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Tests with numbers

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We would like to use this article to start a discussion on some better ways to construct tests containing numbers. We would like to emphasize outright that we do not know the best question-building variant. The aim of our work

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is to draw polygraphists' attention to what can influence questions containing numbers when performing a polygraph examination, and how.

The peak of tension test (POT) was developed by Leonard Keeler (1994). Two types of classic POT procedures exist – a known solution peak and a searching peak (Saldžiūnas & Kovalenko, 2010). In field examinations, both types of POTs are often used in Japan, Russia, Belarus, Lithuania, Poland and Latvia.

The classic POT test

When an individual has been apprehended stealing from an employer and is suspected of having taken other items, the searching peak can be used (Abrams, 1989). Starting with an overly high estimate and working downward, the following questions can be asked:

1. During the time that you worked at McCormick's, did you take more than \$5,000?
2. During the time that you worked at McCormick's, did you take more than \$4,000?
3. During the time that you worked at McCormick's, did you take more than \$3,000?
4. During the time that you worked at McCormick's, did you take more than \$2,000?
5. During the time that you worked at McCormick's, did you take more than \$1,000?
6. During the time that you worked at McCormick's, did you take more than \$500?

It is very unlikely that the individual would know how much money had been stolen, but they could probably make a reasonably accurate estimate. Knowing that the amount was not \$5,000 or \$4,000, the subject would not react to these questions. If the subject started doubting at \$3,000 and was unsure if that were the amount, a response would most likely be demonstrated at that point (Abrams, 1989).

Japanese polygraphists (Nakayama, 2002) are of the opinion that questions concerning location produced better detection than those concerning numbers (date, time, sum of money stolen, or the number of offenders). We also agree that questions concerning numbers must be formulated with care. Sometimes when one makes an assumption that the person under examination does not know (or remember) the precise number it is better to state the possible intervals in the question. A similar solution is applied by Russian

and Belarusian polygraphists. They refer to POT, GKT and CIT as indirect tests (Varlamov & Varlamov, 2010).

The numbers test used in Belarus

Vladimir Knyazev, when investigating one criminal case in which there was a need to identify the number of vehicles stolen by the suspect, formulated the following indirect search (CIT) test:

Test No..... *How many cars were stolen with your participation?*

From 20 to 25 cars?

31. From 5 to 10 cars?

32. From 40 to 45 cars?

33. From 30 to 35 cars?

34. From 45 to 50 cars?

35. From 10 to 15 cars?

36. From 25 to 30 cars?

37. From 15 to 20 cars?

38. From 35 to 40 cars?

39. From 1 to 5 cars?

Attention should be drawn to the fact that the numbers are stated randomly, i.e. not in increasing or decreasing order. The test's examination polygram is provided in Figure 1.

