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## Forensic Examination of Memory Traces Part 2

Forensic examination of memory traces requires a change of approach to the polygraphic examination, especially the way in which it is conducted. To rely on a comparison, one may say that the difference between polygraphic examination as so far understood (lie detection, detection of deception, etc.) and forensic examination of memory traces is much like the difference between examination of traces and microtraces (microtraces are particles of matter or features of a physical action connected to an event that are hardly visible or not visible to the naked eye). Much as in the case of microtraces, the ability to disclose and protect memory traces is significant.

The possibility of using memory traces adds to the potential, much as the popularisation of the use of microtraces resulted in a major increase in applying

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forensic material traces in criminal procedures. This also results from the fact that a criminal procedure is based mostly on memory traces. Forensic examination of memory traces allows not only establishment and examination of what actual memory traces are registered in the nervous system of the person testifying or providing explanations. Thanks to the possibility of establishing the time and the circumstances when such traces originated, their susceptibility to destruction is significantly lower compared to microtraces.

The examinee should be allowed to present his or her version of the event. It is impermissible to perform assessments, especially critical ones, in respect to the utterances of the examinee, challenging the examinee's truthfulness, threatening with consequences, etc. One should also aim to clear all the doubts that the examinee may have, as far as this is possible.

Improper instruction, improper treatment of the examinee, showing disregard, conceit, lack of objectivity, and dishonesty in most cases negatively influence the physiological activity of the examinee.

Differences in the emotional state of the examined people and in their manner of reacting to stimuli may result not only from the individual qualities of the examinees but also from their attitude to the examination, resulting from various motivations, and involvement in various social interactions, etc.

Presented below is a numerical evaluation of 113 confirmation tests.

General remarks:

1. 32 people were subjected to this analysis.
2. In the decided majority of cases (29 examinations of the 32 analysed), the examination was conducted using the Reid technique, with control question tests. (In Polish conditions, this is the most precisely recognised and described technique, for which reason verification of the results should not cause problems, also for other experts).
3. In all the cases assessed where control question tests were used, the result was positive for the people examined.
4. In some tests, confirmation examinations, where the examined answered aloud "NO" to all the questions, the test was conducted more than once (altogether 55 tests).
5. In all the examinations, the first test conducted was the one in which the examinee answered aloud "NO" to all the questions.

6. Usually, the second test to be conducted was the SAT (altogether 44 tests). In a few cases, the second test to be conducted was the one where the person examined answered the truth.
7. The third test to be conducted was the confirmation test, where the examinee provided true answers aloud to all the questions – “YES” or “NO” (altogether 14 tests). This version of the test was used only in certain examinations, most frequently, yet not only, when the two earlier procedures did not provide an unambiguous result.
8. All the examinations analysed were conducted by the same expert, with a polygraph machine made by the same producer and of the same type, to reduce to a minimum differences that may result from different ways of conducting examinations and use of different models of polygraphs.
9. A seven-grade scale was used for scoring.
10. Breath 1 denotes thoracic respiration, and breath 2 abdominal respiration.

Results (scores) for individual physiological parameters registered:

1. Tests in which the examined answered aloud “NO” to all the questions.

Score	-3	-2	-1	0	1	2	3	Total
Breath 1	0	0	1	45	9	0	0	55
Breath 2	0	0	1	44	10	0	0	55
GSR	0	0	4	16	17	10	8	55
Cardio	0	2	0	15	15	14	9	55
Total	0	2	6	120	51	24	17	220

Eight results fell in the range from -1 to -3, which accounts for 3.63% of all results.

The result 0 was detected in 120 cases, which accounts for 54.54%.

The result 1 was detected in 51 cases, which accounts for 23.18%.

The result 2 was detected in 24 cases, which accounts for 10.9%.

The result 3 was detected in 17 cases, which accounts for 7.73%.

Only once in all the 55 tests was there a difference in the evaluation of breath response: 0/1.

No differences were found in the manner of reacting between thoracic and abdominal respiration.

In nine cases, the presence of complex responses was detected in cardio.

