6 Enhancing Deliberation Through Computer Supported Argument Mapping

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Introduction

As this is being written, the Governor General of Australia, Dr. Peter Hollingworth, has not resigned. Yet over the previous weeks and months he must have been thinking about it long and hard. He has been under intense pressure from various quarters, based on allegations that in previous positions of leadership he had not handled some sexual abuse incidents appropriately. In pondering what he should do, he must have been considering the many and varied arguments on both sides of the case. He must, in short, have been *deliberating* about his future.

Deliberation is a form of thinking in which we decide where we stand on some claim in light of the relevant arguments. It is common and important, whether in our personal, public or working lives. It is also complicated, difficult and usually poorly done.

This chapter contends that deliberation can be improved by mapping out the arguments, especially when the mapping is supported by newly-available computer tools. This point is supported in two ways. First, the chapter describes how computer supported argument mapping contributes to gains in general reasoning skills among undergraduate students. Second, it describes how real-time computer supported argument mapping can facilitate group deliberation in the workplace. The case studies are preceded by some clarification and discussion of the key concepts of deliberation and argument mapping, and of the relationship between argument maps and prose.

What is Deliberation?

Deliberation, as the term is used here, is a process aimed at deciding whether some claim ought to be believed by considering the relevant arguments[1]. The claim might describe what one should do (i.e., be of the form *I/we should do X*) and so deliberation can be directed towards action as well as belief. The arguments considered will invoke further claims, and in some cases their truth must also be determined through deliberation; and so on. Thus deliberation often involves considering an extended hierarchy of arguments.

Deliberation is not the same as reasoning. Reasoning is tracing the web of inferential relationships among propositions; this can be done without intending to determine whether any particular proposition is true. For example, from *All As are Bs* and *All Bs are Cs* you can infer *All As are Cs* without caring whether any of these are true or even what they mean. This is reasoning but not deliberating. Deliberation obviously involves reasoning, however; indeed, reasoning is the means by which one deliberates. If reasoning is like running, then deliberation is like running to catch a bus or to win a race.

Deliberation also differs subtly from argumentation. The latter is defined by van Eemeren et al. as

> a verbal and social activity of reason aimed at increasing (or decreasing) the acceptability of a controversial standpoint for the listener or reader, by putting forward a constellation of propositions intended to justify (or refute) the standpoint before a rational judge. (van Eemeren et al., 1996 p.5)

and on this account, at least, involves rational persuasion: the point of argumentation is to influence others' attitudes by means of arguments. Deliberation, by contrast, is aimed at determining one's own attitude.

Deliberation is often, like argumentation, a collective activity. For example a group of friends may deliberate over which restaurant is best, or a group of historians may deliberate to determine whether the treatment of indigenous Australians by European settlers merits the term "genocide". These forms of deliberation essentially involve both reasoning and argumentation.

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[1] As Webster's defines it, to deliberate is "to weigh in the mind; to consider the reasons for and against; to consider maturely; to reflect upon; to ponder; as, to deliberate a question." (Webster & Porter, 1913)

What is Argument Mapping?

An argument map is a presentation of reasoning in which the evidential relationships among claims are made wholly explicit using graphical or other non-verbal techniques. Argument mapping is producing such maps.

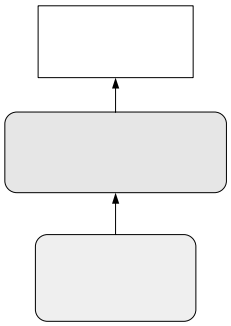
All reasoning involves propositions standing in logical or evidential relationships with each other, and thus forming evidential structures. In any given case this "constellation of propositions" must be expressed or presented in some way in order to be comprehended or communicated. Overwhelmingly, this is done in prose, whether spoken or written. Argument maps can thus be seen as alternatives to prose as vehicles for presenting arguments.

To illustrate: consider the following piece of prose:

> Very few scientists have spent much time thinking about the end of the world, and those few have reached diverse conclusions. All scenarios for the end of the world are highly speculative. They cannot be tested or verified by observation or experiment. The beginning of the world in the colossal explosion that we call the Big Bang has left many physical traces that can be observed and analyzed. The science of cosmology is largely concerned with collecting tangible evidence of things that happened billions of years ago, going all the way back to the beginning. No such tangible evidence can exist for the ending. For this reason, most scientists consider that the end of the world does not have much to do with science (Dyson, 2002)

This passage presents some reasoning; the reasoning involves various propositions concerning matters such as science, observation, and the end of the universe. The propositions are listed in the text; part of the hermeneutic challenge for the reader is to figure out their evidential relationships to each other.

Here is similar reasoning, presented as a map:



This map uses some simple mapping conventions: the main conclusion is written in a white, square box at the top, and grey rounded boxes contain reasons; the arrows indicate the relations of supposed evidential support.

Note that it is not clear that the reasoning presented by the map is identical to the reasoning presented in the prose. This is mainly because it is hard to say what the logical structure behind the prose actually is; there is room for different interpretations. There is no such room in the case of the argument map; there, the logical structure is entirely clear and unambiguous, assuming one understands the conventions.

