Think Link, Invent, Implement, and Collaborate! Think Open! Think Change! Think Big!

Keynote Speech Honoring Douglas Engelbart on Doug Engelbart Day in the state of Oregon, at Oregon State University, January 24, 2002

by
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Part A. What we thank Engelbart for

We have come here to thank Doug Engelbart for his ideas, for his leadership, and for his life! I am personally here to thank him for one day in about 1972, for taking me into his office and showing me the future. Doug, I am sure you don't remember that day. That meeting must have been just one in a long line of visits you were receiving as a result of your early work.

But I remember that day. I learned a lot from that meeting, as well as from your report *Augmenting Human Intellect* (Engelbart, 1962), which I read in the late 60s.

What can we learn? Contributions and values
The question before us today is: What can we learn from Doug Engelbart these days? Many things of which we constantly need to remind ourselves. You will notice a lot of exclamation points in the title and in my speech. That is because after 30 years I am still enthusiastic about the contributions and values we find in Doug's work. Let me identify some of these contributions and values. I have organized my talk into 8 parts, each with an exclamation point.

1. Think link!

The last decade in computing was in one sense the decade of linkage. It was the decade of linking together (however fragilely) much of our common knowledge on the world wide web.

Linkages are the centerpiece of hypertext and the world wide web. Doug was the first person to actually develop a working hypertext system that Vannevar Bush had envisioned in 1945. The world wide web is a magnificent construction. You may know that ARPANET, the forerunner of the internet, was first managed out of Doug's organization.

Linkages for me are the very symbol of complexity. They bring to mind connections and relationships -- which are the "stuff" of modern complexity.

There is still work to be done in making links really useful and efficient and more meaningful.

The semantic web
One such initiative is the Semantic Web (Berners-Lee, et. al. 2001), the first workshop of which was held at Stanford last summer. And whom did I run into there? Doug Engelbart. Still thinking deeply about meaningful links!

I could see from the presentations at that conference that there is a lot of work to be done in thinking about meaningful linkages. This is a conference of philosophers, and philosophers need to be working on the semantic web. The engineers are talking about ontologies, the engineering of ontologies. And I can tell you from the little I know about ontologies that most computer engineers do not know what philosophers know about ontologies.

But there is a lesson here: Young philosophers in the audience, keep your eye on where Engelbart shows up. He has an eye for the future. And one of his eyes for augmenting human intelligence was, last summer, on the semantic web.

An invitation
At the end of each section of my talk today, I am going to issue an invitation – an invitation to collaborative work. My first invitation to you as philosophers and practical users of information: Help us think about the semantic web. And help us think more deeply about linkages and relationship.

2. Think collaborate!

Augmenting human intellect is a collaborative job. Doug knew that from the start. His hypertext system was from the beginning a collaborative one. It has launched a whole subdiscipline: computer-supported collaborative work. We academics aren't always too good at this. But if we are to augment human intellect, we must learn to collaborate in much better fashion. The kinds of tools that Doug has spent his life developing are part of it. But just part of it. We have some social learning to be done. How often have we truly collaborated on a project? Yes, we come to meetings with our papers and read them and think we have "made a contribution." We even sit on committees, for hours, for days, for years, heck, sometimes for decades! And we think we have collaborated.

Deep collaboration
But I ask you at the beginning of this conference to imagine what deep collaboration might be like. How much of our own work will we have to give up? How much of our own egos will we have to put on the shelf while we are deeply collaborating?

