Proceedings of the 2nd International Conference on the Pragmatic Web

“Building Common Ground on the Web”

Tilburg, The Netherlands, 22–23 October 2007

Editors:
Simon Buckingham Shum, Mikael Lind and Hans Weigand

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Logical Argument Mapping: A cognitive-change-based method for building common ground

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ABSTRACT
In this paper, I situate Logical Argument Mapping (LAM) within the broader context of IBIS-based Computer Supported Argument Visualization (CSAV) and Dialogue Mapping, and argument mapping as realized in Rationale. While the primary goal of these methods is to clarify issues and to augment cognitive processes, LAM’s purpose is to motivate cognitive change by establishing a normative standard of argumentation.

Categories and Subject Descriptors
H.1.2 [Models and Principles]: User/Machine Systems – human factors, human information processing, software psychology

General Terms
Management, Documentation, Human Factors, Languages, Theory.

Keywords
Computer Supported Argument Visualization (CSAV); diagrammatic reasoning; Dialog Mapping; Logical Argument Mapping (LAM); Rationale; Jeff Conklin; Charles S. Peirce; Tim van Gelder.

1. INTRODUCTION
Talking about the role “the Web” can play in fostering mutual understanding across cultural, intellectual, and other boundaries, and in building common ground among people who often experience difficulties in understanding each other based on their very specific perspectives, values, and interests, the first thing that comes to mind is the fact that communication and cooperation can be improved by visualizations on which people collaborate synchronously. “Putting something in the middle” helps to maintain focus ([17], [24], [29]) and stimulates dialogue, argumentation, creativity, and the “negotiation of meaning” [27].
Logical Argument Mapping can help to build three different forms of “common ground”: (1) in negotiations, LAM can be used to deepen mutual understanding and to stimulate cognitive change in cases where the clarification of what people think is not sufficient to find an agreement; (2) in the analysis of texts and narratives, LAM can help the analyst to find common ground between her interpretation and the intentions of the author whose utterances she tries to analyze; and (3) in intercultural communication, there is some hope that LAM maps can be used as a sort of universal language in which a variety of culturally shaped styles of argumentation can find a common ground—e.g. arguing by examples, or by generating surprise, or only implicitly arguing by arranging statements in a certain way. In the fourth section of this paper I will show how LAM works by mapping an example for the second point of this list.

2. WHAT IS AN “ARGUMENT”? 

By now, the best overview of various CSAV approaches may be available in Visualizing Argumentation: Software Tools for Collaborative and Educational Sense-making [14], and the most elaborated single methodology in Jeff Conklin’s Dialogue Mapping: Building Shared Understanding of Wicked Problems [2]. The terms “argument” and “argumentation” are central in both books, but as their subtitles already indicate, they are used here in a broader sense.

Visualizing Argumentation starts of with a list of four definitions from an English dictionary ([14], ix). An “argument” is, first, a “discussion in which disagreements and reasoning are presented”—yes, one might say, but that seems to be the case in every discussion, so why not simply talking about “discussions,” or “controversies,” instead of “arguments”? Then: a “course of reasoning aimed at demonstrating truth or falsehood”—yes, but where does such a “course” begin and where does it end? A “course of reasoning,” let’s say about the existence of God or atoms, can stretch over thousands of years, but if everything said about these issues is part of one “argument,” then it is hard to define the boundaries of this argument. The third definition hints at a “fact or statement put forth as proof or evidence; a reason”—yes, but that is precisely that: a reason, not an argument. (The same can be said when Conklin defines an argument as “an opinion or piece of evidence that either supports or objects to one or more ideas;” [2], 99: the piece of evidence is just this, a piece of evidence, not an argument). Then: a “set of statements in which one follows logically as a conclusion from the others”—yes, but there are also arguments that are not logically valid per se, for example inductive arguments.