The paradigmatic argument map is a *visual* display, much like the familiar paper maps of towns, subway systems, treasure islands etc.. A more abstract approach would define an argument map as any presentation of reasoning in which evidential structure is made wholly explicit or unambiguous, whether by visual means or some other approach. It ought to be possible to construct argument maps in which the structure is conveyed explicitly through other sensory modalities. Blind people, for example, might construct argument maps using chemistry sets, where claims are encoded using Braille on the balls and then joined up using sticks into argument structures. These could be unambiguously read by people with appropriate skills. The key point is that, if the argument mapping conventions are clear and appropriate, inferential or evidential relations can be "read off" the presentation in a more or less mechanical way. There is no need for sophisticated comprehension and reasoning skills in order to figure out the *structure* of the reasoning (though understanding and evaluating individual steps in the reasoning might take further thought).

The fairly minimal definition recommended here allows for enormous variety in argument maps. The point of argument mapping is to present complex reasoning in a clear and unambiguous way, and mappers should use whatever resources work best in achieving this goal. Currently, argument maps are mostly "box and arrow" diagrams like the one above, but it may turn out that some different approach will work more effectively. For example, somebody may develop a clever way to present arguments in virtual 3D, or even in immersive "virtual reality" fly-through environments. As long as the presentation makes the structure of reasoning completely explicit and unambiguous, it will count as argument mapping.

Argument Mapping Versus Prose

Although prose is the standard way to present reasoning, it is not a good tool for the job. Extracting the structure of evidential relationships from reasoning as typically presented in prose is very difficult and most of the time we do it badly. This can be easily illustrated, in a kind of exercise we have done informally many times in workshops. Take any group of people sufficiently trained in reasoning and argument mapping that they are quite able to create argument maps to make explicit whatever reasoning they have in mind. Now give them a sample of *good* argumentative prose, such as a well-argued opinion piece from the newspaper. Ask them to figure out what the reasoning is, and to re-present it in an argument map. This usually takes about 20-30 minutes, during which time you can enjoy watching the participants strike various Rodinesque postures of intense concentration, wipe their sweaty palms, etc.. Then compare the resulting argument maps. You'll find that you have as many different argument maps as there are people doing the exercise; in many cases the argument

maps will be wildly different. This shows that the opinion piece failed to reliably convey the author's argument, whatever it was.

Argument maps are deliberately designed to overcome precisely this problem with prose. Exercises similar to the one just described show that they fulfil their intended role. Take any group of people sufficiently trained to be able to be read argument maps. (This training usually takes not more than a few minutes.) Present them with an argument map, and ask them to identify the reasoning presented in the map, and re-present it in whatever form they like (map, prose, point-form etc.). This is a very simple task and usually takes almost no time; indeed, it is so trivial that the hard part is getting the participants to go through the motions when no intellectual challenge is involved. Ask them questions designed to elicit the extent to which they have correctly identified the structure of the reasoning presented by the map (e.g., how many distinct reasons are presented for the main conclusion?). You'll find that they all understand exactly what the reasoning is, and ipso facto all have the *same* sense of the reasoning.

In short, a task – identify the presented reasoning – which was difficult, time-consuming and almost always fails in the standard prose format is easy, fast and almost completely reliable in the argument mapping format. The point here is really quite simple, although it often meets resistance. Representations deliberately designed to communicate reasoning easily, rapidly and reliably can achieve this goal. Representations not deliberately designed for this purpose fail to achieve this goal. Who should be surprised?

Why are argument maps so superior when it comes to presenting the structure of reasoning? The short answer, just rehearsed, is that unlike prose, they were *designed* to do the job well. More can be said, however. At least four main factors explain the superiority of argument maps. These points concern limitations of prose which are partly or wholly overcome in argument maps.

Prose requires interpretation

The most obvious problem with prose is that the reader has to *figure out* what the relationships among the claims are, using whatever clues (semantic, contextual, verbal) are offered by the text. This is hard work, and because every reader has different skills, background knowledge, etc., they will likely come up with different sets of relationships, i.e., different interpretations of the reasoning. In an argument diagram, by contrast, all relationships are made completely explicit using simple visual conventions. Readers have to do very little work in order to see how the claims are related (or, at least, how the claims are being *presented as* related by the person who produced the diagram). In practice, this removes a huge cognitive burden. Readers can then devote their mental energy to thinking about the argument itself rather than trying to figure out what the argument is.

Prose neglects representational resources

The second problem with prose is that it makes use of an impoverished set of representational resources. It is just a monochrome stream of words, sentences and paragraphs. It generally makes little or no use of colour, shape, line or position in space

to convey information about the structure of the argument. Yet we know that the brain can process large amounts of colour, shape line and space information very rapidly. It makes little sense to ignore those resources if they are available. In an argument diagram, for example, colour can be used to indicate in a matter of milliseconds whether a claim is being presented as reason or an objection. In prose, the reader has to *interpret* the claim and its context to figure out its role in the argument. Helpful authors will assist readers in the difficult process of interpretation by providing verbal cues (for example, logical indicators such as "therefore"), although it is quite astonishing how frugal most authors are in providing such cues.

