

Preface

The difficult part in an argument is not to defend one's opinion but rather to know it.

Andre Maurois (1885-1967) French biographer, novelist, essayist

He who knows only his side of the case, knows little of that.

John Stuart Mill (1806-1873) British philosopher, economist

Why a book on *Computer-Supported Argument Visualization*? A search on a major online bookstore reveals numerous titles matching the individual words *argumentation*, *visualization* and *computer-supported cooperative work*, but none on *visualizing argumentation* or *computer-supported argumentation*. However, a query on an internet search engine reveals over 1000 hits almost all of which describe relevant documents and projects, testifying to significant activity in this area—but still, not a single book. However, beyond plugging a hole in the book market, a less pecuniary motivation for this volume derives from observing the world around us.

Seeking quality communication and mutual understanding are hardly novel goals, but in our fragmented, pluralistic, but globally connected world, they have never been more important, nor harder to establish and sustain. Borrowing a biblical metaphor, there is a veritable Tower of Babylon in our intellectual, social, and political world. Although we don't believe that there is a Rosetta stone (gift of tongues?) that will translate all of the different tongues into one, we do believe that there are tools which can help us to establish common ground between diverse stakeholders, understand positions on issues, surface assumptions and criteria, and collectively construct consensus on whatever grounds can be found.

From this rather lofty stuff, let us focus the scope of discussion, and note some of the other tectonic forces in play. In educational theory, we see a paradigm shift from cognitivist ideas and approaches to teaching towards constructivist, competency-based ideas and approaches in order to help students cope with fast technological and societal changes. These approaches stress independent learning in rich information environments, authentic learning tasks, and of particular relevance here, the negotiation of meaning by understanding multiple perspectives. How are perspectives to be reified, contrasted, critiqued, integrated? Argument visualization tools are one candidate.

In operations research, cognitive science and business analysis, it is recognised that for many real world problems, agreeing on what the real problem is requires extensive discussion, as does agreeing on what might constitute a solution. Simulations, spreadsheets, and other modelling approaches can typically be deployed only after the problem has been sufficiently defined, bounded and constrained by assumptions, in other words, after much of the most intellectually demanding work has been done. This should ring bells for managers, engineers, lawyers, scientists, political and environmental strategists, conceptual designers, architects, urban planners, intelligence analysts, and so forth. Computer-Supported Argument Visualization (CSAV) tools are designed to assist in collating, and then making sense of, information and possible narratives that weave threads of coherence.

Making sense of multi-perspective problems and disparate information sources is of course just the first step. We need to make sense, in order to act and shape the future. Anticipating the future is as important as ever, and perhaps, getting harder. As Ogilvy (2002) has argued, we may be better employed in trying to construct, rather than predict, the future, by inventing and mentally inhabiting multiple possible futures that we would like to see. The growing use of scenarios to help groups identify hidden values, visions, constraints and contingencies switches the spotlight squarely on dialogue, sense-making, competing narratives, assumptions – all of which lie at the heart of argument visualization.

Ross Todd, describing the late twentieth century as the Age of Information where the external organisation, transformation and communication of information is emphasised, sees the twenty-first century as the Age of the Mind. “This transformation, commonly acknowledged as the “information society”, is global in its reach, yet intimate and constant in its impact. An examination of its short history suggests that two phases of the transformation are evident. These two phases are seen in the notion of the “information society” as a global phenomena, and as responses within organisations and systems. Lawrence Heilprin identified these stages as the “age of information” and the “age of the mind” (Heilprin, 1989, p. 364). The “age of the mind” refers to the shift in focus from the production and availability of information and its associated technology, to concerns about how people utilise that information, the barriers and challenges they face in accessing and interacting with information, what they do with the information, and how it enables them to get on with their lives. For learning organisations, this means addressing the question of how information technology and the richness of the electronic information environment can be integrated in the learning process meaningfully. The focus must be on people as active information processors and on how information empowers and enables people, rather than on the information per se. Karl Weick’s work on organisational sense-making also resonates with this, hence our conception of argument visualization tools as sense-making tools.

