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The Result of a Polygraph Examination as an Argument in Criminal Investigation

The result of polygraph examination is a testimony put forth by an expert after concluding examination on a subject who agreed to undergo the procedure. The subject of consideration here is only the results acquired in examinations conducted as part of criminal investigations, which implies the omission of pre-employment examinations, post-conviction sexual offender testing (PCSOT), and other uses. Moreover, the analysis focuses on only those examinations that ended in indication that the subject of examination was deceptive as a result of the expert using one of the comparison question techniques, or as a person recognising an event in the case of applying the Concealed Information Test (CIT) technique. Nor does the study account for the results of inconclusive examinations.

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Thus the result of a polygraph examination $\boldsymbol{R}$ covered by the scope of this article can assume the form of one of two propositions (as proposed in Widacki, 1982):

$\boldsymbol{R_1}$: Person $\boldsymbol{A_i}$ reacted to the relevant questions in the tests like a subject providing deceptive answers to these questions,
or
$\boldsymbol{R_2}$: Person $\boldsymbol{A_j}$ recognises the event $\boldsymbol{p_n}$.

Because $\boldsymbol{R_1}$ and $\boldsymbol{R_2}$ are the testimonies of an expert, who can be called $\boldsymbol{E}$ here, it can be said that
$\boldsymbol{T_1}$: $\boldsymbol{E}$ states that $\boldsymbol{R_1}$,
or
$\boldsymbol{T_2}$: $\boldsymbol{E}$ states that $\boldsymbol{R_2}$.

Because propositions of the $\boldsymbol{R_1}$, $\boldsymbol{R_2}$ (generally: $\boldsymbol{R}$) type and of the $\boldsymbol{T_1}$, $\boldsymbol{T_2}$ (generally: $\boldsymbol{T}$) type are produced for the use of the investigation, one should assume that they belong to the mass of evidence. This article aims to consider such propositions as arguments in the investigation procedure.

In the context of the matter in question, an argument is a certain inferential structure composed of a single premise or premises, on whose grounds, with the use of appropriate generalisations, the conclusion is deduced. The premise is a particular "basis", a certain knowledge base that provides grounds for performing intellectual operations, in a word: information. Pure information, however, is not yet evidence, though it can become such as far as it fits being used in inferential reasoning, or, in the simplest terms, in indirect inference; this "fitting" being the basic and common feature for all pieces of evidence (Twining 2006, p. 438). In our case, this means that pure $\boldsymbol{R_1}$ information is not yet evidence, and the interference performed by the investigator, which transforms the result of a polygraph examination into a piece of evidence, has the following form: if $\boldsymbol{T_1}$ then $\boldsymbol{R_1}$. The same is true about the $\boldsymbol{T_2}$ and $\boldsymbol{R_2}$ propositions and the if $\boldsymbol{T_1}$ then $\boldsymbol{R_2}$ inference. It is only recognition of these inferences that introduces the propositions $\boldsymbol{R_1}$ or $\boldsymbol{R_2}$ to the mass of evidence (see: Stein 2005, p. 35).

An investigation can be interpreted as a multiple, repetitive process of generating, testing, and justifying various hypotheses explaining the individual questions in the given matter. The conclusion of the proving argument assumes the form of a hypothesis which can become a constituent of the description of

the given course of events. Hypotheses together make up the crime scenario (Braak 2010, p. 18). Before the incorporation of a given hypothesis into the main scenario of the event (i.e. that which explains the circumstances of the crime best), it needs testing to eliminate the potential false positive which it exposes (Bex 2009a, p. 23).

Thus two questions arise: (a) why did ***E*** consider the $\boldsymbol{R_1}$ or $\boldsymbol{R_2}$ propositions, and (b) what can the role played by the $\boldsymbol{R_1}$ or $\boldsymbol{R_2}$ propositions be in the main scenario of the investigated event?

The analysis of the argument from the expert's opinion was conducted by Walton, Reed, and Macango (Walton, Reed, Macango 2010, pp. 14–15) , who developed the scheme of Stein's inference quoted above into the following syllogism (using the symbols applied above):

(*Major premise*) Source ***E*** is an expert in the field of polygraph examinations, which contains the propositions $\boldsymbol{R_1}$ or $\boldsymbol{R_2}$. (*Minor premise*) E claims that the propositions $\boldsymbol{R_1}$ or $\boldsymbol{R_2}$ are true. (*Conclusion*) The propositions $\boldsymbol{R_1}$ or $\boldsymbol{R_2}$ may credibly be considered true.

