

APA MAGAZINE

The Magazine for the Polygraph Professional

November/December 2011

Volume 44,6

2012
Looking Forward



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Tech Talk

The Polygraph Examination and Information

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It is well known that the polygraph examination gives an opportunity to find out information about concealed and significant events of life of any man. The second well-known fact is that the physiological reactions registered during polygraph examination can be caused both by the mental processes during concealment of the information and by any other mental activity of man. And the third fact: The use of the polygraph gives an opportunity to determine the involvement of an examinee in any crime much better than by way of random guessing.

Until now there are no specific patterns in physiological reactions which can definitely indicate the nature of mental processes (for example, surprise, concealment of information, fright, etc.) which have caused these reactions. During polygraph examination the increase of physiological reactions following one stimulus (question or subject) in comparison with the reactions following some other stimuli is the signal that the stimulus (with the big reaction) has subjective importance for the person.

However, these facts put the fundamental question - how we can get the information with real semantic content if the polygraph registers only some physiological reactions on some questions? To answer to this fundamental question we may use experiments which were reported by Raskin, Barland and Podlesny (1978). More than 30 years ago these scientists used the guilty-knowledge test (GKT)¹ and wrote the following:

“The subject was administered a series of five charts each having six alternatives to a different question concerning information related to the crime. The items consisted of a set of equally plausible alternatives, one of which was the correct (critical) alternative. The question sequence was as follows:

¹ Editor's Note: This method in more recent years is also known as the Concealed Information Test.

Chart 1

Regarding the type of ring that may have been taken,

- (1) Do you know if it was a sapphire class ring?
- (2) Do you know if it was a pearl engagement ring?
- (3) Do you know if it was a silver and turquoise ring?
- (4) Do you know if it was a gold wedding ring? ***
- (5) Do you know if it was a ruby class ring?
- (6) Do you know if it was a diamond engagement ring?

Chart 2

Regarding the floor of this building that the ring was hidden on,

- (1) Do you know if it was the 1st floor?
- (2) Do you know if it was the 12th floor?
- (3) Do you know if it was the 6th floor?
- (4) Do you know if it was the 4th floor?
- (5) Do you know if it was the 8th floor? ***
- (6) Do you know if it was the 10th floor?

Chart 3

Regarding the number of the room that the ring was hidden in,

- (1) Do you know if it was Room 800?
- (2) Do you know if it was Room 820? ***
- (3) Do you know if it was Room 810?
- (4) Do you know if it was Room 816?
- (5) Do you know if it was Room 814?
- (6) Do you know if it was Room 803?

Chart 4

Regarding the type of envelope that the ring was hidden in,

- (1) Do you know if it was an inter-campus mail envelope?
- (2) Do you know if it was a medium-sized manila envelope?
- (3) Do you know if it was a business-sized white envelope? ***
- (4) Do you know if it was a small-sized manila envelope?
- (5) Do you know if it was a small-sized white envelope?
- (6) Do you know if it was a large-sized manila envelope?

Chart 5

Regarding the name of the doctor that the guilty person was instructed to ask for,

- (1) Do you know if it was Dr. Trumbull?
- (2) Do you know if it was Dr. Tolman?
- (3) Do you know if it was Dr. Heisse?
- (4) Do you know if it was Dr. Jordan?
- (5) Do you know if it was Dr. Calvin?
- (6) Do you know if it was Dr. Mitchell? ***

"The first alternative was included to buffer initial responding and was not scored. The remaining five alternatives consisted of a critical item and four noncritical items. The critical item was the correct alternative, and noncritical items were all incorrect. The critical items were positioned among the noncritical items in a pseudo-random order across charts. In the above list, critical items are identified with asterisks. The rationale of the guilty-knowledge technique was explained to each subject in that group, and prior to each chart the question was reviewed, but no alternatives were stated until the test

was administered except with Chart 4. Prior to that chart, an example of each type of envelope was shown to the subject and specifically named. Subjects were instructed to answer “no” to each alternative on all of the charts” (Raskin, Barland, Podlesny, 1978).