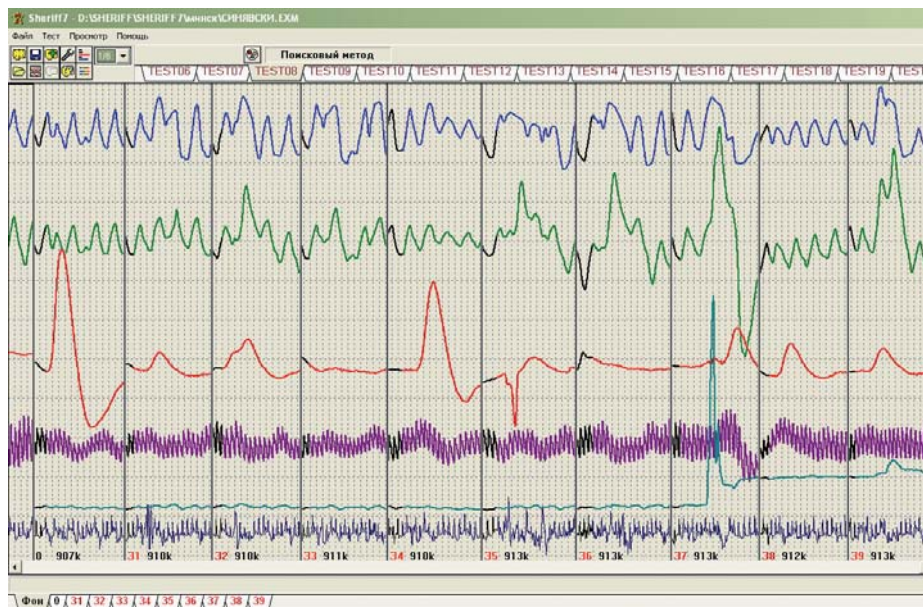


Figure 1. Polygram for examined person suspected in vehicle thefts

The examiner noted the strongest response after asking Question No. 34 (Figure 1). He made the assumption that the suspect had participated in the thefts of 45-50 vehicles. During the later investigation it was proved that the suspect had participated in thefts of more than 40 vehicles. Please note that a criminal is not likely to have a diary in which he/she registered all the thefts in which he/she participated. So-called similar crimes interference may be manifested (Nakayama, 2002). Therefore, it is impossible to identify the exact number of car thefts in which the suspect has participated. In the case of POT tests, the examined person becomes familiarized with the items prior to testing. Russians and Belarusians do not familiarize the person under examination with the items in the indirect tests; they only attempt to arouse the memories of the criminal act to the suspect during the pre-test conversation.

Event knowledge test

The event knowledge test (EKT) (Saldžiūnas & Kovalenko, 2007-2011) is used for investigation of crime in Lithuania. It should be borne in mind that the pre-test conversation includes only the instruction on how one should behave during the polygraph examination. The test includes the sequence of questions and corresponding groups of answer options. The questions are discussed with the suspect. The suspect does not know the answer options and their sequence. During the examination, after the examiner states an answer option, the suspect gives his/her natural evaluation, such as YES, NO, I DON'T KNOW, I DIDN'T SEE IT, etc.

In 2011 we examined police officer D. with a polygraph on the issue of whether D. provides confidential information to criminals. The EKT from 15 questions was compiled. Question No. 9 and its answer options are shown in Table 1.

Table 1. Question No. 9 and its answer options

No. 9. When did you last provide confidential information to persons who did not have the right to such information?			
0.	You gave the information 5 years ago	no	response
1.	You gave the information 3 years ago	no	response
2.	You gave the information 2 years ago	no	response

3.	You gave the information 1 year ago	no	response
4.	You gave the information 1 month ago	no	
5.	You gave the information this year	no	response
6.	You don't remember when you last provide confidential information	I didn't give any	response
7.	You haven't provided any information to outside persons	yes	response

In Table 1 the first column shows the number of the answer, the second column provides the answer option, the third presents the information on how Officer D. evaluated the answer option, and the fourth column shows the examiner's decision according to the polygram (Figure 2) whether the response was present. Answers No. 6 and No. 7, which perform the control role, are introduced according to the EKT, therefore the question testing is performed only once. In this specific case the symptomatic responses were observed after all the answers with the exception of No. 4. Attention should be drawn to the fact that in the concealed information test (CIT) there is usually only one relevant item. In the provided example, all the answers (even the sacrificial answer No. 0) can be relevant. Remember that it is not necessary to evaluate the response after the sacrificial answer.

In the POT and EKT examples the numbers are provided in decreasing order (they can also be provided in increasing order); in an "indirect" test the numbers are presented randomly and the suspect cannot foresee when he/she will be asked.

Figure 2. The polygram of question No. 9 presented to Officer D. Curve 1 – pneumograph channel, Curve 2 – heart rate (HR), Curve 3 – cardiograph channel, Curve 4 – electrodermal channel, Curve 5 – plethysmograph channel.

Presented with the relevant number, therefore, it is possible that the suspect will find it difficult to counteract.

In order to get a better understanding of the ways of shaping of the suspect's responses, we performed a review of several articles.

Popovichev (2011) draws attention to the fact that two options of change of emotional tension (or stress) can be registered in the POT tests: when the suspect's stress tension is high starting with the first item and starts to reduce

after the relevant item (Figures 3&4). In Figure 3 the relevant item is No. 4, and in Figure 4 it is No. 3, after which the suspect's stress state reduces to the background. Hira & Furumitsu (2002) established that after the relevant item the cyclic recurrence of breathing changes in 24% of polygrams and the EDR amplitude reduces in 26.6% of polygrams.

