Requirements for reflective argument visualization tools: a case for using validity as a normative standard

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Abstract. This paper formulates in the first part some requirements for a certain sort of computational argumentation systems, namely those which are designed for a very specific purpose: to motivate reflection on one's own thinking, and to induce cognitive change. This function of argumentation systems is important for argument-based conflict negotiations, deliberation processes, intercultural communication, text analysis, and learning through argument visualization. In all these situations success is only possible when people are able to change their mind, learn something, or start to reframe well-established ways of perceiving and interpreting things. Based on these requirements, I defend and explain in the second part my decision to use for Logical Argument Mapping—a method specifically designed for supporting reflective argumentation—only argument schemes that are deductively valid.

Keywords. Semiautomated computational argumentation systems, Computer Supported Argument Visualization (CSAV), Logical Argument Mapping (LAM), cognition, diagrammatic reasoning, Peirce

Introduction

Visualizing arguments is not only useful when we want to persuade somebody, but also when we want to clarify our own thinking about “wicked” problems [1], or when we use arguments in social settings to facilitate, for example, negotiations in conflicts [2], deliberation processes, or intercultural communication. In all these situations a main function of argument visualization is to stimulate reflection and cognitive change; the goal is to learn something. If arguments fulfill primarily this function, I use the term “reflective argumentation.” Since I think that reflective argumentation is something that everybody should learn, I am interested in computational argument systems that could support reflective argumentation not only for specialists, but for a broader community of users including, let’s say, high school students.

This paper is mainly about the requirements for those argumentation systems that are supposed to stimulate reflection. In its second part, however, I will argue that these requirements could best be fulfilled by systems of argumentation that focus particularly on deductively valid argument schemes.

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1. Requirements

Focusing on what I call “reflective argumentation” means, first of all, that an argumentation system has to fulfill the following first basic requirement: It must allow the visualization of arguments in a way that what the user sees when looking at the construction of her or his argument compels her or him to reflect critically on the conditions and presumptions that guided the process of argument construction itself. Cognitive change must be induced, as Kathleen Hull puts it in her description of Charles’ Peirce’s concept of “diagrammatic reasoning,” by something that—although created by ourselves—“stands up against our consciousness” ([3], 282, 287; cf. [4], CP 1.324; [5]).

This basic requirement leads immediately to a criticism of two extremes that can be distinguished in the broad spectrum of computer-based argument support systems that are available today. On the one hand, there are systems that do not challenge the user enough to formulate complete arguments (e.g. [6], [1], [7]); the problem is here: if premises remain hidden, there is no way to reflect on them. On the other hand, there are systems that—while trying to represent everything—are so complex and abstract that the user is more threatened by confusion than by reflection (e.g. [8], [9], [10]). Obviously, there is a trade-off between user-friendliness on one hand, and precision, disambiguation, systemativeness, completeness, and range of applications on the other [11].

Talking about user-friendliness and this trade-off means first of all that we need to identify the specific problems normal people have with arguments and argumentations. (I am using “argument” here as a set of statements—a claim and one or more reasons—where the reasons jointly provide support for the claim, or are at least intended to support the claim. An “argumentation” is defined here as a set of arguments in which a main argument is supported by further arguments). Empirical research on Computer Supported Collaborative Learning (CSCL) and Computer Mediated Communication (CMC) indicates that computer tools often produce “technical disturbances and a loss of thematic focus” that “have a negative effect on collaborative learning processes” ([12], 69). Sometimes, they cause people to talk more about the technique than about the task in front of them, increasing thus the cognitive load they have to handle instead of reducing it ([11], [13]). But even if no computer is involved, there is some anecdotic evidence from classroom experiences in the area of planning and public policy that hints at a deeper problem. When it comes to arguments, this area of research and teaching seems to be completely in the hands of the famous “Toulmin model” (e.g. [14]). However, as Gasper and George showed in a critical reflection on “assessing, improving, and transcending the Toulmin model” that was based on an analysis of published literature and classroom experiences in planning and public policy, there is a real danger of “oversimplification” since students often try “to squeeze everything into a single simple diagram” [15]. But if this is possible—and my own experience with teaching similar approaches to argumentation confirms this observation—then the deeper problem seems to be that many students simply do not know what an argument is, or how to apply an only vague notion of “argument” in concrete situations.