The authors, rightly pointing to the natural readiness to accept experts' opinions, equally justly write that there are no reasons to consider them infallible and omniscient, suggesting at the same time treating the arguments from their opinions as defeasible. To facilitate the analysis of such arguments, the authors propose a tool composed of six questions, the answers to which will help in solving the problem of opinion credibility. In the context analysed here, the questions are as follows: (1) how credible is ***E*** in the capacity of an expert? 2) Is ***E*** an expert in polygraph examinations? (3) According to ***E***, what do the propositions $\boldsymbol{R_1}$ or $\boldsymbol{R_2}$ result from? (4) Is ***E*** personally a reliable source? (5) Are the propositions $\boldsymbol{R_1}$ or $\boldsymbol{R_2}$ coherent with the claims of other experts? (6) Are the claims of ***E*** based on the mass of evidence?

Questions (1) and (2) refer to the qualifications and personal properties of ***E***. The answer should be sought in ascertaining the certification that the expert might have. That can for example be a certification issued by the institution that employs the expert or by a professional corporation. They can also be certificates of training completed, scientific achievements, etc. The answers to question (1) can also be sought in the expert's biography, his or her references, and the opinions about the expert in the professional community.

Question (4) may be interpreted as a problem concerning the quality of the expert's work. Primarily, this is about the correctness of the method of polygraph examination used. Therefore, it is worth reiterating that correct and allowed in practical use is a method with precision defined in an independent and fully published study, sufficient diagnostic value (at least 80% for investigation purposes), and a range of other features (Krapohl 2006, for other quality requirements see: Konieczny 2009).

Question (5) is not fully clear. If one assumes that it refers to a polygraph examination of the same person (persons $\boldsymbol{A}_i$ and $\boldsymbol{A}_j$), conducted by other experts to achieve the same goal, they will either support, much like $\boldsymbol{E}$, propositions $\boldsymbol{R}_1$ or $\boldsymbol{R}_2$ (which will entail the use of the *communis opinio doctorum* principle), or if they recognise some other propositions, there will be a dispute. The sense of such disputes and means of tackling them are described in D. Dwyer (2008). If the consistency of the result of polygraph examinations is to concern its alignment with other expert opinions, then the case is decided at the stage of building a scenario, as discussed below.

Question (6) actually concerns the persuasive skills of the expert, and specifically whether he or she will be capable of convincing the recipients of his or her opinion about the correctness of the inference made on the grounds of the materials gathered, primarily the charts acquired while conducting the tests. The question can be considered a "subquestion" to (3).

Question (3) is definitely the most important of the entire set quoted above. It concerns the grounds for forming opinions, that is generalisations that allow the construction of an argument. If such a generalisation is used in evidence-based reasoning, it can be defined as generalisation on evidence. It allows inference from premises to conclusions, in this way influencing the power of the given evidence-based argument, and becomes the "cement" bringing the given argument together (Bex et al. 2007, p. 146).

According to the definition proposed by Anderson, generalisations are general claims concerning the way of perceiving the mechanisms in the world surrounding us, human behaviours and intentions, environment, and interactions between the environment and individuals (Anderson, Schum, Twining 2005, pp. 262–288). They may be based on empirical studies, but can also result from everyday experience and/or general common-sense knowledge. Generalisations cannot be assigned the feature of "certainty"; they are qualified with the

use of a modal quantifier, such as "usually", "often", "generally", "sometimes" (Schum 1994, pp. 81–82). Yet, as far as they are statements achieved through scientific procedures, the level of their probability is (or at least should be) known. The generalisations constructed, which have their modal quantifier provided or whose probability is known, allow potential criticism of their use in a specific situation, as a scrupulous analysis is a procedure that is equally important as the formulation of generalisations (Bex 2009, p. 93). It goes without saying, therefore, that the use of generalisations provides the necessary grounds for every step in the complicated chains of evidence reasoning (Bex, Koppen, Prakken, Verheij 2010, pp. 127–128).

Generalisations can assume the form of a statement, but also that of a conditional.

Below are examples of generalisations used in polygraph examinations.
(I) "Comparison questions are designed to provide the innocent suspect with an opportunity to become more concerned about questions other than the relevant questions, thereby causing the innocent suspect to react more strongly to the comparison than to relevant questions" (Ruskin, Honts 2002, p. 7).

This statement provides the grounds for a number of various polygraph techniques, known as comparison question techniques. Their precision is known and may, as is the case with the Utah Zone Comparison Technique, exceed 90% (Krapohl, 2006). This technique leads to propositions of the $\boldsymbol{R}_1$ type.