So, before “polygraph examination” the probability that any examinee was involved in the “crime” (stealing of golden wedding ring) was:

$$P_{\text{before}} = 0.5 \quad (\text{or } 50 \% / 50 \%)$$

During “polygraph examination five charts were used and each of them had six questions. The first question of any chart is the “sacrificial” one, and reactions on these “sacrificial” questions are never taken in account in the further analysis. So, any of five charts has five “working” questions. One of them is the element of the “crime” (critical item) and four others which are irrelevant (noncritical items).

If one took any one of the examinee’s charts (for example – Chart 1) the probability that the reactions on the element of the “crime” (i.e. relevant question) were random is mathematically represented as $P_{\text{Ch1}} = 1/x = 0.2$ where “x” is the number of “working” questions in any chart.

It’s clear that the probability of the random reactions of the examinee on the elements of the “crime” in Chart 1 (P_{Ch1}) and in Charts 2, 3 and 4 are equal: $P_{\text{Ch1}} = P_{\text{Ch2}} = P_{\text{Ch3}} = P_{\text{Ch4}} = P_{\text{Ch5}} = 0.2$

If, during polygraph testing, somebody from the group of examinees demonstrated strong reactions on relevant questions in all Charts 1 - Chart 5, the probability that these reactions were random would be calculated as follows: $P_{\text{ran Ch1-Ch5}} = (P_{\text{Ch1}}) \times (P_{\text{Ch2}}) \times (P_{\text{Ch3}}) \times (P_{\text{Ch4}}) \times (P_{\text{Ch5}})$

Any polygraph examiner knows that if he (or she) uses five charts of guilty knowledge test (GKT) and sees strong reactions on the relevant questions he (or she) is right to make the conclusion that this examinee is involved in the crime somehow. In our case (stealing of golden wedding ring) the probability that strong reactions of the examinee on all relevant questions are the random event is this: $P_{\text{ran Ch1-Ch5}} = 0.2 \times 0.2 \times 0.2 \times 0.2 \times 0.2 = 0.00032$, (or 0.032 %).

After polygraph examination the examinee has demonstrated strong reactions to all elements of the “crime” and he (she) has become the suspect. In this case the probability of the involvement in the “crime” of this suspect, is $P_{\text{after}} = 1 - P_{\text{ran Ch1-Ch5}}$

Earlier it was stated that before the polygraph examination the probability that the suspect has been involved in the stealing of a golden wedding ring was: $P_{\text{before}} = 0.5$. After the polygraph examination (in our case – strong reactions of the suspected on elements of the “crime”) the uncertainty (in our case – the involvement of the suspect in the “crime”) can be reduced (Venttsel, 1969).

Really, the probability of the involvement of the suspect in the “crime” has increased ($P_{\text{after}} = 0.9984$). The polygraph examiner comes to the following conclusion: this person was involved in the disappearance of a golden wedding ring.

The result of the polygraph examination is the difference of probabilities:

$$I = P_{\text{after}} - P_{\text{before}}$$

This difference “points out how experiment ‘ α ’ (in our case – polygraph testing) reduces full uncertainty about ‘ β ,’ or how much something new we get to know about ‘ β ’, conducting experiment ‘ α ’. The difference ‘ T ’ is named for the information about ‘ β ’ which is contained in ‘ α ’. Thus, we have an opportunity for numerical measurement of the information” (Jaglom & Jaglom, 1973). Of course, this simple example gives only the most general representation, but it gives the clear answer to the fundamental question stated above.

In this example GKT was used. But the probabilistic principle of the results received with the help of polygraph is one and indivisible. This principle doesn’t depend on the kind of tests - of comparison question technique (CQT) or of concealed information technique. Of course, when the polygraph examiner uses CQT the estimation of probability and receiving of information isn’t so simple – such estimation is very complicated.

So, the polygraph examination described above by Raskin, Barland and Podlesny gave a very important result - when the examiner registers reactions of an examinee during polygraph testing, he receives information about the examinee’s involvement in investigated events in the strictly scientific meaning of the concept – “information.”

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Quotables

There is a subtle danger in a man thinking that he is “fixed” for life. It indicates that the next jolt of the wheel of progress is going to fling him off.

- HENRY FORD, My Life and Work