## 2. Silent Answer Test (SAT)

Score	-3	-2	-1	0	1	2	3	Total
Breath 1	0	0	0	36	6	2	0	44
Breath 2	0	0	0	35	7	2	0	44
GSR	0	0	5	8	13	10	8	44
Cardio	0	1	1	10	16	12	4	44
Total	0	1	6	89	42	26	12	176

Eight results fell in the range from -1 to -3, which accounts for 3.98%.  
 The number of 0 results detected was 89, which accounts for 50.56%.  
 The number of 1 results detected was 42, which accounts for 23.86%.  
 The number of 2 results detected was 26, which accounts for 14.77%.  
 The number of 3 results detected was 12, which accounts for 6.82%.  
 Only once in 44 tests was there a difference in breath response 0/1.

In one case there was a difference in the manner of response. Present in thoracic respiration were sustained suppressed cycles, while ascending suppressed cycles were recorded in abdominal respiration.

In four cases with GSR responses graded as -1, the cardio score was positive and received higher values. In a single case both the GSR and cardio received -1 scores, which did not prevent a positive opinion from being issued for the examinee, due to the results of the remaining tests.

Complex responses in arterial blood pressure were present in two cases.

## 3. Tests in which the examinee answered truthfully aloud "YES" or "NO".

Score	-3	-2	-1	0	1	2	3	Total
Breath 1	0	0	0	12	2	0	0	14
Breath 2	0	0	0	11	3	0	0	14
GSR	0	0	0	1	5	6	2	14
Cardio	0	0	0	5	4	4	1	14
Total	0	0	0	29	14	10	3	56

No results were detected in the range from -1 to -3.  
 The number of 0 results detected was 29, which accounts for 51.78%.  
 The number of 1 results detected was 14, which accounts for 25%.

The number of 2 results detected was 10, which accounts for 17.86%.

The number of 3 results detected was 3, which accounts for 5.36%.

Out of the 14 tests, there was only one case of 0/1 difference in breath response.

Complex response in arterial blood pressure was present in one case.

The total score of individual types of confirmation tests after adding up the scores for individual physiological parameters:

Tests in which the examinees answered aloud "NO" to all the questions

Total score	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	Total
Number of tests	0	2	1	3	11	13	6	10	5	2	2	0	0	55

3 results were detected in the range from -1 to -3, which accounts for 5.45%.

The number of 0 results detected was 3, which accounts for 5.45%.

Results in the range from 1 to 4 were detected 40 times, which accounts for 72.73%.

Results of 5 or more points were detected 9 times, which accounts for 16.36%.

Silent Answer Test (SAT)

Total scores	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	Total
Number of tests	0	1	0	7	4	8	11	6	2	2	1	0	2	44

1 result was detected in the range -1 to -3, which accounts for 2.27%.

The number of 0 results detected was 7, which accounts for 15.91%.

Results in the range from 1 to 4 were detected 29 times, which accounts for 65.91%.

Results of 5 or more points were detected 7 times, which accounts for 15.91%.

Tests in which the examinee answered truthfully aloud “YES” or “NO”.

Total score	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	Total
Number of tests	0	0	0	0	1	6	2	3	1	0	1	0	0	14

No results were found in the range -3 to 0.

Results in the range from 1 to 4 were detected 12 times, which accounts for 85.71%.

Results of 5 or more points were detected 2 times, which accounts for 14.29%.

Types of emotional changes registered in individual tests and parameters:

Breath responses:

Type of test	NO	SAT	Truth
irregular breath	-	-	-
sustained suppressed cycles	4/4	4/3	-
descending suppressed cycles	2/3	0/1	1/1
ascending suppressed cycles	2/2	4/5	1/2
breath blocking	-	-	-
Sigh of relief	-	-	-
Loss of baseline (upward)	-	-	-
Loss of baseline (downward)	-	-	-
change in inhalation/exhalation ratio	-	-	-
increase in breathing rate	-	-	-
decrease in breathing rate	-	-	-
hyperventilation cycles/increasing amplitude	2/2	-	-
suppressed cycles followed by hyperventilation cycles	-	-	-
irregular breath after answer to key question	-	-	-
irregular breath preceding answer to key question	-	-	-
involuntary movement/fidgeting	-	-	-
absolutely irregular breathing	-	-	-

Note: thoracic respiration/abdominal respiration

## Galvanic Skin Response:

Type of test	NO	SAT	Truth
response to all questions with highest response on critical one	26	16	8
single ascent and descent of curve	9	14	1
saddle response (complex response)	-	3	1
long-lasting response	-	-	-
descending curve	-	-	-
response to all questions until and including critical one, followed by lack of responses	5	4	2
lack of response until and exclusive of critical one, followed by reaction to critical and all ensuing questions	-	-	1
increase of response to questions until and including critical one, followed by decrease of responses	-	1	-
increase of curve until and including critical question followed by a long sustained response	-	-	-
other	-	-	-

