 3–4 (9–10), 145–152.

Saldžiūnas V. & Kovalenko A. (2010): *Field and Laboratory Polygraph Examinations*, *European Polygraph* (in print).

Varlamov V.A. & Varlamov G.V. (2000): *Psychofizologija polygrafnych proverok (Psychophysiology of PV Examination)*, Prosvetschenije-Jug., Krasnodar [text in Russian].

Trofimov T.F. (2006): *Определение мотивации в технике детекции лжи*, Материалы VII Международной научно-практической конференции, Куб ГТУ, Краснодар, 179–185 [text in Russian].