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Commentary on Verheij

Peter Mcburney

Author: Peter McBurney
In Response to: Bart Verheij's *Evaluating arguments based on Toulmin's scheme*

Bart Verheij (2001) discusses Toulmin's (1958) well-known argumentation scheme from the perspective of the *evaluation* of arguments, as distinct from their structure, which was Toulmin's main focus. I believe Verheij's topic is important, and I found his treatment interesting and sound; his paper is also clear and well-written. My comments on the paper are reflections provoked by reading it, and they primarily consist in suggestions for extensions and further exploration of these ideas.

1. Argumentation has found recent application in Artificial Intelligence (AI) and computer science, and Toulmin's scheme has been influential in this regard. (See Carbogim *et al.* 2000 for a partial review of applications of argumentation in AI.) These applications have drawn on argumentation – both monolectical and dialectical – in a number of (overlapping) streams:

- To represent human reasoning in some complex domain, such as legal reasoning (e.g. Bench-Capon *et al.* Forthcoming). Here, argumentation aims to capture subtleties of argument inexpressible in traditional logical formalisms, an aim which also appears to have been one of the objectives of Toulmin in proposing his schema (1958).
- As a proof-theory or a semantics for some non-monotonic logics (e.g. see Dung 1995, Prakken & Vreeswijk Forthcoming). In this stream, the argumentation system may provide a computational mechanism for establishment of the (defeasible) acceptance of a statement in the logic, by means of the comparison of the arguments presented for and against it.
- To represent uncertain, ambiguous and conflicting information, either by treating arguments as tentative proofs of claims (Krause *et al.* 1995) or by having the arguments for and against a claim confront each other (McBurney & Parsons Forthcoming).
- As the basis for interactions between autonomous software entities, such as negotiations between intelligent agents in e-commerce systems (Parsons *et al.* 1998) or between components in software-development processes (Finkelstein & Fuks 1989, Stathis 2000). Here, the formal dialogue games of Hamblin (1971) and MacKenzie (1979) have found application.

In each of these application areas, evaluation of arguments is important. For example, if arguments are treated as tentative proofs and used to represent uncertainty, then one may attach to each argument a measure of the degree to which it is believed true. It is then possible to define calculi for the manipulation of these measures so as to resolve differences between the arguments presented for and against a claim (Krause *et al.* 1995). Such calculi are examples of labeled deductive systems (Gabbay 1994), i.e. logical formalisms in which formulae have labels attached to them.

Because of its importance, considerable attention, as Verheij notes, has been given within AI to evaluation and resolution of arguments in argumentation systems. Yet much of this attention has been at a very abstract level, assuming some relationship of *defeat* between arguments without defining this relationship in any greater detail. Verheij's paper therefore represents a novel, and overdue, analysis of the different ways in which one argument may rebut (and hence defeat) another, if each argument is represented in Toulmin's structure.

2. Verheij has assumed (Section 2.1) that a qualifier is part of the claim of an argument, and so rebuttal of a claim (rebuttal category 2, Section 2.4) would, in effect, be a rebuttal of the claim as qualified by the particular qualifier assigned it. Thus, a particular rebuttal of the statement *"Harry is probably British,"* would not necessarily also be a rebuttal of the statement, *"Harry is possibly British."* Similarly, a rebuttal of either of these two qualified statements would not necessarily serve as a rebuttal of the statement, *"Harry is British."* If rebuttals and claims are intertwined in this way, how does one rebut the use of a qualifier, independently of the statement to which it is attached? A statistician, applying Neyman-Pearson theory, for instance, would only accept the qualification of "with 95% confidence" applied to a claim in certain circumstances, usually involving the demonstration that certain procedures had been followed. A statistician applying an alternative theory of statistical inference, such as Fisherian or Bayesian theory, may not accept this use of this qualifier in these circumstances, and may rebut it. This rebuttal may be independent of the content of the claim to which the qualifier is applied. How does one represent this qualifier-specific-but-claim-generic rebuttal when claim and qualifiers are considered as a single entity?

3. In the paper, Verheij's focus is on a first level of defeat, not on more complex relationships between arguments, such as rebuttals of rebuttals, and rebuttals of rebuttals of rebuttals, etc. In such cases, what status has each of the arguments involved? One response is to assign status, as Verheij does in this paper, just as for the first level, so ignoring the information provided by the additional levels. Another approach which has been used in some AI applications of argumentation is to define more than the two evaluation status classifications presented here. An example is the argumentation classification scheme of Krause *et al.* (1994), in which statements are assigned labels such as *Possible*, *Plausible*, *Probable*, etc, according to the dialectical status of arguments for and against the statements. This approach shows how formal argumentation may be used to support a qualitative representation of uncertainty. I believe this connection between argumentation and uncertainty has considerable potential, so far mostly unexplored.