Whatever we make of the all-embracing umbrella of “knowledge management”, we do find at least one robust concept that opens up and provides useful coverage: the community of practice. The dynamics of good communities of practice that enable skilled performance, situated learning, coordinated activity, and the elegant dissemination of know-how and expertise need to be better understood and nurtured.

One of the key lessons emerging from such work is that people need spaces – temporal, physical, cognitive, emotional, formal and informal – to simply talk and share ideas with colleagues. Within organisations, the locus of much knowledge production is the dialogue, the discussion, the argument: people expressing ideas, negotiating meaning, arguing viewpoints, pursuing agendas, and seeking – or avoiding – common ground. However, as we suspect most of our readers can verify, much of the energy poured into talking is often wasted, poorly channelled, never treated as a knowledge resource. Some chapters in this book (van Gelder; Conklin; Selvin) describe how argument visualization can help tackle the problem of dysfunctional communication.

What we have started doing is in fact tracing the roots and rationale behind different argument visualization approaches, a process that continues throughout this book in much greater depth. Suffice to say at this stage that given the pervasive need for task-oriented discourse, from “knowledge work”, to academic learning, to political and organizational negotiation, there are intriguing possibilities for reifying in visual form structural aspects of that discourse to enable more effective, collective reflection.

Aims of this Book

This book – written by researchers and practitioners, for researchers and practitioners – presents the current state of the art of the new field of *Computer-Supported Argument Visualization*. Readers will find conceptual foundations, and application case studies in both organizational and educational arenas, as well as ideas for future research, and practical techniques to extend one’s individual and collective sense-making ability.

The American Heritage® Dictionary of the English Language: Fourth Edition defines an argument to be:

- 1 a. A discussion in which disagreement is expressed.
- 2 a. A course of reasoning aimed at demonstrating truth or falsehood: *presented a careful argument for extraterrestrial life.*
- 2 b. A fact or statement put forth as proof or evidence; a reason.
- 2 c. A set of statements in which one follows logically as a conclusion from the others.

The etymology lies in the Latin *argumentum*, from *arguere* which means to make clear. And this is what it’s all about. How do we make clear – at least so far as one is willing and able – what we think, what we mean, what we believe and need, so that we can work together to define and solve the problems that confront us? The above definitions frame *argumentation* not only as discourse for persuasion, logical proof, and evidence-based belief, but more generally, discussion in which disagreements and reasoning are presented. The precise form that argument visualization takes depends on the demands of the particular field, user community, and context of use. As the forthcoming chapters make clear, different business and academic contexts lead to very different goals, representations, and modes of working. Think of the differences between the

argumentation one finds in a legal courtroom, a school classroom, a scientific workshop, a party political conference, and a corporate boardroom. Especially in organisational deliberation, disagreements and reasoning are rarely a matter of formal logic, and as already highlighted above, some chapters in this book are particularly concerned with capturing, and reifying for inspection, the whole range of constraints that impinge on everyday sense-making and debate.

Overview of the Book

The book has two sections. The first section deals with historical and conceptual foundations to the topic of visualizing argumentation. The second section illustrates the breadth of application that CSAV is finding, describing applications in education, organisational sense-making, and scholarly discourse

In Chapter 1, *The Roots of Computer Supported Argument Visualization*, Simon Buckingham Shum sets this book in historical context, tracing the twin roots of argument visualization and computer-supported argumentation that have converged to create CSAV in its current form. The earliest work he was able to find on visually mapping arguments dates back to 1913 in the work of John Henry Wigmore on mapping evidential argumentation in legal cases, whilst historians of technology will note with interest that Vannevar Bush and Douglas Engelbart, whose work laid the foundations for hypertext and interactive personal computing, both pinpointed scholarly argumentation as key applications of the nascent technologies they envisaged, and in Engelbart's case, actually built.