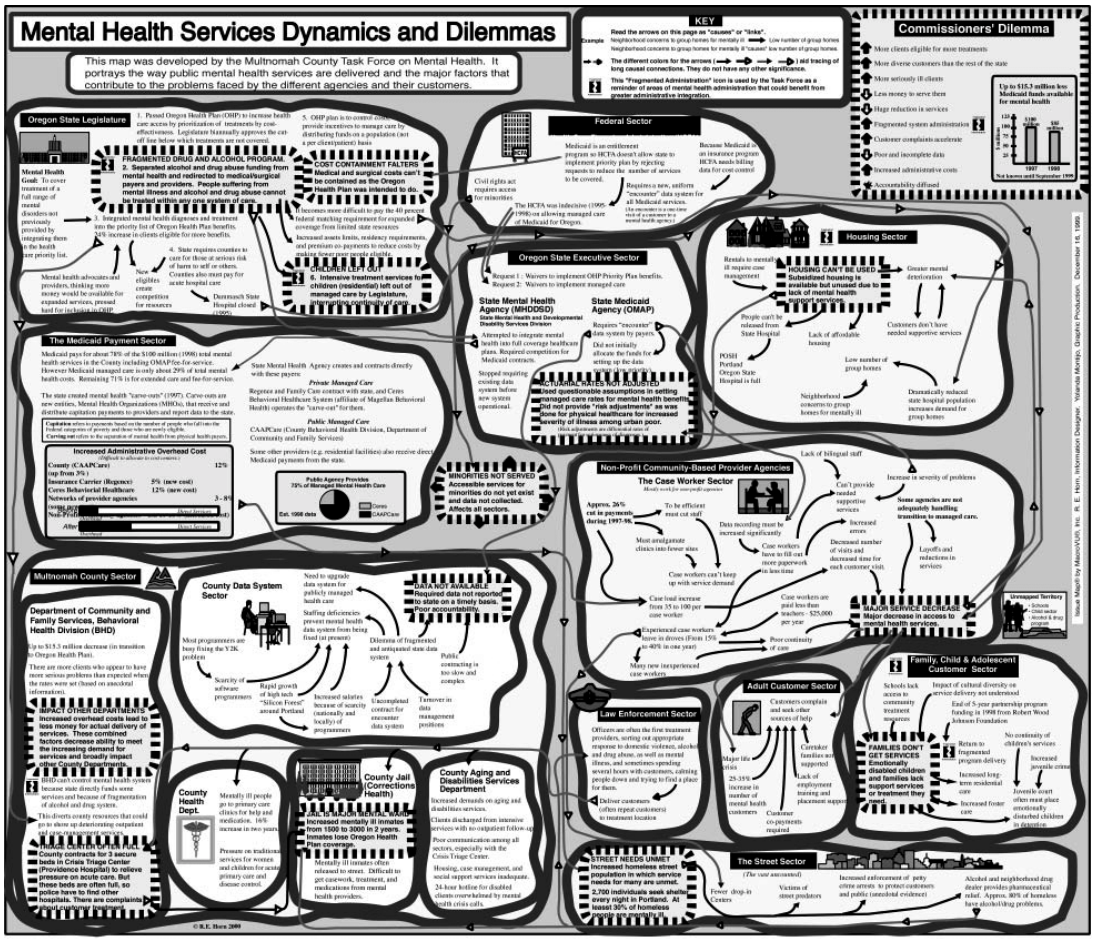
An invitation
My second invitation to you, drawing inspiration from Doug's work: Imagine what deep collaboration would be like--and try it out.

3. Think big!

Everything about Doug is about thinking big. He didn't start small. His first major research question was "How do we augment human intelligence?" That's a big question. To solve the problems we face as a species, and to manage our ongoing predicaments, we need the capacity to think bigger, more comprehensive thoughts. How do we think big thoughts? I'm going to tell you one way.

Complex social messes

My own work on complexity is specifically on complex social messes. They have been called "ill-structured problems" or "wicked problems." I call them "social messes." We have been working with community task forces attempting to diagram their dilemmas, the difficulties of working with their complex bureaucracies -- in short, helping them work their way out of complex social messes. Among other things, this has required the ability to collaborate by creating common mental models of their problems. Complexity is not so much of a problem when you have one mentally ill person to treat as when you have three thousand of them in the county jail, which is what we found just north of here in Portland. How did we address that kind of complexity? With what we are calling a knowledge map. (Horn, 2001a) Here is what our map of the problems and dilemmas of delivering public mental health services in Portland looks like. (Horn, 2001b)



Scale and scaling up
Big implies scale. Doug recognized from the beginning that scale was important. In his writing, he is constantly concerned with scale and scaling up technologies. Changes of magnitude create changes in complexity and coordination. They require collaborative responses to problems. They require that we work together with common mental models.

Improve our improving systems
As Doug has shown, in these kinds of situations, we need to learn how to improve our improvements. We need to have a recursive learning system. That is, we need to improve our improving systems. I have tried to do that as a consultant with one of the largest corporations in the world. It is a difficult task.

Human cognome project
Let me give you another example of thinking big. Recently I was at a National Science Foundation workshop on Converging Technologies for Improving Human Performance at which we were asked to look 15 years ahead to how four major technologies might converge to improve human performance. These technologies were nanotechnology, biotechnology, information technology, and cognitive science. We were asked to think big. So I suggested that we launch a Mapping the Human Cognome project. That was about as big as I could think a few weeks ago. In some ways I think of the Human Cognome project as possibly the sibling of Doug's Augmenting Human Intellect project. People, of course, then asked "What is the Human Cognome?" I suggested that it was an umbrella concept that needed articulation. I think that the Human Cognome project is probably a half-century-long project. I have some ideas where it might go, and it is surely a project that will require deep collaboration for its unfolding.