Prose is sequential, arguments are not

A third deep problem with prose is its sequential nature. Arguments are fundamentally *not* sequential. We take them to be directed acyclic graphs (roughly, tree structures), and others might claim that they are actually more complicated than that, but one thing is clear: arguments, like grammatical structures, are not just one thing after another. Prose, however, intrinsically imposes a sequential structure: all the sentences presenting all the claims making up the argument have to follow each other like carriages in a train. This means that prose necessarily introduces inappropriate juxtapositions: in some places claims which are not directly related in the reasoning must be concatenated in the prose. Sure, you can use verbal indicators, paragraph breaks, section breaks, etc., to help overcome the problem. But these are superficial or stop-gap measures, and cannot eliminate the fact that the reader, in order to understand the argument, must mentally reconstruct the non-sequential logical structure from the sequential sentential structure of the prose. This point was eloquently expressed by William Minto:

> In writing you are as a commander filing out his battalion through a narrow gap that allows only one man at a time to pass; and your reader, as he receives the troops, has to reform and reconstruct them. No matter how large or how involved the subject, it can be communicated only in that way. You see, then, what an obligation we owe to him of order and arrangement – and why, apart from felicities and curiosities of diction, the old rhetorician laid such stress upon order and arrangement as duties we owe to those who honor us with their attention. (quoted in (Minto, 1995) p.178)

Minto was wrong, however, in believing that one's subject "can be communicated only in that way." Minto wrote this well before the arrival of argument mapping as a feasible practice. These days, if one's subject is a piece of reasoning, there is another way to communicate it, a way which does not demand that the battalion file through the narrow gap. An argument map presents the entire argument, all at once, in its proper order, more like marching a battalion across a flat parade ground - and viewing it from a helicopter!

Prose cannot visually display metaphors

A fourth deep problem with prose is that it makes no use, in the form of presentation, of the deep metaphors in terms of which we naturally understand arguments.

According to George Lakoff, human understanding essentially involves metaphors grounded in our basic bodily experience (Lakoff, 1987). This general principle applies to understanding arguments as a special case. It is no accident that so many of our metaphors for reasoning and argument are basic ones of space, force, size: how much *support* does the reason offer, what is the *balance* of considerations, how *strong* is that objection, and so forth. Indeed, it is an interesting exercise to try to describe fundamental aspects of reasoning, argument and evidence *without* using such basic metaphors. Using diagrams, we can to some extent take advantage of those mental schemas; e.g., we can place all the reasons over here and all the objections over there, or we can make stronger reasons bigger, or place them underneath (supporting) the conclusion, etc.. None of this is possible in standard prose; thus argument diagrams can tap directly into our fundamental ways of understanding arguments in ways that prose cannot[2].

New Tools for Argument Mapping

The basic idea behind argument mapping is remarkably simple. Everyone knows that good graphics are very effective for presenting complex structures; that we are much better at *visualizing* complexity than we are at *cognising* it. Argument mapping just applies this basic insight to complex reasoning.

Yet argument mapping has never really taken off as a practical tool for real argumentation or deliberation. Why is this? No doubt there are many factors, but one of the most important is surely that argument maps have not been easy to produce. Given available tools, standard practices, and people's abilities, it has been much easier to write out one's reasoning than to present it in a map, at least for reasoning of any complexity.

Now, however, we are seeing major changes in this regard. The arrival of the personal computer and printer has opened up a whole new range of possibilities for supporting thinking. A few decades ago, argument maps would have to be sketched by hand, and producing serious maps would require skilled draftsmen and highly specialised equipment. This is no longer true; even quite ordinary computer users can use standard desktop computers and inexpensive yet powerful software packages to create complex maps with a quite professional appearance.

The next major development will be tools designed specifically to support argument mapping. Using generic packages is still too slow and cumbersome, especially when major structural revisions to argument trees are needed. Dedicated tools will support argument mapping in much the way that PowerPoint effectively supports the process of producing overheads for a presentation.

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[2] Joseph Laronge has been very creative in incorporating metaphors into argument diagrams; see, for example, his contributions to the argumap email discussion list (groups.yahoo.com/group/argumap).

Some first steps in this direction have already been taken. The primary function of software packages such as Araucaria[3], Athena (Rolf & Magnusson, 2002) and Reason!Able (van Gelder & Bulka, 2000) is to support argument mapping. Using such software, one can now assemble argument maps easily and rapidly; and for certain tasks, such as reorganising reasoning, they can be superior to prose.

Packages in the current generation of argument mapping software are fairly basic, and still have numerous usability problems. Soon however there will be much more sophisticated packages designed from the outset to help people develop, modify and distribute argument maps. Working with reasoning in "argument mapping mode" will become easier than working in standard prose mode. Since argument mapping expands our capacity to engage in reasoning, such packages will be a major technological augmentation of our rational capacities; arguably, they will constitute the first major advance in this area in a very long time (Monk, 2001).

Enhancing Deliberation via Argument Mapping

The main thesis of this chapter is that argument mapping can substantially enhance deliberation. That is, we deliberate better when we use argument mapping to lay out reasoning, as compared with standard or traditional practice, which is to use prose. To deliberate better is, in the end, to make better judgements as to what is true and what is false. Such judgements can be better in two ways. First, they can be better-founded; more systematic, more balanced, more objective. Second, they can be more correct; they can better reflect the truth of the matter. Presumably if they are better in the first sense they will be better in the second.