If this is indeed an adequate characterization of a quite substantial deficit in some parts of the world regarding a competence that should be an essential prerequisite for being a politically mature citizen at least in democratic societies, then we should determine a second basic requirement for reflective argument systems as follows: These systems should be designed in a way that the education of their users is part of the system itself. Simon Buckingham Shum is quite right when he says with regard to argument visualization tools that we need “a new literacy in being able to read and write in...
the new medium, and a new fluency in using these conversational tools in appropriate ways in different contexts” ([16], 19). But since this will be true for prospective teachers of the new tools as well, it should be important to make the tools themselves educational.

The need of making the education of its users a part of an argument system implies a series of further requirements. The most important one is the following, third requirement: The system itself must provide the means users need to evaluate what they are doing when constructing an argument. This again leads to a fourth requirement: An argumentation system should provide a limited list of clearly defined argument schemes that function as the normative standard in reference to which a user can evaluate the completeness and strength of an argument. This is absolutely crucial for those systems of argumentation whose main purpose is to motivate reflection and to induce cognitive change. There are, of course, several ways to establish such a normative standard, but without it a user could never experience the “compulsory perceptions” Peirce was talking about when he emphasized that learning by experimenting with diagrams is only possible when these diagrams are constructed by means of a “representational system”—that is by a system with a clearly defined ontology and rules of operation—that determines the necessary outcome of such an experimentation. Peirce showed—mainly with regard to proofs in mathematics—that the normativity of those representational systems is the essential precondition of what I discussed in my first basic requirement as the compelling force of external representations: “if one exerts certain kinds of volition [in constructing a diagram, M.H.], one will undergo in return certain compulsory perceptions. … certain lines of conduct will entail certain kinds of inevitable experiences” ([4], CP 5.9; see [5], [17] for some examples). For any learning by means of visualizations it is essential, I would argue, that what we see when looking at such a visualizations forces us to reconsider, to change, or to differentiate what we already know. Otherwise there would simply be no learning. In order to generate such an external force, however, it is essential—and this should be my fifth requirement—that we as the users of an argumentation system have to accept the normative character of its rules as something that is beyond our own power. And since an external representation is only compelling when we understand and realize the rules of the representation system in which it is constructed, people need to learn, and to train, how to meet a predefined normative standard of argumentation as strictly as possible.

A sixth requirement for argumentation systems that are supposed to support reflective argumentation has been mentioned already in connection with my first requirement under the heading of “completeness”: Whatever is relevant for the possibility of cognitive change, or what might have an impact on the acceptability of an argument, must be visible in the representation of the argumentation. This point is important since most of the arguments used in everyday contexts are enthymemes, that is incomplete arguments in which either one of the premises or even the conclusion is only implicitly given. The crucial question at this point is what exactly the meaning of “complete” is. Based on my personal observations of students trying to construct, to identify, or to reconstruct an argument without much preparation, I am inclined to say that the main problem of non-experts in argumentation is their readiness to accept nearly everything as a reason for something else as long as there is at least some relation between the two. What is missing is first of all an understanding that—as has been emphasized by Toulmin—a reason is only a reason for a claim if there is a “warrant” that “authorizes” the step from the reason to the claim ([18], 91). The distinction between “reason” and “warrant” is crucial when it comes to the evaluation of an argument since a critique can
always attack two different things that can be defended independently of each other: the truth of the reason, and the truth of the warrant. For this reason, a “complete” visualization of an argument must always include both, the formulation of a reason and the formulation of a corresponding warrant; if one of them is not already explicitly given, it has to be reconstructed.

At this point in my list of requirements for argumentation systems that should be able to support reflection and cognitive change, I think the best way to fulfill all the six requirements—and the easiest for users—is to use only **logically valid** argument schemes for the core arguments of a more complex argumentation, as realized in Logical Argument Mapping (LAM), an argument visualization method that I described elsewhere. This decision can be defended with reference to each of the requirements discussed so far:

1. Since logical validity represents a clear normative standard, a system that allows only valid arguments would indeed “compel” the user “to reflect critically on the conditions and presumptions” that guide the process of argument construction
2. Such a system could easily “educate” the user to do it right
3. It would provide all the means a user needs to “evaluate” arguments
4. Logical valid argument schemes can be presented in a limited and clearly defined list
5. Since the validity of an argument scheme is either obvious or easily to demonstrate, it is easy for users to “accept” validity as normative standard
6. Since a valid argument is always a “complete” argument, accepting validity as normative standard helps the user to achieve completeness in constructing and evaluating argument.