An invitation
My third invitation to you: Help us think about the Human Cognome project.

4. Think change!
Doug is the father of one of the biggest changes in the 20th century--the personal computer. One of the reasons we need to augment our intelligence is to handle the rapid pace of change in this century.

Meaning-making in the midst of constant change
Human beings are meaning-making creatures. This indicates to me that there is new meaning every day. As someone recently wrote: "You never step into the same brain twice. It only seems that way." This implies that our intellect augmenting systems must be open to new meanings. But that complicates our collaboration. If you bring a bunch of new meanings to our meetings everyday, how can we incorporate them into our collective work? We can't be changing everything all the time. How do we address the question of relative stability? How much change and how much stability?

An invitation
My next invitation to you: Think deeply about change and stability. For our psyches, which require both; for our organizations that run on both; for our world which exhibits both at every moment.

5. Think open!

To change is to be open to change. Some of Doug's newer big ideas have to do with open systems. Thinking deeply about how to be open, how to incorporate others' ideas, is the essence of the deep change I've been talking about. It means that your contribution is important. Doug's work on the open hyperdocument is an example of this value in operation. In this speech, I can't get into the specifics of his vision for that. But note that there are specific values embedded in this quest for a document that will be open, will serve us all.

An invitation
My invitation: Let us help each other to be open to the changes in meaning that are required in this chaotic time.

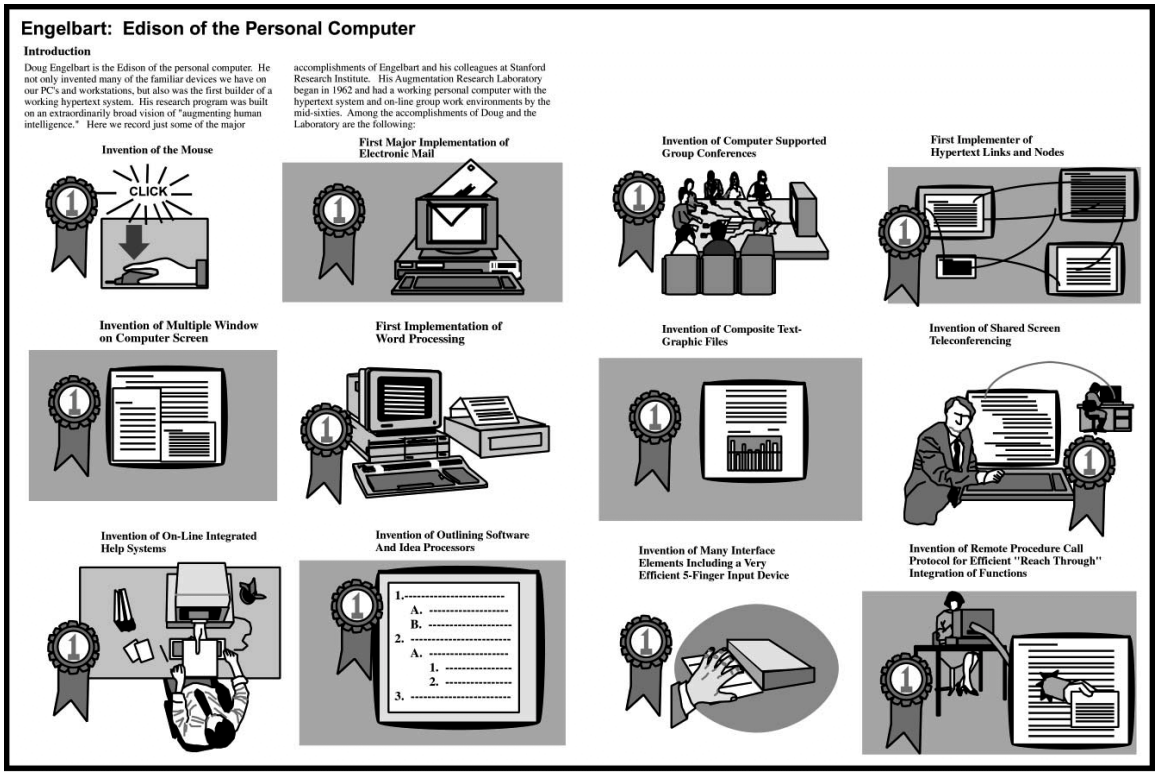
6. Think implement!