The following sections provide two examples of how using argument mapping can improve deliberation by improving the quality of the reasoning which makes it up.

Argument Mapping in Critical Thinking Training

Deliberation is usually done quite poorly. An impressive piece of evidence in this regard is the study reported by psychologist Deanna Kuhn in her book *The Skills of Argument* (Kuhn, 1991). Kuhn and her team intensively interviewed hundreds of people, sampling from many age groups, occupations, educational backgrounds, etc., with a view to gauging their basic reasoning and argument skills. As I interpret the huge amount of data she presents, she found that over half of the population simply cannot reliably exhibit the basic skills needed in order to successfully deliberate over important issues of any complexity. For example, she found that while most people readily hold an opinion on an issue such as why many criminals repeat their crimes, over half, when asked for evidence to support that opinion, could not provide any at

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[3] See http://www.computing.dundee.ac.uk/staff/creed/research/araucaria.html

all. They would of course say a lot of stuff in response to the request for evidence; the trouble is that what they said wasn't *evidence* (let alone good evidence).

A natural response to this deplorable situation is to suggest that people ought to be *taught* these basic skills; and if ordinary education doesn't produce adequate general reasoning and argument skills, then there ought to be special courses in how to do it. And in fact, there are such courses, although not many people ever get to take one. Almost every university provides subjects such as Introduction to Logic, or Critical Thinking, courses which are usually advertised as worth taking because they improve general reasoning skills. But is this true? Unfortunately there is not much evidence on the issue; only a handful of studies have been conducted. The evidence we do have suggests that such courses make little if any difference. Indeed, the gap between the available evidence and the strong claims made on behalf of such courses suggests that the philosophers and departments who offer such courses are guilty of misleading advertising. It is especially ironic that teachers of courses which focus on critically scrutinising evidence have made so little effort to critically scrutinize the evidence for their own claims.

Why do standard courses on reasoning fail (if they do) to substantially improve reasoning skills? I think there are three main explanations. First, they spend a lot of time teaching irrelevant material. Techniques of elementary formal logic, such as the theory of classical syllogisms and propositional logic, are of little or no use in real-world reasoning. Eminent philosopher Y. Bar Hillel once said

> I am reasonably sure that humanity spends more time on argumentation in natural languages than on the pursuit of scientific knowledge. It is therefore of vital importance to get better insights into the nature of argumentation in natural languages, and I challenge anyone here to show me a serious piece of argumentation in natural languages that has been successfully evaluated as to its validity with the help of formal logic. I regard this fact as one of the greatest scandals of human existence.

The forum of equally eminent philosophers to whom he said this was unable to meet the challenge (Bar-Hillel & others, 1969).

Second, reasoning is a skill, and skills generally improve through practice; however standard courses take a "theory first" approach in which improved performance is supposed to result from understanding the theory. Students spend their time wrestling with the theory and don't get nearly enough genuine practice.

The third explanation is most relevant to this chapter: insofar as such courses deal with real reasoning and argumentation, they do so in the standard prose format. This seems like an obvious and natural thing to do. As described above, however, prose is a poor medium for presenting arguments, imposing heavy and pointless cognitive burdens. Consequently, students' attempts to grapple with reasoning are confounded by the need to struggle with the prose presentation. This creates spurious difficulties which impede development of general reasoning and argument skills. If this is right, then students trained in reasoning using argument mapping ought to improve more rapidly than students in traditional courses.

The Reason! Project at the University of Melbourne has taken this approach. From the outset the goal was to develop a superior method for enhancing critical thinking, focusing on reasoning and argument skills. Its guiding inspiration has been what we call the Quality Practice Hypothesis, the claim that critical thinking skills improve through extensive amounts of the right kind of practice. The challenge is to set up a situation in which students will in fact do large amounts of such practice. As part of meeting this challenge we developed the Reason!Able software, which is a "quality practice environment" – a place where students can engage in reasoning tasks more effectively than in traditional contexts. The most important feature of Reason!Able in this regard is that it is very largely a matter of argument mapping; everything the students do with it takes place in that mode. The software supports rapid and easy construction, modification and evaluation of argument maps.

The Reason! method for enhancing critical thinking consists of students working through a large number of Reason!Able-based exercises. The efficacy of the approach has been intensively evaluated. Every time we run the one-semester subject, we pre- and post-test students using a number of different tests. On the California Critical Thinking Skills Test (CCTST), arguably the best available objective (multi-choice) test of critical thinking, students as a group reliably improve with an effect size of about 0.83 of standard deviation[4] (van Gelder, 2001). By this measure, a Reason!-based course is many times as effective as traditional critical thinking courses. To get a rough idea of the scale of improvement here, consider that an equivalent gain in IQ would be about 12 points in 12 weeks. Or, for another perspective, consider that the expected gain in critical thinking skills in the course of an undergraduate education, based on a wide variety of studies, is about 0.5 of a standard deviation[5]. Twelve weeks of training based on argument mapping improves reasoning skills, as measured by the CCTST, by an amount substantially in excess of the expected gain while at college.

