Taking a Page from the Law Books: Considering Evidence Weight in Evaluating Assurance Case Confidence

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What is an assurance case?

What causes uncertainty?
- the phenomena we are reasoning about have an empirical nature
- Toulmin’s schemes have elements that are subject to uncertainty

Deductive vs. inductive reasoning
- Inductive reasoning (as opposed to deductive reasoning) is reasoning in which the premises seek to supply strong evidence for (not absolute proof of) the truth of the conclusion. [1]
Working Definition of Confidence

- Confidence in an assurance case is the quality or state of being certain that the assurance case is appropriately and effectively structured, and correct.

- In order to evaluate our confidence in the truth of a proposition, we must evaluate our confidence in the proof that has been suggested.
Evidence Weight

- “the degree to which a rational decision-maker is convinced of the truth of a proposition as compared to some competing hypothesis” [2]

- “a balance, not between the favourable and the unfavourable evidence, but between the absolute amounts of relevant knowledge and relevant ignorance” [3]
Practical Ramifications

- an important factor for establishing readiness of the assurance case to be presented for review
- compiling compendiums of relevant evidence
- our notion of “ripeness for review” is separate from the expected result of the review
“BAE Systems deliberately did not disclose to its customer at the meeting the known figures for the large proportion of hazards which it had left “open” and “unclassified” (many with only vague recommendations that ‘further work’ was required) or otherwise draw attention to the large gap remaining in its analysis.” [4]
Measuring Evidence Weight \[3\]

- “the principle of equipollence is indefensible, [therefore] there is no natural unit of weight and the prospects of any non-arbitrary system for measuring weight are very poor”

- not applicable even with regard to primitive predicates, as primitiveness is not correlated with relevance
Measuring Evidence Weight cont. [3]

- ranking and comparing is possible (at least for arguments about a given subject-matter)

- we need “an ordering for a certain set of families of evidential predicates and [to concern] ourselves only with arguments from premisses [sic] that contain just predicates belonging to the first family, or just those predicates plus predicates belonging to the second family, or just predicates from each of the first three families, and so on cumulatively”
Measuring Evidence Weight cont. [3]

- “it will be important to give priority in the ordering of predicate-families to those families that contain at least one predicate which is highly relevant in relation to the accepted prior probability of at least one conclusion in the given field”

- to avoid arbitrariness, when two or more predicate-families receive the same priority, they need to be combined in a single family, “… that contains every possible combination of the predicates belonging to the tying predicate-families”
What Next?

- Is there a way to address the problems with measuring and ranking evidence weight?
- Is this one value to be included in a tuple measure for confidence?

Thank you!

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