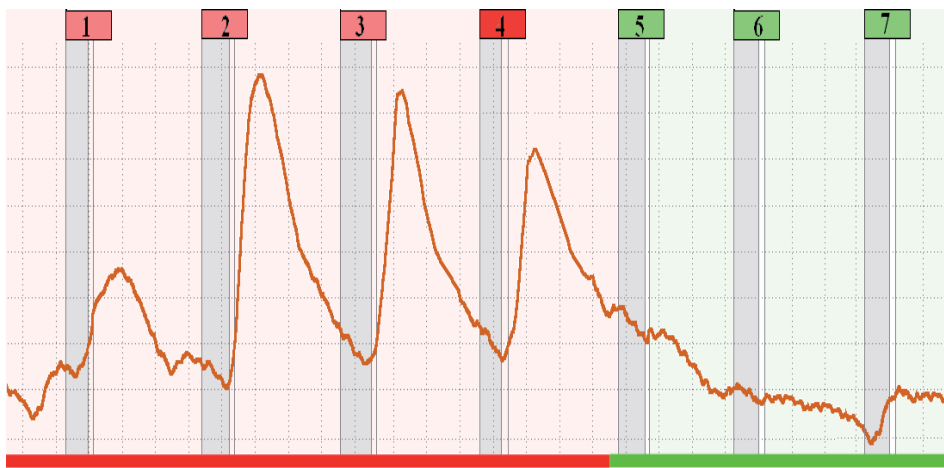


Figure 3. The first electrodermal response (EDR) change variant (Popovichev, 2011)

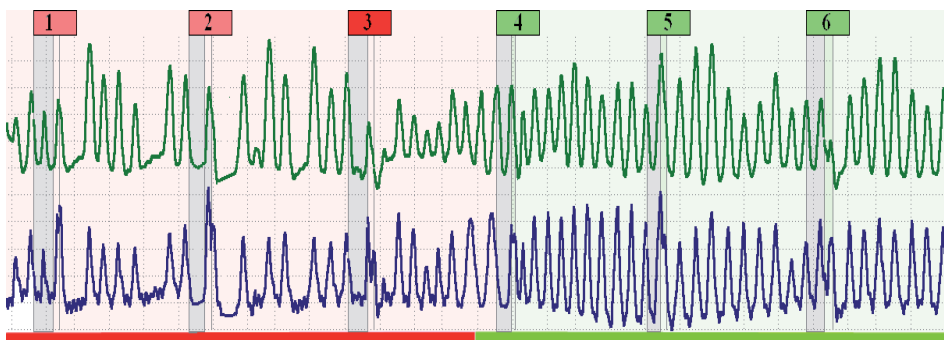


Figure 4. The first pneumograph channel response change variant (Popovichev, 2011)

Popovichev (2011) makes the assumption that the suspect's response to all the items up to the relevant item inclusive is aroused by the state of anticipation. Bradley, Silakowski & Lang (2008) and Lang, Wangelin, Bradley, Versace,

Davenport & Costa (2011) are also of the opinion that the anticipation of danger can arouse autonomic reactions.

Another way of changing the response according to Popovichev (2011) is when increased response is registered starting from the relevant item after all the following items (Figures 5 and 6).

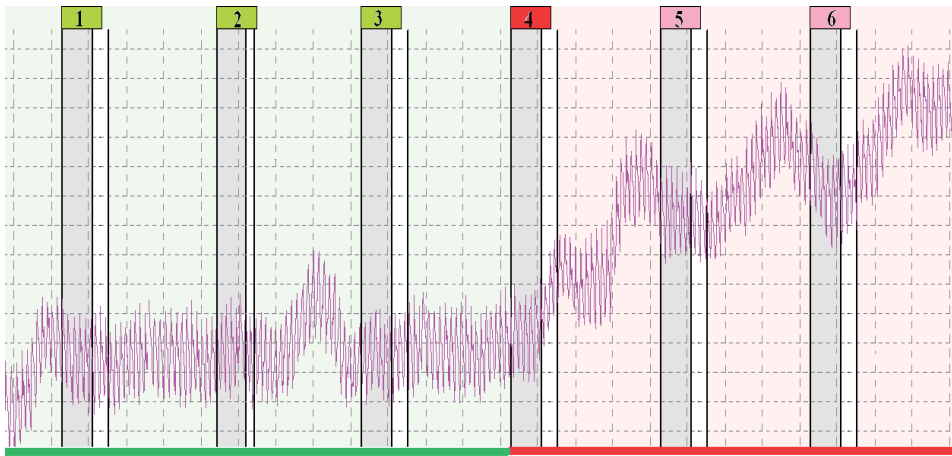


Figure 5. The increased response in the cardiograph channel, registered after relevant item No. 4