## Cardio responses:

Type of test	NO	SAT	Truth
increase and drop in blood pressure	11	9	7
increase in blood pressure	6	4	1
drop in blood pressure	<b>19</b>	<b>16</b>	1
increased heart rate	-	-	-
decreased heart rate	-	-	-
increase of heart-rate amplitude	3	1	-
decrease of heart-rate amplitude	5	2	-
change in position of dicrotic notch (upward, downward)	-	-	-
double waves of blood pressure arousal/increase and decrease	1	-	1
triple waves of blood pressure arousal/increase and decrease	-	1	1
fast heartbeat rate maintained throughout test (>100)	-	-	-
unintentional movements/fidgeting	-	-	-
change in systolic blood pressure	-	-	-
change in diastolic blood pressure	-	-	-
increase in blood pressure until and including the critical question, and its subsequent maintenance	4	2	1
increase in blood pressure until and including the critical question, and its subsequent drop	1	2	1
other	-	-	-

We expect that it may be a major surprise for many experts that in the tests marked here as “NO” the fall in arterial blood pressure accounted for 38% of all responses in arterial blood pressure, and the fall of arterial blood pressure accounted in the SAT tests for as many as 43.2% of all responses in arterial blood pressure.

A significant problem in examining memory traces is the high vulnerability to countermeasures (disruption). In most tests, it is possible to find cases of use of countermeasures to the examination on the grounds of visual assessment of the quality of recording of individual registered physiological parameters. There are, however, cases where even an experienced expert may find it difficult to establish the reasons for a non-standard operation of the organism of the examinee, the more so as there may sometimes be no conditions to examine the state of the examinee’s health.

The numerical values for people using countermeasures in the tests with the use of confirmation tests are interesting. The data pertain only to 15 tests, as selected for assessment were only those cases where the examinees proved especially high skills in disturbing the operation of the organisms. We suspect that the manner in which the recordings are disrupted might escape the attention of many an expert.

Results for the individual registered physiological parameters for all types of confirmation tests:

Score	3	2	1	0	-1	- 2	-3	Total
Breath 1	0	0	0	4	8	2	1	15
Breath 2	0	0	0	4	8	2	1	15
GSR	0	0	0	11	2	2	0	15
Cardio	0	0	0	1	4	6	4	15
Total	0	0	0	20	22	12	6	60

General results for all confirmation tests (disrupted) after adding up the scores for individual physiological parameters:

General scores	0	-1	-2	-3	-4	-5	-6	-7	Total
Number of tests	0	0	2	3	2	5	3	0	15



Together with professional experience, we are acquiring an increasing proficiency in recognising the means used to disrupt the examinations. There are, however, cases when we cannot be sure whether (and how) the person examined uses countermeasures to disrupt the operation of his or her organism on purpose.

The generally available literature reveals the following division of countermeasures:

1. Physical:

- physical exhaustion with intense exercise before the examination
- breath control
- muscular motion (fingers, toes, legs, hand)
- controlling arterial blood pressure
- simulation of anxiety, coughing, irregular breath
- straining the muscles (e.g. abdomen, buttocks, thighs)
- self-inflicted pain (drawing pin in the shoe, biting the tongue, toothache, stomach ache, headache, etc.)
- chewing gum.

2. Psychological:

- psychological exhaustion with intensive exercise before the examination: for this reason, it is not advisable to perform the examination immediately after the crime was committed, especially where the act of committing it exhausts the perpetrator psychologically
- lack of sleep
- religious reasons
- moral reasons
- other reasons mentioned before the examination
- complaining about the tight cuff, especially during the initial phase of the examination
- concentration of the focus of attention on other questions contained in the test than the critical questions
- focusing on matters not connected to the examination (prayer, counting (fairly complicated), thinking about matters e.g. connected to sex, thinking about crimes other than the one being investigated, etc.)
- intense staring at a point on the wall
- self-stimulation by stacking up various threats and problems

- attempts at throwing the examiner by challenging his competence, challenging the usefulness and even legality of examination, ambiguous glances, etc., intensive attempts to “stare the examiner out”
- relaxation
- self-hypnosis and hypnosis
- hunger.