(II) "If a subject has committed the crime, he or she will be able to distinguish the critical item among non-critical items during the polygraph test, while an innocent subject will not. When the deceptive subject discovers the critical item in the question sequence, specific involuntary changes are triggered in the autonomic nervous system" (Nakayama 2002, p. 49).

This generalisation provides the grounds for inferring propositions of the $\boldsymbol{R}_2$ type and provides the grounds for the CIT technique. Its precision is known: in laboratory tests it amounts to 82% among both sincere and deceptive people; in actual cases it verges on 100% among sincere and deceptive people. It is contained between 60% and 90% (McCloughan 2006). The generalisation can be used in practice, but it can also be criticised quite fundamentally (Konieczny 2009, pp. 84–85).

Not every generalisation known in the field of polygraph examinations has its probability defined as well as (I) and (II). In the following case, even the modal quantifier is little known:
(III) The electrodermal recording might lack responsiveness and in some cases be totally devoid of responsiveness due to the examinee's ingestion of a drug or meditation which has anti-muscarinic properties such as antipsychotic and antidepressant meditations" (Matte 1996, p. 175).

Although necessary during the evidential reasoning, generalisations can be dangerous for the correctness of reasoning, especially when they are not expressed directly and are undefined in reference to the scope, level of abstraction, modal quantifier, empirical enforceability, and generally, their power (Twining 2006, pp. 334–335). This is why a procedure that is equally important to their use is their critical testing to minimise the related threats. This can be achieved through a simple test proposed by Anderson, Schum, and Twining. It comprises 12 questions divided into two categories, depending on their generalisation being expressed directly or remaining hidden. In the case of an articulated generalisation its precision and equivalence are studied and attempts are made to adjust the model coefficient/index, while in the case of a hidden generalisation attempts are made to "portray" and reconstruct it by the formulation of its convincing version, and later test it just like in the case of generalisations expressed directly (Anderson, Schum, Twining 2005, pp. 279–280).

To keep things ordered, let us also add that the generalisation itself is not sufficient to perform a proper evaluation of a polygraph examination, as there are also other factors that are decisive for the correctness of that action (Widacki, 2011).

Let us now assume that the result of a polygraph examination provided the grounds for formulating hypotheses in the main scenario of the event investigated. Possible, then, are three ways of criticising (conflicting) such an argument: an attack on the conclusion, an attack on the premises, and an attack on the rule of inference used in the argument (Braak 2010, p. 28).

These options are illustrated in the chart below:

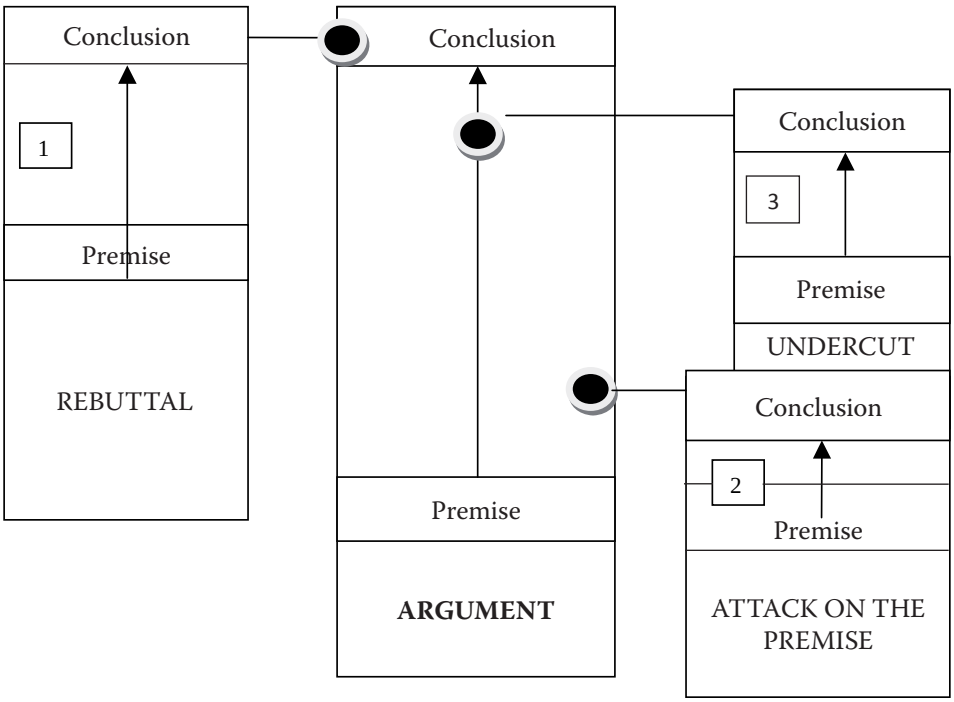

Fig. 1. Ways of attacking arguments

Source: S. van den Braak (2010), Sense-making software for crime analysis, SIKS Dissertation Series No. 2010-12, Universiteit Utrecht