### 2. Validity and defeasibility

Given the direction in which argumentation theory developed since Toulmin, the decision to use only argument schemes that are deductively valid is obviously controversial, to say the least. However, in addition to the arguments for this decision listed above, I want to emphasize one further point. Logical Argument Mapping builds on a clear separation between the **construction** of arguments a user performs in interaction with a software-based argumentation system and the **reflection** he or she performs for him- or herself either individually or in groups with regard to the acceptability of reasons and warrants. While the argument construction is determined and becomes evaluated by the criterion of logical validity, the reflection is determined by the **epistemological question** whether the reasons and warrants are true, or at least acceptable in the respective social situation.

This distinction between construction and reflection corresponds roughly to the differentiation between a “logical” and a “dialectical layer” that has been proposed by Henry Prakken and Giovanni Sartor for the description of legal arguments [20]. While the “**logical** layer defines what arguments are, i.e., how pieces of information can be combined to provide basic support for a claim,” the “dialectical layer focuses on conflicting arguments: it introduces such notions as ‘counterargument’, ‘attack’, ‘rebuttal’

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[2], [17], [19]. The most recent description is available at [http://www.prism.gatech.edu/~mh327/LAM](http://www.prism.gatech.edu/~mh327/LAM).
and ‘defeat’, and it defines, given a set of arguments and evaluation criteria, which arguments prevail" (344). Prakken and Sartor add to this a “procedural layer” and a “strategic or heuristic one,” but for my purposes it would be sufficient to subsume both of these under an enlarged understanding of “dialectic.” With regard to what I discuss here under the heading of reflective argumentation, the main idea is a clear separation between the form of arguments whose completeness can best be evaluated when they are constructed as logically valid arguments, and a critical reflection and debate on the truth of the premises of those arguments, either individually or in collaboration with others. This reflection would then lead either to a revision or refinement of the original argument, or to a counterargument, but again an argument that has to meet the normative standard defined by the chosen argumentation system. This way, the process of argumentation is conceived of as an iterative process of construction and reflection, a process that challenges the user to engage in a kind of dialectical process that leads her back and forth between improving her own understanding of the issue in question and the way she represents it.

Based on this procedural dialectic between argument construction and reflection, I would say that Logical Argument Mapping belongs to what has been discussed in the literature as “defeasible argumentation,” as long as defeasible argumentation is defined—as proposed by Henry Prakken and Gerard Vreeswijk in their handbook article on the “Logics of defeasible argumentation”—as a process in which “arguments for and against a certain claim are produced and evaluated, to test the tenability of a claim” ([21], 219). Since the goal of any sort of reflective argumentation is learning and the development of positions, reflective argumentation is defeasible per definitionem.

In general, however, the term “defeasible” is first of all used in argumentation theory as the essential property of a certain class of arguments. Douglas Walton, for example, distinguishes in his textbook Fundamentals of Critical Argumentation “deductive,” “inductive,” and “defeasible inferences,” defining the last group as those that “may turn out to fail (default) if new evidence comes in” ([22], 52). Or, as Prakken and Sartor write: A defeasible argument is “an argument that is acceptable in itself,” but “can be overturned by counterarguments” ([20], 342). The classical example is the argument: “Birds fly; Tweety is a bird; therefore, Tweety flies” [23]. This argument can obviously be defeated when we think about penguins, dead birds, birds whose feet are encased in concrete, and hundreds of other possible exceptions that would refute a universal statement like “all birds can fly.”

The crucial point, however, is the following. Walton writes at one point that a defeasible inference “is inherently subject to retraction” ([22], 52; my italics). If defeasibility is an inherent property of a certain class of arguments, then it must be possible to decide in each case whether this property is given or not. But how could that be possible? What exactly is the criterion that allows an objective and clear-cut distinction between defeasible and non-defeasible arguments? Although it might be intuitively convincing that “all birds can fly” is defeasible while “all humans are mortal” is not, it is obviously an epistemological question where to draw the line; it is the question what we are willing to accept as true based on the knowledge that is available in a certain situation. But the point is: As we know from the history of science, what we “know” is in permanent change. Yesterday, every specialist believed “that if people with diabetes lowered their blood sugar to normal levels, they would not longer be at high risk of dying from heart disease,” and today we learn that a major study has found that lowering blood sugar with people with type 2 diabetes “actually increased their risk of death” [24]. As has been shown in 20th century’s philosophy of science time and again, it is
simply impossible to justify any knowledge claim in a way that future revisions or refutations are excluded.