The breadth of these definitions corresponds to a certain vagueness with regard to the activities that count in both books as “argument visualization.” While Tim van Gelder defines this activity clearly as “a presentation of reasoning in which the evidential relationships among claims are made wholly explicit using graphical or other non-verbal techniques” ([30], 98), other authors include in the process of argument visualization not only the presentation of “evidential relationships” but also activities like problem solving, the generation of hypotheses and evaluation criteria; expressing doubt and disbelief; reifying, contrasting, criticizing, and integrating perspectives; “an open-ended, dialectic process of collaboratively defining and debating issues”; ([14], vii; [12], 52); and the formulation of “Questions, Ideas, Pros, and Cons” ([2], 60).

Since scientific communication presupposes a certain clarity regarding the meaning of concepts, it would be better to replace this plethora of definitions and activities by something that is simple and clear. What is an “argument”? It turns out, however, that this question is not easily to answer. A definition that seems to be widely shared in philosophy goes like this: an argument is “any set of statements in which the truth of one statement is intended to be supported by the other statement (or statements)” ([16], 13). The authors emphasize “intended” deliberately in this definition, because also bad arguments are arguments. They are ready, for instance, to accept the following as an argument: “They had a bad winter in Alaska last year, because the zamponga is an Italian bagpipe.” The intention to use the statement on the zamponga as a reason for the bad winter in Alaska is sufficient to call this an argument.

Although it should indeed be a most simple and precise way to define an argument as a constellation of statements that consists of a claim and at least one reason for this claim, there is a fundamental problem with this definition: What counts as “reason for”? We can distinguish two attempts to answer this question. One of them is indicated in the definition just quoted from Luckhard and Bechtel: A reason is simply what is intended to be a reason by somebody. The problem of this approach—let’s call it the cognitive approach—is that it is sometimes hard to know what somebody “intends.” If Peter links a statement about the last winter in Alaska with a statement about the zamponga, does he really intend the latter to support the former, or is his intention rather to joke, or to create a typical philosophical example? In both these cases the sentence wouldn’t be an argument according to Luckhard and Bechtel’s definition.

The other way to determine what counts as a reason for a claim has been chosen by Joel Katzav and Chris Reed in the following definition of an “argument”: “A proposition is an argument if and only if it consists (just) in a representation of one fact as conveying some other fact and as wholly doing so. We will say that one fact conveys another if and only if, in the circumstances, it necessitates or makes liable the obtaining of the other. We will say that a fact wholly conveys another if and only if, in all of its constituent facts play a part in conveying the other. As to facts themselves, they are simply identified with what true propositions represent. The idea that one fact conveys another has been explicated in terms ‘necessitating’ and ‘making liable’. In order to get to grips with these terms note, to begin with, that if, in circumstances C, fact A necessitates fact B, then, in circumstances C, A’s obtaining is not possible without B’s obtaining. As to the term ‘making liable’, note that, if, in circumstances C, fact A makes fact B liable, then, in circumstances C, A’s obtaining makes B’s obtaining likely” ([12], 243-44).

Although pretty impressive in its wording, this definition does not say much more than that in an argument we provide reasons for a
From my point of view, a clear definition of the term “argument” is decisive for understanding the scope, power, and limitations of so-called argument visualization tools. It is important to note that especially IBIS, the well-known “Issue Based Information System” on which Conklin’s Dialogue Mapping and many of the studies in Visualizing Argumentation are based, is neither an “argumentation scheme” ([2], 87) nor “an argument mapping notation” ([1], 13) if we define “arguments” in the way I propose. IBIS is primarily a system to clarify issues. Conklin uses it to provide a visualization method that allows groups to cope with problems of social complexity and “wicked problems” in meetings, and in Visualizing Argumentation goals are problem solving in social settings, supporting “collaborative learning” in education [10] and “keeping track of a plethora of ideas, issues, and conceptual interrelationships” ([24], 138). Even if we accept what Conklin calls “Cons” and “Pros” as arguments—although what he lists here are often simply assessments, like “too vague,” that reveal “what stances” people take upon issues and ideas (cf. also [22], 129)—these statements are only a part of IBIS, not the whole thing.