Engelbart is not just a marvelous theorist of augmenting human intelligence. He actually sat down and built a software system to demonstrate it could be done. Not in the 1990s. Not in the 1980s. Not even in the 1970s. Doug had an operating collaborative, hypertext system in the 1960s!

Doug's inventions
Well, of course he had to build a few things in order to implement it. Things like the mouse. But many other things as well. He had to invent

- electronic mail
- multiple windows on the computer screen
- word processing
- online help
- outlining software
- composite text-graphic files
- shared screen teleconferencing
- and many other things

Here was my rendering of this implementation work in my 1989 book, *Mapping Hypertext.* (Horn, 1989)



In short, Doug had to invent the personal computer in order to implement the first software system in order to make the first few steps toward augmenting human intelligence.

That's a long series of steps in order to take steps to make progress. But sometimes it has to be done that way.

An invitation
My next invitation to you: Let's get busy implementing solutions to the major tasks of our day.

That's the first part of my talk, covering some of the contributions and values we can thank Doug for. Now for the second half of my talk.

Part B. Some of the major tasks of our day

Doug has done a lot, but he has left some work for us to do as well. Thank you, Doug, for not doing it all! Thank you for leaving some things for the rest of us to do! What are some of today's needs in the augmenting of human intelligence?

7. Think visual-verbal!

Those of you who know me will not be surprised to learn that visual language is one of my top nominations for a major task of the decade. The world is seeing the emergence of literally a new international auxiliary language. I call it visual language although it might be called visual-verbal language, because I think its major distinguishing feature is the tight integration of visual and verbal elements, each doing the job they do best to help us communicate. (Horn, 1998b)

The data support it

Should you use it? Yes, unless you want to make it harder for people to understand and learn what you have to say. Here is some of the data. In one group of studies, adding appropriate visual to words improved learning by 23%. In another group of studies adding visuals to words improved transfer of learning by 89%. (Mayer, 2001) There are other studies by Chandler and Sweller (1991) that offer similar evidence that visual-verbal learning is better.

Stand-alone diagrams

Much of the visual-verbal content used in these studies was what we could describe as "stand-alone" diagrams. Stand-alone diagrams do what the term indicates. Everything you need to understand the subject under consideration is incorporated into the diagram.

Philosophers underachieving in diagramming

We have to admit it: philosophers are woefully inadequate at making diagrams. Many would rather ramble on in long, boring prose paragraphs than take the time to outline a good diagram. I've tried to remedy that. In fact, someone once accused me of having put more philosophical diagrams in my published work than have all of the philosophers in history – combined.

I recently had the experience of talking with a group of graduate students who, once I'd introduced the subject of diagrams, told me of creating very elaborate diagrams to understand the topic they were studying and then having to cram the exquisite portrayal of concept and relationship into standard academic prose.

An ethical question

If the Mayer data hold, for philosophers this poses an ethical question. Can we ethically continue to write our papers, our philosophy, in the same old prose way, creating 23 to 89% more difficulty for readers, and hence, creating that much more suffering for them? Can we ethically not use diagrams?

An invitation

Thus, my next invitation to you: Learn some visual language and have some fun as well, because as a human species we are all inventing it. It is happening in this decade. You can be a part of that global group that is inventing this magnificent new communication medium.

And to the philosophers in the audience, I remind you of Wittgenstein's epigram: "The limits of my language are the limits of my world."

8. Think structure!

My friends in the audience will also not be surprised at my second nomination for work to be done. Understanding the patterns, organization, and structure of our thought and communication systems is a critical item on our agenda of augmenting human intellect. It is one of the great challenges of the 21st century. It may very well be one of the centerpieces of the Human Cognome project. The semantic web will surely be built on this understanding.

