Visualising the argumentation structure of an expert witness report with Rationale (extended abstract)

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Abstract. This paper reports on a case study in which the use of the Rationale software was investigated to analyse the argumentation structure of a Dutch expert witness report in a criminal case. The underlying motivation of the case study was to explore the usefulness of argumentation visualisation software for increasing a judge's understanding of expert reports and for assisting him or her in asking the proper critical questions to the expert. By way of an initial exploration of this usefulness, an expert report was analysed with the Rationale software. The visualisation was informally discussed with a legal expert, who was generally positive but also expressed some concerns and expected that the main usefulness of the tool is in training and education of judges.

1. Introduction

It has often been suggested that argument visualisation software (AVS) can be useful in managing the complexity of argumentation and proof in legal cases (Schum and Tillers; 1991; Verheij; 2005; Van Gelder; 2007; Walker; 2007; Sombekke et al.; 2007; Van den Braak; 2010). This extended abstract reports on a case study in which the use of AVS was investigated to analyse the argumentation structure of a Dutch expert witness report in a criminal case. The case study was carried out in collaboration with the Dutch Council of the Judiciary (Raad voor de Rechtspraak, henceforth RvdR)[1].

The practical motivation for the project was as follows. The increasing complexity of legal cases has led to an increase in the number and complexity of expert witness testimonies. Since judges are laypersons in the fields of expertise of the expert witnesses, they often find it hard to understand the expert reports and to ask the proper questions to the expert (Kwakman; 2006). The RvdR is therefore very interested in education programmes and support tools that can help judges in dealing with expert evidence.

One tool which can possibly provide support to judges is an AVS. If a judge analyses the argumentation structure of an expert report with an AVS, this could increase the judge's understanding of the report and assist him or her in asking the proper questions

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to the expert. Alternatively, these benefits could result if the judge is provided with such an analysis made by someone else. The purpose of the present case study was to give an initial exploration of this potential usefulness of AVS. To this end, an expert report containing a psychological examination of a suspect of a robbery with attempted murder was analysed by us with the Rationale software (Van Gelder; 2007). We were in particular interested to see whether the report contains a substantial amount of argumentation and, if so, to what extent the argumentation can be visualised with a tool like Rationale. The resulting visualisation was informally discussed with a staff member of the RvDR who is involved in the RvdR's programmes concerning expert evidence. The case study was carried out as part of a two-and-a-half month undergraduate project of the first author of this extended abstract, supervised by the second author.

In this extended abstract we first briefly introduce the used Rationale software and motivate our choice for Rationale in light of alternatives such as Avers (Van den Braak; 2010) and Araucaria (Reed and Rowe; 2004). We then briefly summarise the expert report and outline the analysis of its argumentation structure with Rationale. We conclude with some comments on the experiences gained during the study and the potential of AVS like Rationale for practical use in legal settings.

2. Argument visualisation software

Different AVS implicitly or explicitly commit to different models of reasoning and argumentation. Most AVS support the visualisation of 'standard' argumentation models, in which conclusions are supported by one or more grounds, which can be horizontally linked (all grounds needed to support the conclusion) or regarded as alternative grounds for the conclusion (one ground suffices to support the conclusion. Grounds can be 'vertically' supported by further (combinations of) grounds, resulting in a tree structure. Several AVS of this kind also support the visualisation of objections or counterarguments. Araucaria allows statements in two trees to be horizontally connected, meaning that the two connected statements are incompatible. Rationale, by contrast, allows vertical 'objection' links from one statement to another, meaning that the former statement supports the negation of the latter statement (this interpretation is based on personal communication with Tim van Gelder and on ter Berg et al. (2009, pp. 25–6)). In addition, Rationale allows that a statement attacks the connection between grounds and a conclusion. Thus it can be said in terms of Prakken (2010a) that Araucaria only supports the visualisation of rebutting and undermining attacks while Rationale also supports the visualisation of undercutting attacks.

The possibility to represent undercutters was not the reason why Rationale was adopted in this case study. The reason was instead that Rationale, being a commercial product, has superior facilities for zooming in and out and thus for maintaining overview over large graphs. This proved essential for visualising the expert report.

As explained further below, the expert made use of abductive reasoning, which raises the question why Avers (Van den Braak; 2010) was not used. Avers is an AVS for crime investigation in which scenarios about what may have happened can be constructed and then linked with 'standard' argumentation to the available evidence. However, as also explained further below, the expert's use of abduction could be modelled in with an argumentation scheme, which obviated the need for Avers.