### 3. Chemical:

- consumption of alcohol
- consumption of drugs
- consumption of pharmaceuticals
- smoking a large number of cigarettes.

The technique that we use is highly helpful in these cases.

At the beginning of the examination, in the control questions tests or in the first peak of tension test (when only such tests are used), we place last the question “Are you trying to disrupt this test in any way?” This question naturally requires appropriate discussion while discussing the questions.

In the case of significant emotional changes arising in the examination while answering this question, or should any doubts at all be raised, it is possible to use the peak of tension test, a development of the question above. The test we have produced follows:

1. Neutral question?
2. Neutral question?
3. Are you hiding any health problems?
4. Have you come to the examination feeling sleepy?
5. Have you taken any medications in the last 24 hours?
6. Did you rub anything into your palms before the examination?
7. Have you taken any drugs within the last 24 hours?
8. Have you drunk any alcohol over the last 24 hours?
9. Are you feeling any pain during the examination?
10. Are you looking intently at the wall?
11. Are you straining any muscles?
12. Are you thinking intensively about something other than the questions asked?
13. Did you smoke a cigarette before the examination (did you smoke more cigarettes than you said)?
14. Have you drunk coffee today?

15. Did you arrive at the examination feeling tired?
16. Are you trying to disrupt this examination in a manner different from the ones I listed?

This is not a closed set of questions and can be complemented with any questions that the person conducting the examination may find useful. For example, if we have doubts whether the examinee's manner of breathing is natural, we can add to the test above the question "Are you breathing differently from normally on purpose?"

Similarly, the person conducting the examination may omit certain questions if he is concerned that they concern behaviours that do not occur during the examination. For example, when the GSR recording looks natural, we can omit the question "Did you rub anything into your palms before the examination?", and so forth.

In justified cases, it is possible to develop each of these questions into a more detailed test. If the examinee reacts emotionally to the question about taking medications before the examination, we may aim to define what type of medications were taken, using for example the questions below (this is not a closed set either):

1. Neutral question?
2. Neutral question?
3. Have you taken any stimulants over the last 24 hours?
4. Cough syrup?
5. Nose drops?
6. Narcotic drugs?
7. Tranquillisers?
8. Cardiac medicines?
9. Painkillers?
10. Antibiotics?
11. Have you taken any medications other than the ones I listed over the last 24 hours?

With the suspicion that drugs were taken before the examination, the following set of questions may be used:

1. Neutral question?
2. Neutral question?

3. Have you taken morphine over the last 24 hours?
4. Opium?
5. Marijuana?
6. Cocaine?
7. Amphetamines?
8. LSD?
9. Ecstasy?
10. Heroin?
11. Have you taken any drugs over the last 24 hours other than the ones I listed?

In case of doubt, it is possible to disclose how many times the examinee has taken narcotic drugs in his life or in a specific period of time, when he did so for the last time, etc. (these tests may provide a separate technique of examination towards drug use).

Of course, throughout the examination, we watch carefully the behaviour of the examinee, his appearance, facial expression, gesticulation, way of speaking, look of the eyes and especially of the pupils, and way of breathing. We also pay attention to the person's body odour: sweat, tobacco, alcohol. This, however, is a subject for a separate study.

#### Comments:

1. use of countermeasures in examinations (especially in respiration, and in GSR: escape into thoughts) may result not only from eagerness to hide the knowledge of the main fact, but also of attempts to hide facts of secondary and even tertiary importance.
2. Disruption of tests during the stimulation tests, in isolated cases, may have the same grounds as the ones mentioned above.
3. No attention should be paid to the examinee disrupting the examination by tensing muscles. It is to be tested whether he behaves in a similar manner during the stimulation test and the repeated main test. It is only after a number of attempts that you can focus attention on the examinee's behaviour, remind him he should behave, and repeat the main test again.
4. Some people may on purpose disrupt the examination (stimulate responses) after the asking of control questions, eager to create stronger responses to these questions on purpose. If they do so skilfully, this may escape the attention of an inexperienced expert.
5. Changes of activation within various physiological systems may differ from

another, yet it is hardly probable that a high level of activation within one system is accompanied by a simultaneous state of relaxation in another one.

## References

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