Mapping information

As some of you know, I developed Information Mapping®, a methodology for analyzing complex subject matters that is now a standard in technical writing. We have trained over 300,000 people in the U.S. and more overseas to analyze and write using this method. (Horn, 1989)

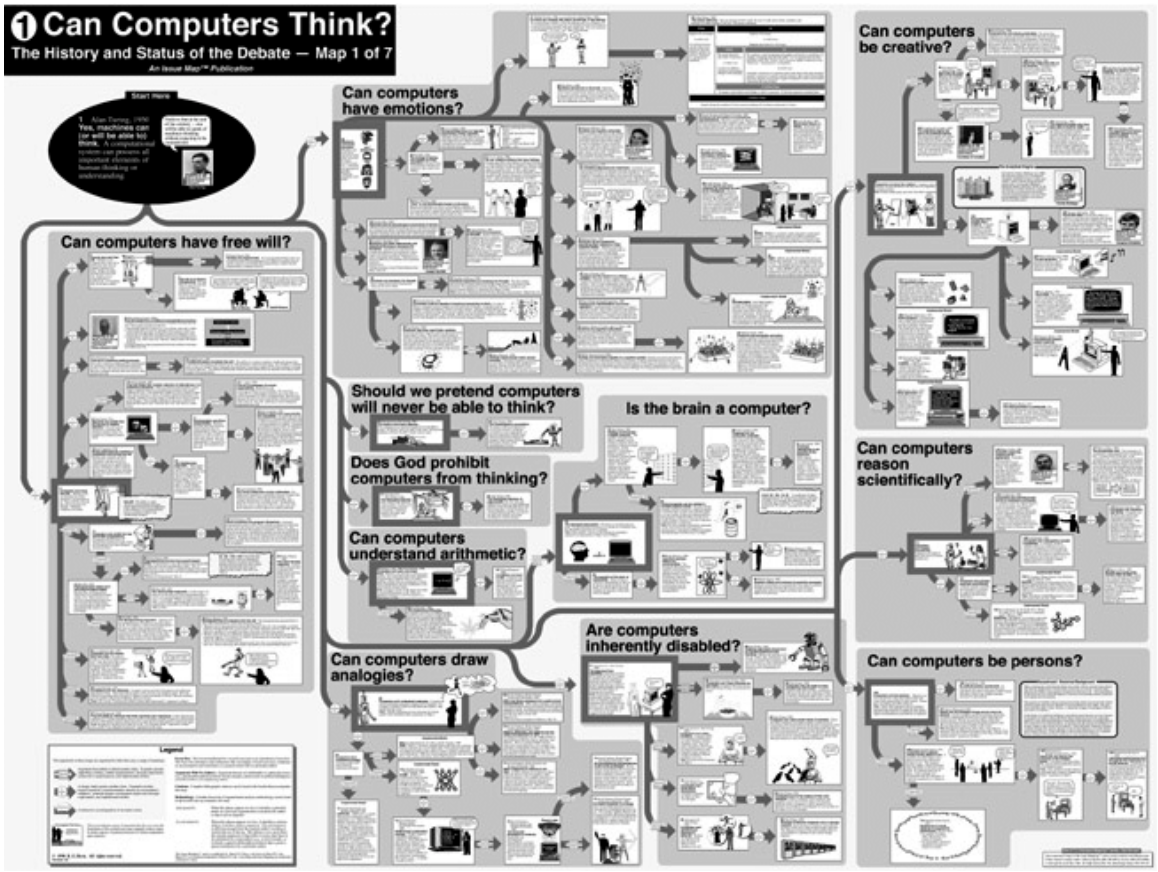
I think that some of the work we've done in the Information Mapping research on understanding the chunks of thought and the forms of the chunks of thought gives us, in a modest way, many clues about how to restructure certain parts of the semantic web.

Now here is a second point about structuring—an especially important one to the philosophers in the audience. When asked, "What do philosophers actually do all day?" One wag replied, "They argue."

If that is true, and if there is a better way of arguing, shouldn't you use it? Recent research is showing that there is a better way of arguing.

Argumentation mapping

Recently, there has developed a burgeoning new field of argumentation mapping (Monk, 2000). It is built on the argumentation analysis that Stephen Toulmin, a major philosopher of our time, introduced in 1958. (Toulmin, 1958) Unlike Information Mapping, which deals mostly with relatively stable subject matters, argumentation mapping deals with debated subject matter. For those who haven't seen it, it looks like this. (Horn, 1998a)



Claim. Research is finding that a semester's practice in doing argumentation mapping is the best way to teach critical thinking. That is work being done by Professor Tim van Gelder of the University of Melbourne. He is finding that students who practice argumentation mapping for a semester gain twice as much in critical thinking skills as those gained in 3 years of undergraduate education.

Method. What was his method? Van Gelder says: "First students every semester are pre- and post-tested ...using two different tests - one the California Critical Thinking Skills Test and the other a written test of our own devising, much like the Graduate Record Exam Writing Assessment, and graded blindly by two independent scorers."