For two years running we have also pre- and post-tested the same students using a written test of our own devising, requiring students to read some argumentative prose and to critically evaluate the reasoning. We had their written responses blindly scored by two critical thinking experts who are quite independent of our team. Although there was much more variation in scores, the overall magnitude of the gain was approximately equivalent to that found using the CCTST (van Gelder, 2001). This indicates that although the training was based on argument mapping, the students were improving their ability to handle reasoning in standard prose formats. In other words,

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[4] There are various ways to calculate effect size, but we use one standard one: roughly, the average improvement divided by the standard deviation on the pre-test.

[5] This estimate is by Earnest Pascarella, a leading authority on the impact of higher education. Pascarella gave this estimate in a manuscript under preparation for the revised version of *How College Affects Students* (Pascarella & Terenzini, 1991). The figure in the version eventually published may differ.

the training effects transferred from the training tasks to other tasks in a more standard format.

How do we know that the improvement was due to argument mapping rather than to some other feature of the course? Perhaps the real causal factor was the large amounts of practice rather than the argument mapping medium. Indeed, we had designed the approach on the hypothesis that large amounts of quality practice is the key to improving skills. In order to test that hypothesis, we built mechanisms to log every move students made with the software over an entire semester. This data yielded crude measures of the total amount of time students spent using the software and the total amount of activity. We have also used questionnaires to interrogate the students as to their practice regimes. We took these figures as estimates of the amount of practice in reasoning they were actually doing. The Quality Practice Hypothesis predicted that there should be a correlation between practice and improvement. Much to our surprise and consternation, we have so far found virtually *no* correlation between the two.

Figure 6.1: Argument mapping using the Reason!Able software. The software supports rapid and easy construction, modification and evaluation of argument maps. The process helps translate abstract logical complexity into simple, colourful diagrams. When used with a touch-sensitive screen such as the SMART Board pictured above, the argument maps become manipulable in a very direct sense. Photo: Michael Silver.

This suggests that something else is the key difference between the Reason! approach and traditional approaches. Our hunch at this stage is that it is argument mapping. Exercises conducted in the argument mapping format give students a strong

visual sense of the structure of reasoning and argument. Once this sense is acquired, further practice makes relatively little difference. If this is right, argument mapping is inducing a qualitative shift in students' abilities. Using the software, which translates complex arguments into simple, colourful and manipulable structures, students "click" as to how reasoning works. At this stage, however, this conjecture is untested. Our investigations in this area are still quite preliminary, and further studies are underway.

All this does not prove that argument mapping enhances deliberation *per se*. It is fairly convincing evidence that argument mapping substantially improves general reasoning and argument skills, and since deliberation is a matter of exercising those skills, it is plausible that deliberation would be improved.

Argument Mapping in Group Deliberation

Improving individuals' deliberative capacities is fine, but deliberation is often done in group contexts, especially when issues get really complex and important. Can computer supported argument mapping enhance group deliberation also?

Austhink has become increasingly involved in using real-time argument mapping to help groups deliberate about issues involving lots of complex arguments. The situations are quite varied, and so it is difficult to encompass the activity in a compact and comprehensive way. Rather, I will describe in detail one more-or-less typical example, and allow general considerations to emerge in that context.

A factory in Sydney producing domestic cleaning products had, a number of years previously, made a switch from their traditional "one person one job" (OPOJ) mode of operation to a multi-skilling mode in which each person was trained in, and rotated through, a number of different tasks. The change had been mandated from on high, and had produced a certain amount of discontent in the ranks. Over the following years there had been considerable grumbling and dispute, involving the multi-skilled workers themselves, supervisors, and human resource managers. These people of course brought quite different perspectives, interests, and educational backgrounds to the debate. No matter how much discussion took place, on the factory floor or in meetings, in small groups or large, little progress was made; arguments seemed to just go around in circles, and disagreement seemed only to become more entrenched. For every point somebody made there seemed to be a counterpoint, and in the thickets of disputation, everyone could find a way to hold onto their own opinion.

A human resources manager hoped to achieve some kind of rational resolution by bringing in some more effective way of handling the disagreement. The standard, prose-based methods just weren't working. Having read a newspaper piece about argument mapping, she decided to give it a go. Her goal was not to prove that any one perspective was right to the exclusion of all others. Rather, it was to try to lay out all the arguments so that everyone could better see how complex the issues were and that opponents were usually making at least some valid points. Ideally, from her point of view, the process would result in a solid consensus that some kind of middle road between OPOJ and complete multi-skilling was going to be best both for individuals and for the factory as a whole.

One morning, we gathered in a meeting room. Participants included workers (some of whom had just finished night shift) and managers, as well as one argument mapping facilitator. The facilitator brought along a laptop computer with mapping software loaded, as well as some introductory materials, including a few sample argument maps so participants could see roughly where the process was headed. A data projector and screen were set up, the laptop plugged in, and chairs set up in an arc close to the screen. There were approximately 20 participants, which is a good number for this kind of exercise; larger numbers mean that each person has less chance to be actively involved, which can lead to boredom and disengagement.