4. Considering rebuttals of rebuttals and so on leads to another question: What constitutes effective rebuttal? One argument may attack another, but not overwhelmingly. The notion of effectiveness, of course, depends on the context of evaluation – i.e. who is doing the evaluating and for what purpose. A rebuttal of an argument on the basis of an attack on the integrity of its proponent may be effective in a court of law (in undermining the credibility of witness testimony, for example), but not in those scientific debates where proposals are judged on their own merits. How effective an attack is on a given argument will depend, then, on the application domain and on the meaning the participants attach to arguments in that domain. Dürrenmatt's (1956/1960) novel, *Die Panne*, about the tragically different meanings assigned to a mock trial by its participants, is a powerful illustration of this. The domain-dependence of effectiveness mirrors, of course, the domain-dependence of rules of argument, which, as Verheij

notes, was an important concern of Toulmin. Ultimately, of course, the question of effectiveness of rebuttals in human discourse will itself be the subject of argument between participants.

5. Verheij's presentation of rebuttal and defeat does not incorporate time explicitly. Any system of defeasible argumentation means that statements may be supported at one time, defeated at another, and supported again later on. This change in status may be due to more information being obtained as time progresses (as seems to be the assumption underlying most systems of non-monotonic reasoning) or simply the fact that, in any human or machine reasoning system, arguments can only be presented discretely, not all at once. Considering the temporal dimension to rebuttal and defeat, one could view the relationship between monotonic and defeasible systems as similar to the relationship between classical and intuitionistic mathematics. In the former, mathematical statements are considered to be always either true or false, but not both and not neither. In the latter, mathematical statements are considered with respect to their time-dependent proof status: they are, at any moment, either provably true, or provably false, or possibly neither (Dummett 2000). While statements in intuitionistic mathematics are monotonic (once proven true or false they remain so), unlike those in defeasible argumentation systems, it would be interesting to explore this analogy further.

Another approach, which I have pursued (McBurney and Parsons Forthcoming), is to consider arguments as extending a potentially infinite time into the future, with the possibility always being present of new rebuttals and counter-rebuttals, etc, arising in the future. In this approach, we may view a finite debate as a sample taken from a population comprising an (imagined) infinite debate, and so an important question is: *Under what circumstances are we justified in making inferences about the status of sentences in the infinite debate from the evidence of the finite sample?* However, these efforts have only just begun to examine the temporal aspects of argumentation; it is possible that this work could benefit from some of the ideas of temporal logic (e.g. van Benthem 1999).

6. I think that Verheij's study of rebuttals using Toulmin's argumentation scheme cries out for an intuitive geometric semantics. Toulmin's horizontal diagrammatic representation of an argument structure is one geometric representation, and one could attach nodes and arrows to this representation for rebuttals of data, claims, warrants, etc, extending its currently-limited two-dimensionality. Verheij's vertical graphical representation is one way of doing this, although I believe something is lost in the rotation from horizontal to vertical. (In particular, the difference in meaning between a claim and a datum is less clear to me in Verheij's representation than in Toulmin's representation, although this may simply be a matter of personal taste.) Rather, I think a geometric representation is needed which:

- illustrates graphically the relationship of rebuttals to statements;
- allows for rebuttals to rebuttals, and so on;
- distinguishes between different types of rebuttals;
- indicates the relative strength of arguments, when weightings are attached to them;
- and does so in a manner which incorporates time explicitly.

I have not yet managed to develop a representation which satisfies all these criteria.

It may be worth noting here that formal mathematical semantics have been proposed for argumentation formalisms. For example, using a well-known translation between deductive logical systems and certain types of category (Cartesian closed categories), Ambler (1996) proposed a category-theoretic semantics for argumentation, when arguments are understood as tentative proofs for a claim. Likewise, Hyland (1997) presented a category-theoretic semantics for question-and-answer dialogue-games, a semantics it may be possible to extend to systems of defeasible argumentation. However, the main weakness of these approaches is the absence of any intuitive meaning to those of us without a prior knowledge of category theory. (One might also ask what the benefits of a category-theoretic representation are, apart from the existence of the representation itself.)

7. In his last paragraph, Verheij asks the question: *"[W]hat remains of logic when the rules of argument are variable."* Interestingly, formal logicians have already explored a related question, asking: To what extent do the theorems of a formal logic depend upon the rules of inference used to derive them? In other words, would a different set of (deductive) inference rules lead to the same theorems? This subject, the admissibility of logical inference rules, was initiated by Lorenzen (1955) and has been developed in detail in Rybakov (1997). The obvious follow-on questions from this are: Which rules of logical inference are justified? When? And why? Susan Haack has asked how one might justify modus ponens, for example (Haack 1976): If we justify it by means of examples of its valid use, we are using an inductive argument which seems too weak for a deductive rule of inference. If, on the other hand, we show that the rule maintains truth from premises to conclusion across the inference step in a truth-table, we risk using the very rule we are trying to justify, which seems too strong.

Verheij's interest is in a further question following from this: What happens when rules of inference are not absolute, but themselves the subject of discussion? As he notes, substantial research is still needed to answer this question, along with the related one of determining the rules of argument appropriate to particular domains.

8. Finally, it is worth noting that exploring notions of effectiveness, temporality and the variability of inference rules takes us well away from the world of classical logic and argument. One place these paths may lead us is into the realm of reasoning under resource constraints. Recent work by Gabbay and Woods (2001) has explored questions of logical reasoning under conditions of scarcity of temporal, informational and/or processing resources, thus joining research in psychology, economics and marketing with logic. Such explorations, of course, lead us far from the subject of the paper, which, to my mind, is evidence of the great importance of argumentation as a discipline of academic inquiry.

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