In Chapter 2, *A Cognitive Framework for Cooperative Problem Solving with Argument Visualization*, Jan van Bruggen, Henny Boshuizen and Paul Kirschner introduce research on problem solving cognition, and its relationship to CSAV tools and applications. They present a framework that identifies particular roles that CSAV tools can play as cognitive aids in cooperative problem solving, and then use this to make sense of the research literature on argumentation tools in learning.

Although these are the only two chapters in our *Foundations* section, we refer readers also to a different kind of framework proposed by Selvin in the first part of Chapter 7. This describes general principles and tool requirements to support collective sense-making applications of CSAV, with particular emphasis on the role of a facilitator, and applications to business teams.

Turning to specific applications of CSAV, and continuing the thread on learning started by van Bruggen, et al., we have three contributions on the affordances of argument visualization notations and tools for different kinds of learning.

In Chapter 3, *Designing Argumentation Tools for Collaborative Learning*, Gellof Kanselaar, Gijsbert Erkens, Jerry Andriessen, Maaïke Prangma, Arja Veerman and Jos Jaspers review their previous work investigating the educational affordances of different computer-supported argumentation tools, before reporting a study evaluating their TC3 software tool to support students in critical analysis and argumentative writing. Through detailed analysis of student protocols and use of a variety of tools to support writing, they present a rich and nuanced account which emphasises that the role played

by argument maps in this task depended on other factors such as the task assigned to student, their preparation, and the instructions given.

In Chapter 4, *Using Computer Supported Argument Visualization to Teach Legal Argumentation*, Chad Carr focuses on law, which of all fields, arguably places greatest demands on its students to develop argumentation expertise. Carr reports research that analyses the role of the QuestMap CSAV tool in supporting the collaborative learning of legal argumentation skills, compared to a control group of students using conventional resources. Like Kanselaar, et al.'s work (Chapter 3), he concludes that in learning contexts, the diagrammatic representation may not always play the role expected. He shares insights gained while conducting a sixteen-week study at a leading ABA accredited law school.

In Chapter 5, *Enhancing Deliberation Through Computer Supported Argument Visualization*, Tim van Gelder focuses on CSAV to support deliberation about the plausibility of a position in an argument. He starts by considering the differences between maps and conventional prose for communicating arguments. He then reports research that demonstrated significant improvements in students' acquisition of critical thinking skills when they used a CSAV tool called Reason!Able. The chapter then switches focus to illustrate the same approach in a very different context, an industrial dispute about working conditions. Van Gelder describes the process and facilitation skills involved in helping staff understand the structure of their arguments and reach consensus on the way forward.

This second case study leads us into the second set of CSAV applications: facilitated CSAV for teams in business and other organisational contexts, trying to make collective sense of complex problems. Collaborative sense-making is of course "learning" in a broader sense, so we cannot draw too hard a distinction from the first set of chapters focusing on education. However, van Gelder's case study and the following two chapters are different in that CSAV must now demonstrate its value in supporting sense-making and decision-making in real workplaces, with all the constraints and complexity that they introduce that are not normally factors when CSAV is used by students on courses.

In Chapter 6, *Dialog Mapping: Reflections on an Industrial Strength Case Study*, Jeff Conklin describes how one of the most influential argumentation schemes dating back to the 1970s, Kunz and Rittel's Issue-Based Information System (IBIS), has been developed into a facilitated CSAV technique called Dialog Mapping. Dialog Mapping (like van Gelder's industrial case study) introduces the facilitator as a key player who adds value through expertise in argument mapping and group process. Conklin then presents what is probably the longest-term case study available of CSAV adoption in an organization, reflecting on the lessons that can be distilled from a company that has used the QuestMap tool continuously for the last decade to support synchronous and asynchronous work.