Results. "In the most recent study...students showed gains in critical thinking across both tests of almost one standard deviation, " van Gelder reports.

Interpretation. "This is about 4 times the expected gain for standard critical thinking courses, and almost twice the gain in critical thinking for three years of undergraduate education."

Ethical question

If these findings are substantiated by other researchers, what are the ethical implications for teaching students critical thinking? Can you ethically continue to teach students

critical thinking not using argumentation mapping practice? Emulating Doug's example of implementing what we find can serve us well.

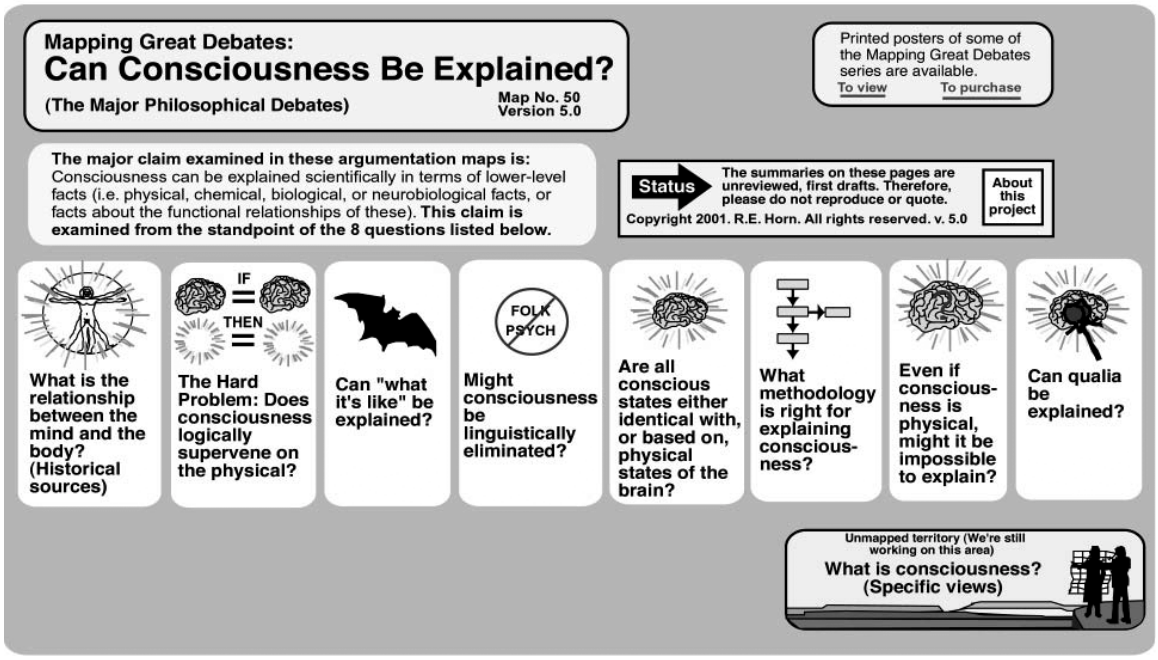
Navigational structure

Now for another point. Argumentation analysis has relevance for structuring the web. I think that we need to develop a whole navigational infrastructure based on argumentation mapping. Such an architecture would not replace current methods of navigation but would enhance them based on structuring information.