3. The expert report

The expert report concerns a psychological examination of a suspect of a robbery with attempted murder. To support the judge in deciding whether the suspect was mentally accountable for the crime, the expert had to provide insight the mental state of the suspect during the crime and its effect on the suspect's behaviour. In this abstract we focus on the subquestion whether the suspect is suffering from some mental disease. In his report the expert mixes a description of several psychological tests and examinations with two alternative diagnoses. Initial observations and tests suggest that the suspect is a timid, sensitive boy whose emotions block quickly and who is strongly hindered by feelings of inadequacy and inferiority. This diagnosis predicts, among other things, that the suspect is introvert and neurotic and suffers from a form of fear of failure that negatively impacts on performance. However, these predictions are contradicted by later findings. The expert then adopts a second diagnosis, namely, that the suspect suffers from a severe inability to experience and express his inner feelings and emotions (in Figure 1 summarised as 'Predominant feelings of inadequacy'), which the expert then classifies as an atypical kind of autism. The expert supports his second diagnosis in two ways. He first gives an abductive argument, stating that the findings on the suspect's behaviour can be explained by the severe inability to experience and express his inner feelings and emotions. He then gives additional direct evidence for the existence of this severe inability.

An overview of the expert's reasoning is provided in Figure 1 (made by us by summarising several subtrees in single nodes).

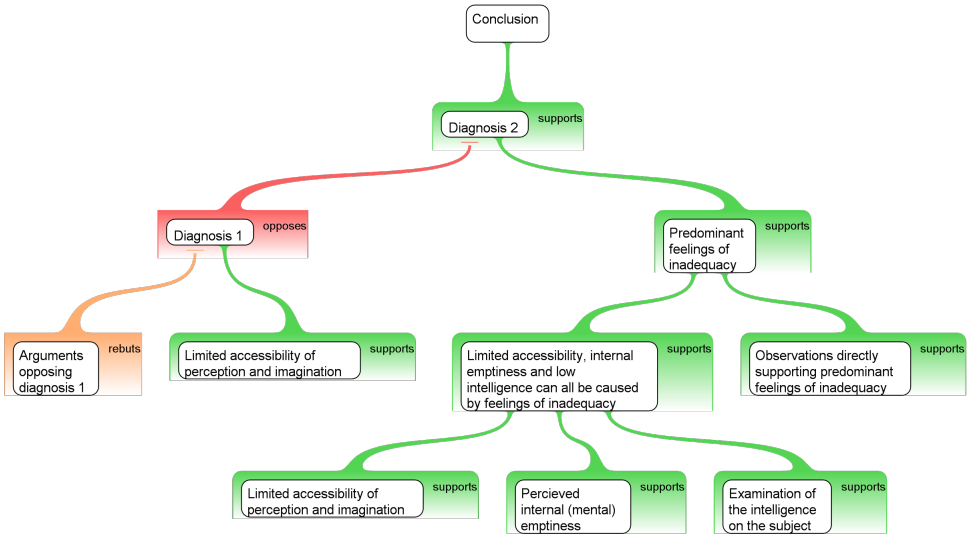

Figure 1. Overview

In this brief summary of the expert report in fact already a choice has been made for a particular theoretical view on the expert's argumentation, namely, as essentially being abductive diagnosis. In fact, this account was only adopted after a first analysis in a more rule-based style (effectively applying modus ponens to observations and implicit gener-

alisations) proved unsatisfactory. After adopting the abductive theoretical view, the further analysis was guided by the following argumentation scheme for abductive diagnosis (similar to Walton (1996)'s scheme from evidence to hypothesis).

Person P exhibits behaviours $B_1, \ldots, B_n$
Diagnosis D explains behaviours $B_1, \ldots, B_n$

Therefore, Person P suffers from disease D

The critical questions are:

- CQ1: Does diagnosis D predict other behaviours that are contradicted by observations?
- CQ2: Can behaviours $B_1, \ldots, B_n$ be explained by alternative diagnoses?

Positive answers to these questions generate counterarguments. The support for the first premise of the two abductive arguments was visualised in modus ponens style with generalisations left implicit, ultimately based on implicit generalisations that tests and examinations of a certain kind are reliable indicators of their results.

4. Some findings

4.1. Visualising abductive reasoning

AI models of abductive diagnosis are not stated in terms of argumentation (Prakken; 2010b). Nevertheless, in the present case a 'standard' argumentation format proved sufficient, since the expert's diagnostic reasoning could be modelled with the above-listed argument scheme for abductive diagnosis (although Rationale does not provide support for constructing instances of schemes, as in Avers, nor for indicating which scheme has been applied, as in Araucaria). The positive answer to CQ1 was visualised as an objection to the first diagnosis (See Figure 2, which displays the first four levels of the argument in support of the diagnosis plus the conclusion of the objection).