Conklin's work is developed further in Chapter 7, *Fostering Collective Intelligence: Helping Groups Use Visualized Argumentation*, in which Albert Selvin details the principles behind facilitating CSAV in real time, in business contexts, and the functional requirements on tools to support this. These are derived from his work on the Compendium approach, which extends Conklin's Dialog Mapping approach both conceptually (overlying

formal modelling on IBIS), and technically (bringing CSAV into the age of the web and open standards). Selvin then presents three examples of Compendium in use, to illustrate how the principles and tool functionalities he has proposed play out in different contexts.

The scene shifts once more for the final two chapters, where we move into the world of scientific argumentation, or more broadly, scholarly argumentation (including technical, medical, and humanities).

In Chapter 8, *Infrastructure for Navigating Interdisciplinary Debates*, Robert Horn describes his work on crafting maps of “great debates” in science, in order to clarify the key claims and arguments in play. Using examples such as the Turing Debate on machine intelligence, genetically modified food, and the mind-body problem in consciousness research, Horn describes the information design challenges that they have faced in order to reify the structure of complex debates clearly both in visual terms, and intellectually, at an appropriate level of detail. Another aspect of interest in this work is the question of large scale mapping on different media. The early work was done using large paper posters to manage the size of the maps. More recent work has started to work in web interfaces, which impose new constraints, as well as opening new possibilities for managing complexity.

In this latter respect, Chapter 9 picks up the baton to explore a CSAV scenario for scholarly publishing and argumentation. In *Visualizing Internetworked Argumentation*, Simon Buckingham Shum, Victoria Uren, Gangmin Li, John Domingue and Enrico Motta describe ongoing work to investigate how research results could be published and debated as claims and arguments over the internet, to augment conventional text publications. They describe the development of an ontology for scholarly discourse, which provides researchers with a language in which to summarise the key contributions of a research paper, and its connections to the literature. They then describe how CSAV tools can support both the construction of argumentation maps, and various forms of analysis of the argument network as it grows in order to navigate, detect and track structures of interest.

It is fitting that the book is concluded by Doug Engelbart, who figures as one of the main sources of inspiration for CSAV (reviewed in Chapter 1). In his *Afterword*, Engelbart reflects on the progress made since he first envisaged interactive software tools to augment human intellectual work in the 1950s and 60s. His historic 1962 report used interactive argument construction and analysis as a prime scenario to illustrate the potential of such tools. Engelbart outlines his continuing mission to build infrastructures to assist communities to improve the way they work, in order to better tackle the complex, urgent problems facing humanity. He concludes that computer-supported collaborative argumentation is a key element in this infrastructure, and poses a number of questions that define an agenda for the future convergence of *Computer-Supported Argument Visualization* with his goal of “augmenting human intellect.”

Book Website

The book's companion website – www.VisualizingArgumentation.info – provides links to online resources and references cited in chapters, full colour images, forums for discussion with authors and the wider community, and alerts to relevant events and resources. We trust that you find the combination of this volume and its website a valuable springboard for future work.

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Chad Carr

August, 2002

References

- Heilprin, L. (1989). Foundations of information science reexamined. *Annual Review of Information Science and Technology*, 24, 343–372.
- Katzenbach, J. R., & Smith, D. K. (1993). *The wisdom of teams: Creating the high-performance organization*. Boston: Harvard Business School Press.
- Ogilvy, J. A. (2002). *Creating better futures: Scenario planning as a tool for a better tomorrow*. Oxford University Press.
- Quinn, J. B., Andersen, P., & Finkelstein, S. (1996). Managing professional intellect: Making the most of the best. *Harvard Business Review*, March-April, 71-80.
- Todd, R. and McNicholas, C. (1997). Electronic information and learning organisations. *Proceedings of the Eighth Australasian Information Online & On Disc Conference and Exhibition*, (pp. 363-373). Retrieved on August 30, 2002 from <http://www.csu.edu.au/special/online97/proceedings/on1206.htm>
- Weick, K. E. (1996). *Sensemaking in organizations*. Newbury Park, CA: Sage.

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