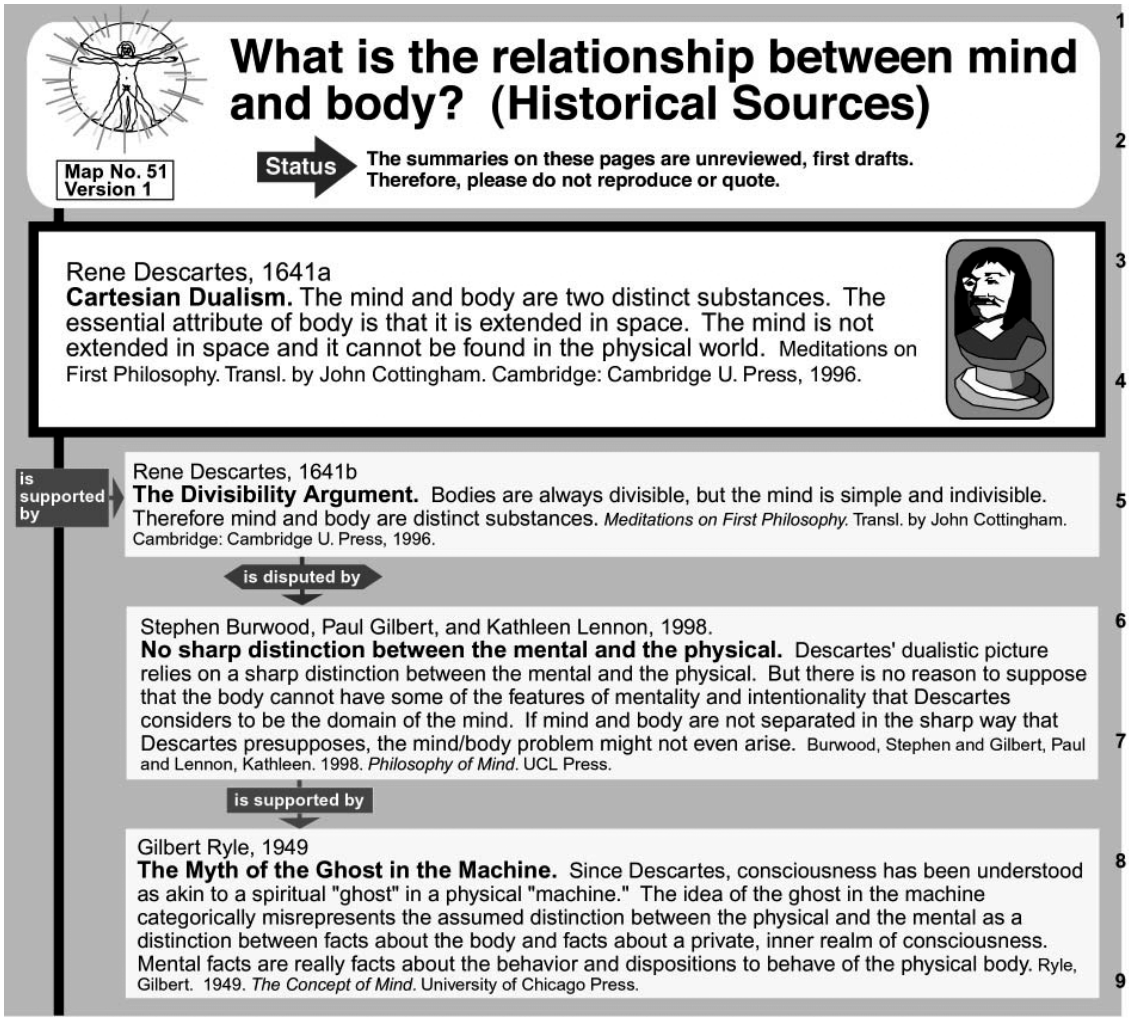
Consciousness maps as example

We have started a small project toward this end at the Saybrook Graduate School and Research Center. It is a series of argumentation maps on the philosophy of consciousness.

Here's the top level "home page" of the debates. (Horn, 2001c)



And here is what the arguments of one of the strands of the debate look like.



An invitation

My next invitation to you: Help us give your students the benefits of argumentation mapping. And a second invitation: Help us with the consciousness argumentation mapping project.

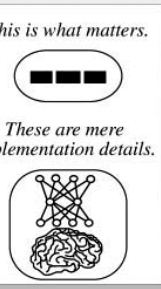
Worldview mapping

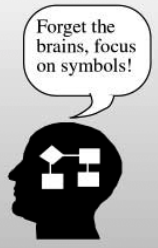
And I have another challenge for you that has come out of structuring our argumentation mapping project. In the Mapping Great Debates series, we found that there were at least 10 different "camps" or worldviews represented in the protagonists. We tried to briefly characterize them with a set of postulates. (Horn, 1998a) Here are a couple of examples:

Spectrum of Positions

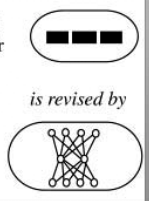
Implementationalism

Implementationalism
The mind, in its general structure, is a symbol processor. Connectionism is only useful as a theory of how those symbolic processes are implemented in the brain. Proponents: Zenon Pylyshyn, Jerry Fodor,and Brian McLaughlin.



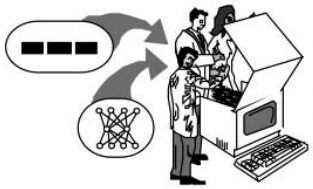


Revisionism
Symbolic accounts of mind will be exactly correct, after they have been revised on the basis of insights from connectionism. Proponents: This position has been articulated by several authors but has not been explicitly endorsed.