Alternatively it could have been modelled as an undercutter. In that case, it would in Figure 2 have been linked to the support box containing the two grounds that directly support diagnosis 1. The positive answer to CQ2 was visualised by letting the alternative diagnosis be the main diagnostic conclusion and letting the first diagnosis be an objection to that diagnosis. What cannot be modelled as such in Rationale is the reasons why the second diagnosis is preferred, namely, that the second diagnosis explains both the initial findings (also explained by the first diagnosis) and the further findings (contradicted by the predictions of the first diagnosis). In fact, these reasons are also largely left implicit by the expert. All he does is saying that the suspect's behaviour is not caused by the facts assumed in the first diagnosis but by the severe inability to experience and express his inner feelings and emotions (the second diagnosis). This expresses a choice for the second diagnosis without giving explicit reasons for this choice (See the bottom-left node in Figure 3).

Note that besides the abductive argument the expert gives an additional evidential argument for the existence of the defect. This was visualised as two separate arguments for the same conclusion (see Figure 3). Arguably these arguments accrue Prakken (2005) in that together they provide stronger support for the second diagnosis than alone but accrual can in Rationale not be visualised.

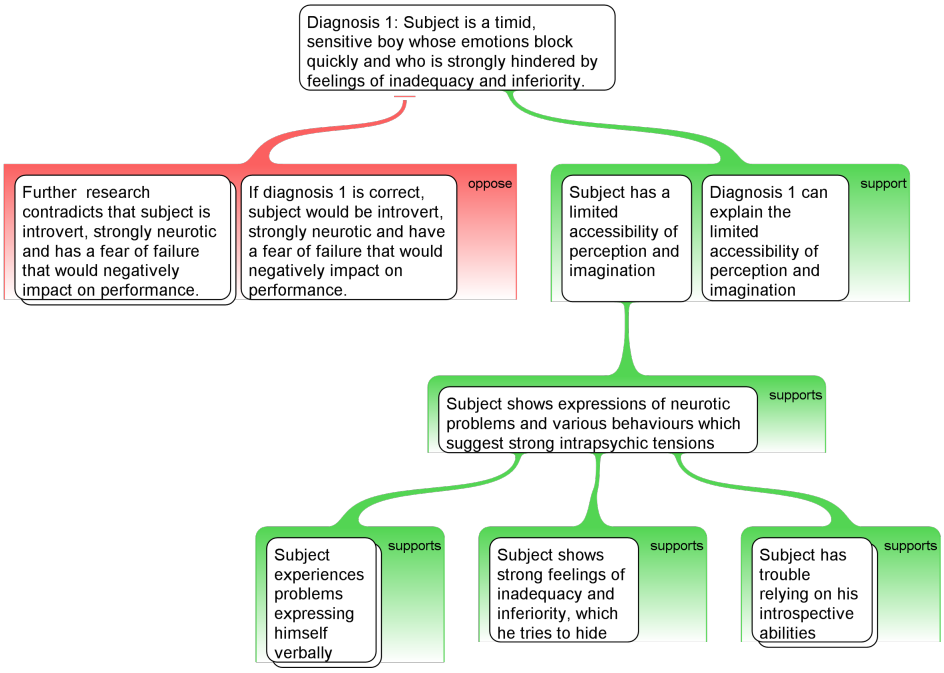

Figure 2. Diagnosis 1 and an objection

4.2. Objectivity of the visualisation

A visual reconstruction of a realistic piece of argumentation inevitably involves interpretation. In this case study a particular problem was that the expert seemed to use many different ways to formulate essentially the same findings or diagnoses. We have tried to unify them but we may have been inaccurate. Apart from this we did not find many argumentative ambiguities in the expert's arguments but other analysts might disagree.

4.3. The legal expert's feedback

After the visual reconstruction of the expert report was completed, it was informally discussed with a legal expert of the RvdR involved in the RvdR's programmes concerning expert evidence. He was generally positive but also expressed some concerns. We briefly summarise his feedback.

To start with, the expert feared that judges might be intimidated by the size and detail of the graph (Figure 4 displays the complete graph, to give an indication of its size). Combined with the fact that most nodes are green, that is, there are not many counter-arguments, this might make that judges will not check the graph in detail. According to the expert, tools for abstraction and summary are needed, such as a feature to summarise uncontroversial parts of the graph in a single abstraction node. For example, ideally a summary as provided by Figure 1 could be automatically linked to the detailed analysis, so that clicking on a node in Figure 1 would display the corresponding subtree in detail.