My impression is that the whole discussion about defeasible arguments confuses one of the most important distinctions in logic, namely the distinction between validity and soundness. As everyone knows, for validity the truth of the premises of an argument is simply presupposed; truth is only important when it comes to the soundness of an argument. That means, however, that any deductively valid argument whatsoever can be conceived of as a defeasible argument, because defeasibility concerns only the truth of the premises. While validity is a question of logic, truth is a question of epistemology and science. As long as we accept both a clear distinction between validity and soundness and an understanding of argumentation that builds on the dialectic between argument construction and reflection, there is no problem to establish logical validity as a normative standard of argument construction, while at the same time admitting that any premise of a logically valid argument can be criticized, refined, defeated, and abandoned at any time.

A deeper reason, I guess, for the controversy between approaches to argumentation that include defeasible inferences and those that are more restrictive concerns different ideas about which purposes models of argumentation are supposed to fulfill. In their handbook article, Prakken and Vreeswijk write with the regard to the more general research on nonmonotonic reasoning—in which they include systems for defeasible argumentation—that most “nonmonotonic logics aim to formalize” the “phenomenon of ‘default reasoning’,” that is reasoning that is based on “a conditional that can be qualified with phrases like ‘typically’, ‘normally’ or ‘unless shown otherwise’” [21]. Formalizing default reasoning is of course important when the goal is to simulate, or to model, human reasoning. But this is not the goal I have in mind. I am only interested in tools people can use to improve their thinking, that is tools for reflective argumentation. A tool like our language. There is no need that the grammar of a language must be very complex to provide a powerful tool. And there is no need to provide more than a bunch of deductively valid argument schemes when the main objective is to engage users in an iterative process of argument construction, reflection, reconstruction, and so on. There is simply no need to define all the possible exceptions to a universal statement like “all birds can fly” in advance, or certain general questions that always come up with certain argument schemes ([25], [8]), when we can expect users who can contribute for themselves—based on a critical reflection on the elements of an argument—those considerations that would be necessary to improve it. It is, of course, an open question which argument schemes we need to guarantee a good balance between user-friendliness and the sophistication of an argumentation system, but the general maxim should be: keep the grammar of your argument language as simple as possible, and as rich as necessary.

In Logical Argument Mapping, for example, arguments from induction, analogy, and expert opinion would be constructed in the logically valid forms of “complete induction,” “perfect analogy,” and “perfect authority.”[3] Although it is obviously hard to find any of these forms in real life situations, this does not matter much as long as the user becomes challenged to reflect on the problems that are inevitably involved with these argument schemes. It should be better to confront the user directly with the problems of these argument schemes and to challenge further reflections than risking that implicit assumptions remain unrevealed.

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3 See http://www.prism.gatech.edu/~mh327/LAM.
This way, it is even possible to represent abductive inferences by means of LAM. Abduction has first been defined by Peirce as “the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea” ([4], CP 5.171). “Logical,” of course, is used by Peirce in a much broader sense than deductively valid [26]; abduction, he says at one point, “consists in examining a mass of facts and in allowing these facts to suggest a theory. In this way we gain new ideas; but there is no force in the reasoning” (CP 8.209). Peirce describes the inferential form of abduction as follows: “The surprising fact, \( C \), is observed; But if \( A \) were true, \( C \) would be a matter of course, Hence, there is reason to suspect that \( A \) is true” (CP. 5.189). Although the conclusion of an abductive inference is only a hypothesis, it is clear that if this hypothesis would be true, as well as the assumption that the observed fact is implied by this hypothesis, the whole argument could be translated into a simple \textit{modus ponens} argument. This means, however, that a user can at any time represent an abductive assumption as a \textit{modus ponens} in order to reflect then on the question whether both the premises of this argument can be accepted as true.

The crucial point that distinguishes my approach to argumentation from the mainstream is that I am not interested to “model” everyday, commonsense reasoning. Of course, it might be an interesting task to develop software that “mirrors” somehow the way people argue for or against a position in different contexts. But why should it not also be an interesting task to develop argumentation systems that can be used simply as \textit{tools} for normal people? Nobody expects that a calculator “models” what humans are doing when they compare prices in the supermarket. A tool is always something that \textit{augments} our natural abilities. Nobody would measure the quality of a tool by its similarity to what we can do anyway, but by its functionality and effectiveness for a predefined purpose. Since the objective of my work is to develop tools that stimulate reflection and learning, the quality of these tools should not be assessed by their degree of similarity to human processes of reflection and learning, but by its success in fulfilling this purpose.

References