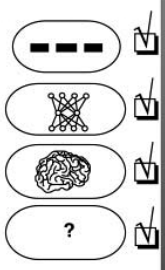


Cohabitationism
Connectionist and symbolic architectures cohabitate the mind. Connectionist networks perform low-level perceptual and motor tasks, which interface with the symbol processor of the mind.
Proponents: John Barnden and Walter Schneider.

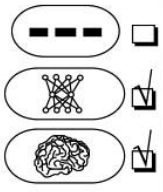
Hybridism
Cognitive researchers should develop hybrid models that incorporate aspects of symbolic and connectionist architectures. This position is usually taken as a practical approach to modeling, not as a philosophical standpoint.
Proponents: Stan Kwasney and Kannaan Faisal, Trent Lange, and Michael Dyer.



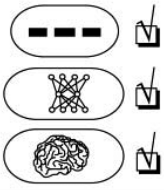
Ecumenicalism
It is necessary to incorporate "everything that works" as we develop theories of mind. Connectionism, symbolicism, neuroscience, and perhaps other approaches will contribute to our understanding of how the mind operates. Ecumenicalism has been called "theoretical pluralism" by William James.
Proponents: Eric Dietrich and Chris Field, Robert van Gulick, Jay Rosenberg, and Gregory Stone.



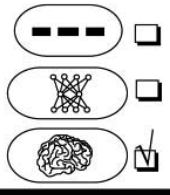
Eliminativism
Connectionism and neuroscience capture all important aspects of mind. High-level, symbolic accounts of the mind should be eliminated from cognitive science.
Proponents: Stephen Stitch, Patricia Churchland, and Paul Churchland.

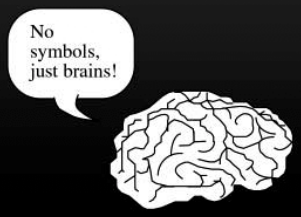


Limitivism
Symbolic processes are approximations of lower level subsymbolic (connectionist) activity, which is an abstraction from biological processes in the brain.
Proponent: Paul Smolensky.



Neural Eliminativism
The only relevant level of description of the mind is at the neural level. Even the connectionist and subsymbolic accounts should be eliminated.
Proponent: Walter Freeman (to some extent).





Eliminativism

Notes:

- These positions are discussed by Dinsmore (1992), Smolensky (1988b, pp. 59–62), and Pinker and Prince (1988, pp. 75–78).
- Few theorists or researchers explicitly position themselves along this spectrum. Many fall into more than one of these categories or lie somewhere on the borders between them.

The postulate system served our purpose in the project at the time, but I came away from that project feeling that we needed other ways to properly represent the network of assumptions, axioms, beliefs, etc. that go into our worldviews.

An invitation
So, I have yet another invitation: I would like to talk to you while I'm here about worldview representation. How do we visually represent worldviews? Here, I don't imagine a little two-by-two matrix with a few words on it as an answer to this problem. No, I imagine more robust stand-alone diagrams, maybe covering several pages. What would they look like? I'm not sure. Let's talk!

9. Think metaphors!

In understanding how to augment human intellect, we have not absorbed the recent advances in understanding the metaphorical sources of philosophical thought. What do I mean by that? Let me ask a question: What philosophy books that have been written in the past 10 years will still be read 100 years from now? My current nomination for one of these was co-authored by George Lakoff and Mark Johnson, called *Philosophy in the Flesh* (Lakoff and Johnson, 1999). I nominate this book because they deeply explore the impact of metaphorical structures on philosophical thinking. What more needs to be done here? You guessed it--I think we need to explore what a linked system of metaphors in philosophical schools would look like diagrammatically.

An invitation
So, another invitation: Who wants to work with me on that?

10. Conclusion
My conclusion is partially summarized in my title. Think Link! Think Invent! Think Implement! Think Collaborate! Think Open! Think Change! Think Big! Think Visual-verbal! Think Structure! Think Metaphor!

Doug Engelbart has spent his life helping us to augment our intelligence. We could do much worse than spend our lives joining in that grand program.

NOTES

1. Tim van Gelder, Univ. of Melbourne, announcement of advance results of a study on Argumap listserve, 5/7/01 (see also:
<http://www.philosophy.unimelb.edu.au/reason/papers/ASCILITE2001.pdf>

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