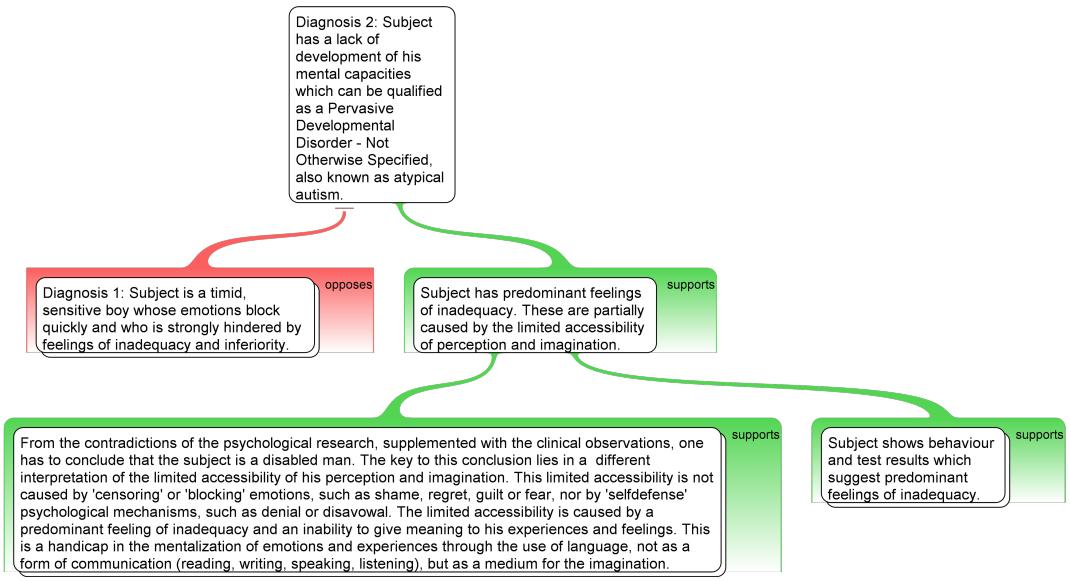

Figure 3. Diagnosis 2

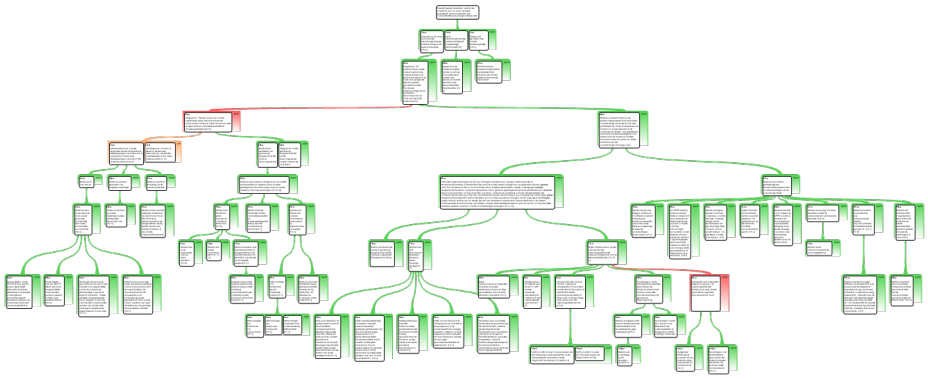

Figure 4. The complete graph

After the idea of argument schemes was explained to the legal expert, he found support for their use desirable, particularly to help in identifying implicit premises and in developing a critical attitude towards the expert witnesses' reasoning.

Finally, the legal expert expected that a tool like this is likely to be more useful in training of judges and education of law students than in legal practice. Once judges have become aware of the potential sources of doubt in argumentation, they can develop a critical attitude towards expert reports without the need to visualise them with an AVS.

5. Conclusions

It goes without saying that a project of such limited scope cannot result in firm conclusions. With this in mind it can be concluded that this project provides some initial support for the hypothesis that AVS may be useful in increasing a judge's understanding of expert reports and in assisting him or her in asking the proper questions to the expert, especially when used as a training or education tool. In particular, we found that the expert report we analysed contains a substantial amount of argumentation, which could be visualised in a natural way with Rationale. However, the usefulness of AVS should be further investigated in studies of larger size, preferably with involvement of judges and expert witnesses as test subjects and/or evaluators. In particular, in the present case study the visualisation was made by us and was not shown to a judge. Letting judges make the analysis or confronting them with an analysis made by someone else may lead to better insights into the potential of AVS to support judges.

Although the Rationale software proved generally suitable for visualising the expert's reasoning, the study has also yielded some suggestions for extending the software. First, although Rationale provides excellent support for maintaining overview of large graphs, additional tools for abstraction and summary may further increase the usefulness of the system. Another useful addition would be support for argument schemes. For example, a feature like in Avers (Van den Braak; 2010) could be added, where users can indicate that they want to add an instance of a scheme to the graph, after which the system automatically adds templates for the premises, conclusion and critical questions to the graph, to be completed by the user. It should be noted that currently Rationale allows links from "Basis Boxes" (for example, "Common belief", "Law" or "Expert opinion") to argument premises, to indicate the source of the premise. However, these links are not meant to be argumentative (Tim van Gelder, personal communication and ter Berg et al. (2009, p. 27)). In particular, they cannot be undercut. It seems a natural idea to replace these boxes by source-based argumentation schemes, so that the support that sources provide for argument premises can be critically examined.

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