Nevertheless, in cases where finding an agreement depends on finding a common ground on those “pros” and “cons,” that is where a shared perception of what those evaluations really mean with regard to the problem in question is necessary, it makes sense to think about tools and methods that are specifically designed for this purpose. Exactly this is what Logical Argument Mapping is supposed to be: a method that can be useful within the context of dialogue and issue mapping.

3. LAM AND COGNITIVE CHANGE

With regard to both the foundation in a clear concept of “argument” and the cognitive dimensions of argument mapping, the method that comes closest to LAM is realized in Reason!Able and its successor Rationale, two software tools that Tim van Gelder developed (http://www.austhink.com/). Similar to the tools already discussed, the general purpose of Rationale is to “improve thinking by providing an easy way to diagram reasoning on any topic.” For this purpose, two kinds of maps can be produced by means of templates (besides “templates” for Conklin-style dialogue maps): on one hand, so-called “reasoning maps” that are suitable for structuring reasons and objections and, on the other, “analysis maps.” The main characteristic of “Analytic Argument Mapping” is the possibility to construct and to evaluate logically valid arguments (see also the many argumentation schemes available at http://wiki.austhink.com/).

For van Gelder, the main cognitive function of Rationale is clarifying one’s own thinking, that is “to help us work out what the reasoning actually is. Prior to the process of mapping, we usually do not have in our minds a fully refined conception of the reasoning just waiting to be diagrammed. Rather, we generally only arrive at such a conception through an iterative process of drafting and revision. When we see reasoning laid out clearly before use, we are better able to identify gaps, obscurities, errors, etc., prompting reformulation. In cases of very complex reasoning, this can go on indefinitely” ([31], 7).

This cognitive function of argument mapping has already been described by Charles Peirce with regard to what he called “diagrammatic reasoning” about a hundred years ago. In Peirce’s semiotics, a “diagram” is a specific form of icons, where “icon” is
defined as a sign whose primary function is to represent relations
(therefore, also algebraic expressions and sentences are icons for
Peirce). Already with regard to icons, Peirce emphasized their
"capacity of revealing unexpected truth." Similar to what van
Gelder says about argument mapping, Peirce points out that "a
great distinguishing property of the icon is that by the direct
observation of it other truths concerning its object can be dis-
covered than those which suffice to determine its construction.
Thus, by means of two photographs a map can be drawn, etc." ([18], CP 2.279).

For Peirce, the crucial difference between "icons" and "diagrams"
is—and that leads us to a point that is only hidden in van Gelder’s
approach but decisive for Logical Argument Mapping—that
diagrams are icons that are constructed by means of a certain
"system of representation" ([18], CP 4.418). Peirce developed the
concept of diagrammatic reasoning in order to understand creati-
vity in mathematics (although his logical notation of the so-called
“Existential Graphs” is based on the same idea [23, 25]). Thus,
the best example of a “system of representation” would be an
axiomatic system. (Another example would be the grammar of a
language; this means, algebraic expressions and sentences are
more precisely diagrams, not icons). A system of axioms does not
only define the representational means that are available in a
field, but it determines also the necessary outcome of any
operation or experimentation we perform within such a system.
Let us take a simple example from geometry that Kant already
used to demonstrate that “mathematical knowledge is the knowl-
edge gained by reason from the construction of concepts” in what
he calls “pure intuition,” that is the Euclidean space in this case
([11], B 741). With regard to a construction of a triangle like the
one in Figure 1, Kant shows that we can prove the fact that the
triangle’s inner angles sum up to two right angles simply by draw-
ing an auxiliary line, i.e. a parallel to the triangle’s bottom line.
The equality of $\alpha = \alpha'$ and $\beta = \beta'$ guarantees then that the sum is
$180^\circ$.

Peirce would say that the axiomatic system of Euclidean geo-
metry creates “realities” in our constructions that “compel us to

![Figure 1. Kant’s construction to prove that the sum of the triangle’s inner angles equals $180^\circ$ degrees ([11], B 744).](image)

put some things into very close relation and others less so” ([18],
CP 1.383). Only Euclidean geometry provides the parallel we
need to perform the proof. It is the ontology (elements and rela-
tions) and the rules of the chosen system of representation that
determines which experiments with diagrams are possible, and
their necessary outcome [8]. For Peirce, this is the foundation of
his pragmatism: the fact, namely, “that 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” ([18], CP 5.9).