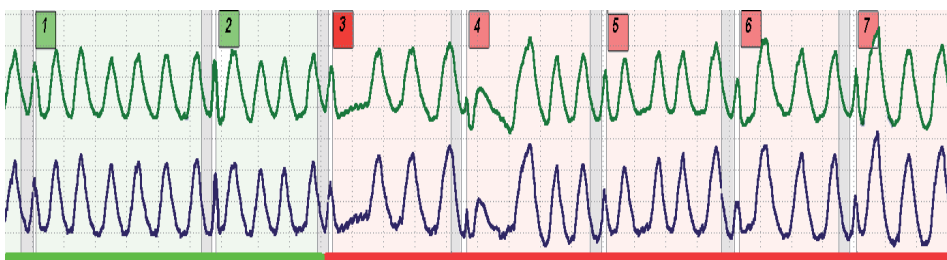


Figure 6. The second Pneumograph channel response change variant (Popovichev, 2011)

Popovichev (2011) makes the assumption that the change of response according to the second variant occurs when the suspect remains calm until the relevant item and the relevant item arouses a significant response which stays throughout the remaining items. We are of the opinion that this could occur

when the suspect remains calm until the relevant item and after the relevant item he/she is unable to return to the calm emotional state. We have not yet observed such a response change, so we are of the opinion that Popovichev (2011) registered the second response change variant due to the following reasons:

- The examination was performed using the classic POT
- These were laboratory examinations
- The suspects were familiarized with the items before the examination.

In working fields we most frequently register yet another progress of change of response during the examination: the suspect's stress is present until the relevant item, the response to the relevant item is higher, and after the relevant item the stress is a bit lower. Figure 1, according to both pneumograph channels, shows that the suspect is also under stress after the relevant item. Where there are more relevant items (Table 1), the polygram becomes more complex (Figure 2).

Let's discuss the issue of what the advantages or disadvantages would be if the items are presented in a consistent way (in the increasing or decreasing order) and in an inconsistent way. Here we will discuss only those cases where the suspect is not familiarized with the items (of the EKT answers) prior to the testing. First, where the numbers are presented consistently: 0; 1; 2; 3; 4;..... or 50; 45; 40; 35;....., the following assumptions can be made:

- The suspect is able to guess the following item after several first items.
- The suspect is able to get ready to counteract by foreseeing the succession of items.
- In case the suspect cannot remember the number in question, response to several adjacent items can be registered.
- Sometimes in polygrams (~25% – Hira & Furumitsu, 2002), the first response change variant can be registered (Popovichev, 2011).
- Sometimes it is difficult to select such a sacrificial item (the EKT answer) that does not result in a loss of important information without evaluating it. Table 1 presents an example where it is difficult to evaluate the response after Answer No. 1 unambiguously.
- Secondly, when the numbers in items are presented in an inconsistent way, i.e. 5; 8; 3; 0; 10;....., then the above-stated assumptions become irrelevant. When the numbers are presented inconsistently, in our opinion that would require a greater number of items. Due to the aforementioned reason the testing may take a longer time. However, we do not know of any studies to substantiate the conclusion that when using an inconsistent presentation of numbers in items a better response is registered.

Summary

1. When developing tests containing numbers, it is very important to evaluate whether the participant in criminal activities is able to memorize the numbers. It may be that he/she only knows them approximately. Should a long time have passed from the event or the criminal have committed several similar crimes, he/she can confuse the numbers.
2. Although Japanese polygraphists recommend using tests involving numbers as sparingly as possible, the experience of Lithuanian and Belarusian polygraphists shows that where tests with numbers are used in a well-thought-out manner one can obtain much important information on the criminal event.
3. Comprehensive studies are needed in order to identify the cases in which it is more expedient to present the numbers in a consistent or inconsistent succession.

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