In what follows, the process we followed has been divided, somewhat artificially, into a series of distinct stages:

Stage 1: Introduce argument mapping

The first stage was a brief introduction to argument mapping. Usually, participants have never seen or even heard of the technique, but are able to understand what is going on pretty quickly. The "box and arrow" structure of an argument map seems to tap directly into an intuitive or metaphorical sense they already have that an argument is made up of "this piece over here and that piece over there". In the introduction, we spend more time explaining why you might want to use the technique than explaining how it works.

Stage 2: Identify the central proposition

Since argument mapping supports deliberation, and deliberation is aimed at determining the truth or falsity of a particular proposition, we next tried to figure out what that proposition should be. This involves a free-flowing discussion of the overall issue, and (non-mapped) debate over the merits of various candidates. Candidates are written in boxes on the screen so that everyone can see and compare without having to hold them in memory. This stage is critical to the success of the enterprise. Participants must accept the central proposition as being at the very heart of their disagreement, such that reaching some kind of consensus on that contention would constitute real progress. From a logical point of view, it should be clear, simple, specific, and an obvious target for the main arguments. In this case, we ended up with "The factory should return to one person one job," although in retrospect this was probably not the best one we could have used. Often you can only really tell how adequate the central proposition is after quite a bit of argument mapping.

Stage 3: Canvass the arguments

In the third stage, we canvassed the arguments for and against, secondary arguments, etc.. This is, loosely speaking, a matter of "brainstorming"; the idea is to get all the considerations which matter to any participant out and onto the map. As arguments are raised, new nodes are added to the argument tree and the sentences expressing the arguments typed into the nodes. With a skilled facilitator, this does not slow the flow of thought very much.

In this case, we followed standard practice and started by attempting to list all the major reasons which seemed to provide direct evidence for the proposition, such as "One person for one job is a simpler system to manage." However mapping usually proceeds in a "depth first" rather than a "breadth first" manner. That is, as soon as a reason is raised, those on the other side weigh in with objections or counterarguments, to which there are further responses, etc.. In order to help maintain a sense of the natural flow of the arguments, it is important to map these – to give them a definite place in the emerging argument tree – as they arise, rather than asking people to hold their point for later, when it may have been lost.

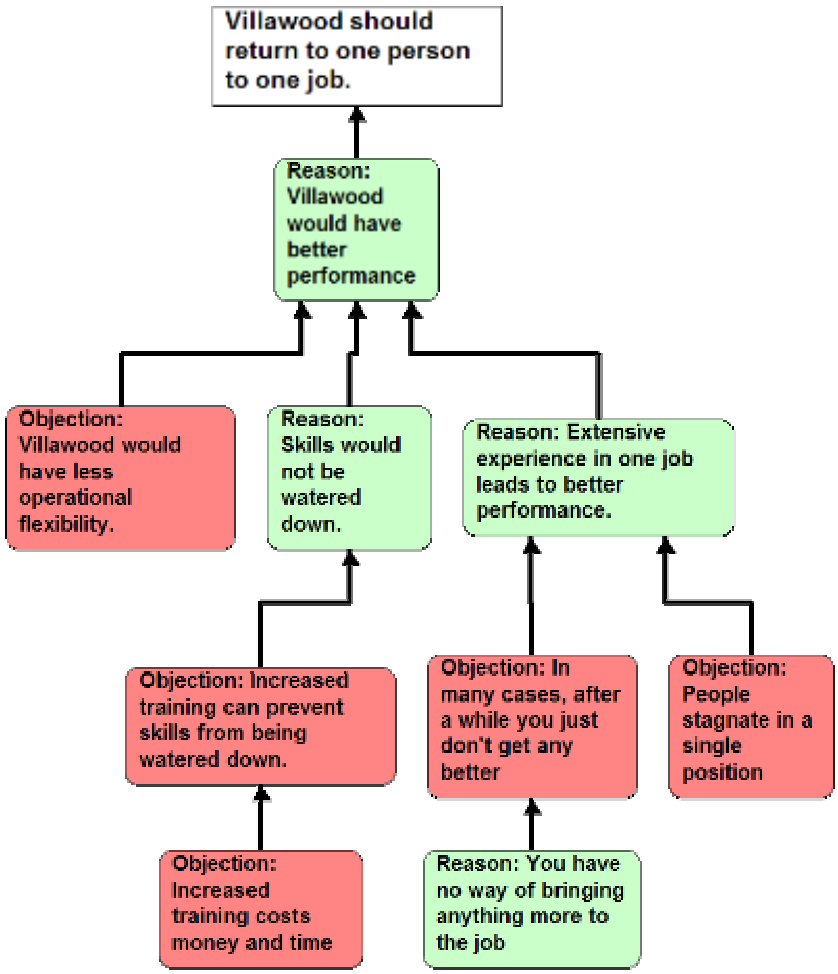

Figure 6.2: A small part of the argument tree-in-progress in Reason!Able format, much as it would have appeared to participants during the workshop. A cluster of argumentation bears upon a single primary reason to believe the main conclusion. This illustrates "depth first" elaboration of the arguments. "Villawood" is the name used to refer to the factory, based on the neighbourhood where it is located.