The arguments that originated while using defeasible reasoning where – despite the correctness of the premises – the conclusion achieved on such grounds can be false, as the premises guarantee only a certain degree of certainty to the conclusion, can be conflicted by the first and third means of attack, that is, respectively, rebuttal of an argument by a counter argument with an opposite conclusion, and an attack on the rule of the conclusion, by negating its use in the given circumstances (undercutting); this does not mean that the conclusion in the argument attacked is false, but only that it is not sufficiently justified by its premises (Bex, Prakken, Reed, Walton 2003, p. 138).

A practical (and actually occurring) case of such a situation can be conducting fewer tests during an examination than required by the procedure for the given technique: for example, in the stead of three envisaged tests of comparative questions, an expert conducts only one, explaining the situation later as due

to lack of time or orders from a superior (an actual case known to the author). Another example can be the questioning of the rule of inference by proving (after CIT technique examination) that the examinee knew the details of the event investigated from a source other than participation in the event.

After ascertaining which of the arguments is stronger than the other, their dialectical status can be established (Prakken 2004, p. 5). This concerns the interaction between arguments and counterarguments. In this sense, three types of status of arguments can be distinguished: justified argument, that is one that triumphs when faced with counterarguments; overruled argument, namely one that loses such a "battle"; and the last, neutral – i.e. a defensible argument which "draws", leaving the "battle" of arguments inconclusive (Prakken, Sartor 2009, p. 233).

For example, if we assume that argument $\boldsymbol{R}_1$ is for some reason stronger than the argument from the explanation of $\boldsymbol{A}_i$, who does not plead guilty, the former can be defined as justified, and the latter as overruled. Significantly, the testing of the dialectical status of the arguments can be conducted only after the majority of them have been generated in a case, which means that various interactions may be perceived between them (Braak 2010, p. 28).

A significant phenomenon in this context is the so-called reinstatement of an argument (Bex, Verheij 2009c, p. 171). Even if for some reasons we prefer the argument provided by ***E***, it can be overruled by a new argument containing one of the following conclusions: the expert who issued a polygraph opinion is not credible, he misinterpreted the results, etc. In this way, this new argument may "reinstate" the argument taken up by the examinee (refusal to claim guilty), which was initially considered overruled. The phenomenon of reinstatement, let us reiterate, corroborates the requirement that – to be able to consider the mutual interactions between the arguments – all the relevant proof and information available in the case must be acquired, which will allow the final evaluation of the dialectic status of the arguments.

Closing, let us cite the so-called abductive practical reasoning scheme proposed in a work by Bex, Bench-Capon, and Atkinson (Bex, Bench-Capon, Atkinson 2009b, pp. 81–86). The scheme has the following form:

Conducting of actions ***A*** serves the attainment of goal ***G***. Thus, person ***P*** has the goal ***G***. Hence, person ***P*** should embark on action ***A***.

The significance of such reasoning may be refuted by the "discovery" that there is a better way of reaching goal *G*. Then action *A* and the previous inference will be challenged, which will allow the construction of successive arguments (Bex, Verheij 2009c, p. 173). It is easy to notice that if *G* marks the discovery of a criminal by the person *P* conducting the investigation, and *A* the use of an investigation method that remains inefficient in the given case, then the idea of conducting a polygraph examination may dawn to *P*, which will bring more benefit than persevering with method *A*, as it will allow the acquisition of new, relevant information, expansion of the pool of arguments, and – most probably – approaching, if not attainment, of the goal.

Conclusions

This essay is only a very small step towards involving the conceptual apparatus of contemporary methodological investigation modelling in the context of polygraph examination. Nevertheless, it seems that even such a small example of the possibility of looking at polygraph examinations from the angle of the modern theory of argumentation seems useful for a number of reasons. It provides notions that make it easier to note the problems and consider them critically, allows the identification of weak points in reasoning, and primarily allows gaps to be found in the existing knowledge and the directions of its expansion to be pointed to.

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