The compelling character of representations that are performed by
the means of representation systems is exactly what we need to
explain the possibility of cognitive change. However, it is im-
portant to note that a representation is the more “compelling” the
more we understand and accept the rules of our system of represen-
tation. That means—with regard to our goal of using argument
mapping to build common ground—that we need, first, a standard
of argumentation that is as strong as possible and, second, the
readiness of people to pursue the goal of meeting this standard as
strictly as possible.

Both these dimensions of a strong argumentation standard and of
educating people to meet this standard are missing in the argu-
ment visualization methods that are available so far. Even Tim
van Gelder, who comes closest to this goal by offering a set of
argumentation schemes, does neither emphasize the need of using
them, nor does he argue for their strength or educate people much
in their usage.

Logical Argument Mapping, by contrast, is based on a system of
representation that forms a standard we have to meet if we want
to apply the method successfully. In addition to some conventions
that are described in the next section by means of an example, the
LAM system of representation entails three basic rules that form
its normative standard: (1.) structure your map according to an
argument form (or scheme) whose logical validity is evident and
generally accepted (e.g., modus ponens, modus tollens,
alternative syllogism, disjunctive syllogism, conditional
syllogism, etc.; see [7]); (2.) make sure that all your premises
(reasons and warrants) are true, and provide further arguments for
their truth if they are not evident; and (3.) make sure that all your
premises are consistent with each other.

To follow these rules, the first step in the procedure of Logical
Argument Mapping is to identify a logical argument form that
represents best what one tries to map as an argument. Usually,
the arguments we see and use in everyday life, or that we find in
texts, do not follow the first rule since it is too cumbersome to
explicate everything we need to get a valid argument. Based on
their convenience, we use mainly enthymemes: incomplete argu-
ments in which either one of the premises or even the claim is
only implicitly assumed. For that reason, the second step is to
transform something that is identified as an argument into a
logical argument by adding what is missing, and by reformulating
the elements of the argument in a way that its validity becomes
evident. Those elements are only three: a claim (i.e., the
conclusion of the argument); a reason, or a combination of
reasons (if reasons for the same claim can be separated, it is
always better to formulate different arguments); and what Toul-
min calls a “warrant,” that is a statement that is sufficient to
justify taking a certain statement as a reason for a certain claim.
In LAM, the warrant is assumed to represent a universal law. On
one hand, this guarantees the validity of the argument and, on the
other, it opens up a flank at which an argument can be attacked in
the next step. Depending on the clarity of the given argument, the
transformation of the second step is a more or less creative
undertaking, but this creativity is constrained and guided by the
three rules.
The third step in the LAM procedure is to consider possible objections against both the reason and the warrant. At this point, the compelling character of LAM as a representational system plays out. Since we are challenged to explicate everything that is needed to get a logically valid argument, we can see exactly where the argument can be weakened. Especially vulnerable is the warrant. Since it is formulated as a universal statement, we only need to find one counter example to this statement to refute the whole argument. Based on the consideration that all those cognitive processes that determine in a certain situation how we frame and perceive an issue, and that are partly deeply hidden in our unconsciousness, will be visible in the form of warrants [6], the need to reflect on the justifiability of the warrant is the decisive step for the possibility of cognitive change.

The fourth step, then, is to decide whether to give up the whole argument, or to reformulate it in a way that it can be defended against the objections, or to develop new arguments against the objections.

Visualizing logical arguments in the form of maps that are constructed roughly as suggested by Toulmin—but stripped of all those features that would jeopardize the logical strength of the argument, like probabilities—is crucial to structure the process of reflection. This, however, is common to all argument mapping approaches. What is different with LAM, by contrast, is the following: The normative standard formulated above challenges the LAM user to explicate everything that is necessary to get a logical argument map, and to refine her or his map as long as it takes to meet this standard. This means, first, that all those implicit background assumptions that determine how we frame an issue—and that are mostly responsible for problems of mutual understanding—become visible and an object of reflection; and it means, secondly, that all the parts of an argument—not only what someone explicitly mentions—are on the table and can be questioned so that a process of building common ground will be motivated [6]. Visualizing what hinders most in building common ground is essential for cognitive change.