As the argument tree gets more complex, it becomes increasingly apparent that the process is not a matter of orderly accumulation of successive points. Rather, much time and thought must be given to reworking the existing tree. Claims which previously seemed OK have to be reformulated so that they are more precise, express the right nuances, or are more clearly distinct from other claims. Particular arguments,

or even whole lines of argument may need to be relocated to another position on the tree. This is one place where good argument mapping software really proves its worth; indeed, real-time argument mapping would be practically impossible without such a tool.

Once all the primary reasons (with their supporting reasons, objections, and so forth) had been laid out, we turned to the primary objections. Work here usually goes a bit more smoothly than with the supporting reasons. This may be surprising, since objections are cognitively more demanding than reasons, and objections to objections (rebuttals) are far more demanding than objections to reasons. By this stage, however, participants are more experienced and comfortable with the process, and they start to pre-package their contribution so it can be entered directly onto the argument map. Also, many of the considerations relevant on the "con" side had already arisen in some form as the "pro" side had been elaborated, and so are better understood by this stage. (Such considerations can prompt a certain amount of effort reworking the tree so as to obtain the most elegant and conceptually satisfying structure for the overall argument.)

Periodically, the argument map was printed out, and copies were distributed to the participants. Although the projected image on the screen was large, it had a low resolution, and as the tree became more elaborate, we were faced with a choice – either the whole map was displayed, in which case the overall structure could be seen but the text of individual nodes was illegible, or we zoomed in to focus on particular parts of the tree, but the overall context was lost. A paper printout is much higher resolution, and although the writing is very small all the nodes can be read. (Of course, beyond a certain level of complexity, typical A4 printouts are illegible as well.)

The "canvassing" stage took about three hours. By that time participants were flagging due to the sustained effort involved. More importantly, they had run out of substantial new points; it seemed like most of the relevant arguments had been made. This is normal. In our experience, as a rule of thumb, roughly half a day suffices to extract all the significant arguments that a group of people can think of on any given issue, even when the issue is of some concern to them. This may be an interesting empirical fact about the level of complexity of typical debates. Of course there are contexts where people command argument structures which would take far more than half a day to lay out, and others where the known arguments can be elaborated in far less time. But under ordinary circumstances, participants in debates have available to them collectively a stock of a few score moves, and these can be mapped out in a matter of hours.

Success in this third phase depends heavily on the skills of the facilitator. Of course he must have the standard repertoire expected of anyone facilitating group discussion. Beyond that, the argument mapping guide must be able to take the raw verbal material and rapidly massage it into a coherent argumentative structure. This means taking what a participant is saying and reformulating it in some text which is recognized by the participant as expressing her point, captures the essential underlying logic, and plugs appropriately into the existing argument tree. The participants have lots of "domain knowledge", but are often less able to translate that knowledge into coherent logical structures. The skilled facilitator knows little about the topic but is able to repackage contributions so that the participants feel that it is *their* arguments which are appearing

on the tree. If the facilitator is a "one man show" and is also creating the visual map on the computer, he must be competent in using the mapping software and typing entries, and moving rapidly and easily back and forth between group facilitation and computer use. Many very able people would not be effective solo argument mapping facilitators because they are just too slow with the computer.

Stage 4: Review arguments seeking rational consensus

The aim of the whole exercise, remember, was to promote rational consensus on the main issue. The next stage, then, was to review the arguments as presented on the map and to see what this implied for the proposition that the factory should return to OPOJ. By this time however, something remarkable had already happened. As the negative case was being mapped out, one argument emerged as conclusively establishing that the proposition was false. In a nutshell, it was that when each person is dedicated to a single task, if the one person responsible for a given task is sick or otherwise unable or unwilling to do their job, it can jeopardize the whole manufacturing process. We wrestled with this objection for a quite a while, trying to think of ways to soften its impact. Various suggestions were made, but none were convincing; this point was the knockdown argument for multi-skilling.

The remarkable part of this is not that this objection came to light, or that it was perceived as a strong one. In fact the point is pretty obvious and has always been a primary rationale for multi-skilling in the workplace. The remarkable part was that when his objection was laid out clearly in the context of all other relevant considerations, its overriding force was fully appreciated in a way it had never been when the arguments were rehearsed in standard ways. Opponents of multi-skilling had previously been familiar with this objection, but must have felt that they had adequate responses to it. Yet when the objection and the responses were laid out clearly for all to see, the strength of the objection and relative frailty of any counterarguments became unavoidably apparent.

Thus in the consensus phase there was little more to be said; the rational consensus among the group was that some degree of multi-skilling was essential, and that all objections to multi-skilling were so many hurdles or barriers to be overcome rather than a overriding case for a return to the bad old ways. There may continue to be grumbling and resentment, but whether the factory should continue to promote multi-skilling was no longer a topic for serious dispute.

Stage 5: Print and display map

By this time, participants had been viewing the projected argument map on the large screen, and had seen A4 printouts of drafts. As they walked out of the room, the complexity and arrangement of the full set of arguments would have to be held in their heads if it was to be retained at all. Yet we have very limited capacity to remember and to process complex structures of reasoning with our unaided brains. Even taking notes, in the traditional sense, wouldn't help much; the notes would probably not capture all the details, and in any case the note taker would have to mentally reconstruct the overall structure of the argumentation from the notes. The output of the mapping

process – the argument map – would have to be somehow made available to participants for review at later times.

Thus the final stage of the argument mapping exercise was producing a high-quality, poster-sized, colourful printed map of the entire set of arguments, for display in some prominent place in the factory. We took the final draft of the map away in electronic form, reworked the argument to clean it up, both within nodes and in its overall structure; then sent it off to be printed in A1 size. This poster was then laminated and sent back to the factory, where it was, at least for a while, pinned up on a public wall so that anyone could read it, review the arguments, and perhaps use it to help them rationally determine their opinion on the matter.

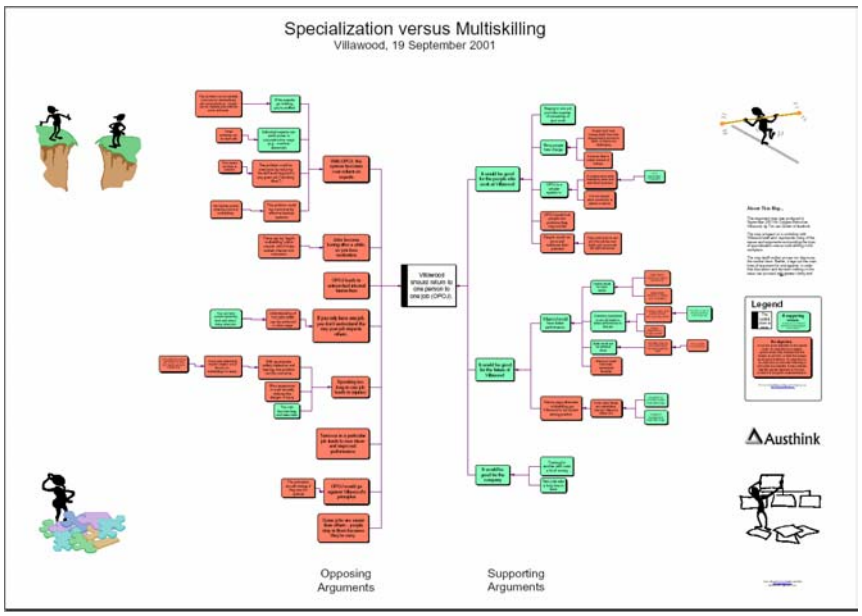

Figure 6.3: The revised argument map. This map was printed in A1 size, laminated, and sent back to the workplace so that participants and others could easily review the arguments. Notice that even though the individual claims (text within nodes) are illegible, the main structure of the argument is clearly visible at a glance. For example, it is apparent that there is a larger number of primary objections (nodes immediately to the left of the central node) than primary reasons.

To return to the main theme of this chapter, how did computer supported argument mapping enhance group deliberation?

1 Most profoundly, the live argument-mapping process expanded participants' sense of the full set of arguments, and where individual arguments belonged in the overall structure. They could, literally, *see* what was going on, in a way not possible with standard prose-based ways of

handling reasoning; and, having seen the full argument, were better able to take relevant factors into account.

2 The evolving, projected argument map gave participants a *common* understanding of the arguments and their structure. In ordinary argumentative practices, people must maintain in their minds a sense of what the overall argument is. Since this is exceedingly difficult to do, they end up with partial versions and everyone has a somewhat different interpretation. When everyone is on a different wavelength, there is a great deal of confusion, needless disputation, and wasted time.

3 The argument mapping process gave participants a powerful sense that they had been *heard*, that their opinion had been registered. When they made a contribution to the overall debate, it was entered in a box and placed on the tree, and it stayed there for all to see for the duration of the workshop; and if it had not been responded to, this was immediately apparent in the visual layout of the argument tree.

4 The argument mapping process smoothed the path to rational consensus by *depersonalising* disagreement. In standard meetings or round-table discussions, positions tend to be identified with people, and debate becomes a personal contest as much as an objective considering of the arguments. When all attention is focused on the argument tree, however, personalities drop away and people are much better able to appreciate the force of the arguments, and to see gaps and weaknesses.

5 The poster-sized argument map is now a permanent part of that particular organisation's memory. On one day, the participants had achieved what was probably their highest-ever level of awareness and understanding of the arguments on a topic of considerable internal importance. If they were to rely unaided memory to store this "knowledge," or even had it written up and filed away in some kind of report, it would surely have been lost. The argument map both encodes that knowledge and makes it readily recoverable for anyone in future.

Conclusion

Deliberation is the primary means by which we strive for, and sometimes actually find, the truth on important, complex issues. Anything which enhances deliberation thereby enhances our ability to know the truth. Argument mapping can substantially enhance deliberation, relative to traditional practices. The emergence of new, dedicated argument-mapping support tools will, I believe, enable argument mapping to become widespread practice in schools, and in the workplace, in domains as various as policy making, research, politics, the law, and dispute resolution. If all this is correct, computer supported argument mapping ought, in the long run, contribute substantially to human well-being. In this sense, our project is a extension of the Enlightenment vision of progress through the refinement and application of Reason.

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