4. AN EXAMPLE

From an epistemological point of view, the truth of premises in arguments is either evident or has to be justified in an ongoing process of argumentation. Thus, Logical Argument Mapping leads either to assumptions that can be accepted as socially shared, or to a certain modesty regarding truth claims. However, whatever the outcome might be, it is a process that we engage in when mapping the logical structure of an argument.

In order to provide an example of how this process unfolds in practice, I will show here how Logical Argument Mapping can be used for the analysis of texts and narratives; or more precisely: for texts and narratives in so far as they contain elements that can be reconstructed as arguments according to the definition of an argument suggested in section 2. My example is a flyer (Figure 2) that was intended, obviously, as an argument, though there is not even an explicit conclusion. (Further examples are available via [7].)

Since we know as part of our historical background knowledge that the information the flyer provides refers to Israel’s construction of a separation barrier between the West Bank and Israel, we can assume that the authors’ intention was to defend this activity by means of an argument. Indeed, at the same time as this flyer was distributed, a group of Palestinian students tried to mobilize against this barrier only about 50m away.

Assuming the intention to argue for this fence, such an argument can be mapped as a logical argument as shown in Figure 3. Obviously, this map cannot represent the process of analyzing the argument, but only a snap shot within such a process. The map itself represents only one of three attempts that we produced and discussed in our work group. The mapping process has been recorded. The record shows a kind of dialectical process that led us back and forth between improving our own understanding of the flyer and revealing the limitations of the argument we tried to analyze. We experienced the mapping process as a process of finding common ground between our interpretation and the intentions of the flyer’s authors.

In order to read and to work with LAM maps we need to know something about the conventions according to which they are constructed. These conventions concern, on one hand, the layout of the map’s structure and, on the other, the way LAM’s ontology is presented, that is elements and relations. It is not really surprising to represent relations by means of arrows, but important is that each arrow has to be specified not only regarding
Figure 3. The transformation of the flyer in Figure 2 into a LAM map
(created with Cmap, http://cmap.ihmc.us/)

its direction, but also with regard to its function. Arguments are identifiable through the “therefore” that links its parts.

Besides arrows, colors are used to specify a coherent position. Rule 3 regarding the consistency of premises (reasons and warrants) is only applicable to what is presented in the ground color of the argumentation; objections and other considerations are presented in different colors. The basic elements of arguments are statements that are presented in two different text box forms: rounded rectangles and ovals. Based on their importance for cognitive change, the warrants are highlighted by using oval text boxes; everything else is presented in rounded rectangles.

The layout of the structure of a LAM map is determined by Western reading habits that direct our attention from the top left corner of a page to the right and downwards. Since the understanding of an argument is facilitated when we know the central claim from the very beginning, this claim is located on top of the map in the left corner. Starting from there, we work to the right and downwards to reconstruct the reasons and warrants in an ongoing process of argumentation.

The map in Figure 3 represents the flyer’s core argument in the top left corner as an “argument by analogy.” The first warrant under the “therefore” here is formulated in a way that we get a logical argument. In further steps, both the reason and the warrant of this core argument are supported by further arguments; some of the reasons are criticized, motivating a refinement of some statements.

5. CONCLUSION
Due to its foundation in Peirce’s pragmatism, Logical Argument Mapping is a method that should enable us to build common ground in negotiations, in analyzing texts and narratives, and in intercultural understanding. Key is the idea that the rules of operation, that define a normative mapping standard, challenge the LAM user to represent everything that determines how she or he sets the boundaries around an issue, and frames, perceives, and interprets what is within those boundaries. Visualizing the driving forces behind our thinking and acting is the first step to reflect on necessary limitations of our perspectives, and to induce cognitive change.

6. REFERENCES


