Shorter version in Proceedings of CSCL 2007

Toward collaborative technologies supporting cognitive skills for mutual regard

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[This is an extended version of a paper appearing the Proceedings of Computer Supported Collaborative Learning, Rutgers: ISLS, July 2007.]

Abstract: In this paper I will elaborate on a promising link between *ethics, thinking skills,* and *online collaborative tools*. Cognitive tools used for communication and collaboration can support and scaffold ethically-relevant skills such as: cognitive empathy, the ability to take multiple perspectives, the ability to reflect on one's biases and emotional state, a tolerance for uncertainty, ambiguity, and change, and the ability to reflect upon the quality of a communication that one is involved in. These thinking skills contribute to the quality of knowledge building and decision making. In the paper I highlight a set of skills called "epistemic sophistication" that are critical to knowledge building under the all-to-common condition of epistemic indeterminacy. Though many projects overlap with these concerns, there is no coherent field of inquiry, no attempt to do rigorous empirical research, share best-practices and lessons learned, or identify the key orienting research questions for the "collaborative technologies supporting cognitive skills for ethics" theme. I argue that an opportunity now exists to source this large body of related work to create a coherent R&D focus.

Introduction

Can technology help people develop ethical and moral skills and sensibilities? The question itself may seem alien or meaningless—technological innovations are usually assumed to be value neutral. Though it is true that a technology can be *used* to support any set of values, including both ethical and non-ethical means to an end, almost universally technology is *designed* to support values such as productivity, efficiency, accessibility, and connectivity.[1] Can technology be not only be used to support ethical ends but be explicitly *designed* to support values such as mutual regard and self-awareness and enhance ethical ways of being?

In this paper I will elaborate on a very promising link between *ethics, thinking skills,* and *online collaborative tools*. My treatment of "learning environments" will be geared to life-long learning contexts and communities of practice engaged in knowledge building and decision making (however, the principles are easily applied to student learning communities). By *ethics* I mean the simple moral concept of individuals or groups treating each other with mutual recognition and regard.[2] To give the reader an early sense of the technology I am referring to, consider the following simple types of online software features that either exist now or could easily be created: discussion forums that ask speakers to reflect on their biases and sources of certainty; decision support software that promotes transparency by recording who was involved in making decisions and archiving supporting and dissenting opinions; and awareness tools that graphically show levels of consensus and participation among participants to support group reflection on the quality of a dialog.

My argument can be summarized as follows: (1) in the modern (or post-modern) world, being **ethical/moral** involves (not exclusively but importantly) a set of **cognitive skills**, including: the ability to put oneself in another's shoes (cognitive empathy), the ability to take multiple perspectives, the ability to reflect on one's biases and emotional state (a type of metacognition), a tolerance for uncertainty, ambiguity, and change (a type of epistemological understanding), and the ability to reflect upon the quality of a communication that one is involved in (meta-dialog). (2) Online **collaborative software** (or "cognitive tools") can be designed to support all of these skill sets by embedding certain protocols, structures, prompts, and other scaffolding devices into existing communication media. (3) More strongly ethical modes of being improve the quality of **knowledge building and decision making**.

A broad interdisciplinary set of research projects and results can be seen as relevant to this thesis, but very few describe what they are doing in terms of this ethics/thinking-skills/collaborative-tools relationship. My purpose for writing this paper is to suggest that more can be done to bring these threads (ethics/thinking skills/cognitive

tools) together and spark new R&D that could lead to technologies that demonstrably support mutual regard at both small (among individuals) and large (inter-group) scales. Next I will unpack some of the key concepts involved in my thesis. I start with an explanation of my use of "ethics" because it is a topic not usually discussed in publication venues such as this one.

Ethics. Most readers may agree that humanity in general, and most groups or situations in particular, would benefit from more deeply ethical/moral ways of being, communicating, understanding, and acting (though there is considerable difference regarding whether or how such could be brought about). Yet the topic of ethics/morals is largely eschewed in the dominant modes of discourse within contemporary academia, business, politics, and culture (though this taboo is softening in recent years). Ethics seems to have been relegated to the far ends of the sociocultural sphere: to branches of esoteric philosophy, to religious prescriptions, and to the banal contexts of dinner party debates and family squabbles. However, the general difficulty in finding ways to dialog about issues of ethical/moral import does not diminish the fact that the ways that people treat each other in an ethical sense is of critical importance in all spheres of the life-world (family, work, cultural, global-political, etc.).[3]

Ethics and cognitive skills. Exercising ethical capacities such as mutual regard involves a combination of intellectual, perceptual, emotion, motivational, and attitudinal elements. We will use the broad sense of "cognitive" to cover all of these areas (as opposed to the narrow sense of "cognitive vs. affective"). The full spectrum of ethical considerations includes an ability to perceive the ethically relevant aspects of a situation (Vetlesen 1994); empathic capacities (Goleman 1995); the desire, commitment, and will to act on ethical values (Taylor 1991); and the knowledge and intellectual skill to plan and carry out actions based on an ethically-motivated goals (Vetlesen 1994). It is difficult, and probably impractical if not impossible, to try to operationally separate rational skills from emotional/social skills in this area, as both are so interdependent.[4] The thinking and communicating skills/habits we are interested in include:

1. An ability to consider or try on the **perspectives** of others (put oneself in another's shoes, or "cognitive empathy");
2. A capacity to engage in productive dialogs of **inquiry** to build mutual understanding;
3. An ability to reflect on one's thoughts, values, **biases** and emotional states;
4. A tolerance for and resilience within **uncertainty**, ambiguity, paradox, and change in information or knowledge;
5. A certain sophistication in one's **understanding of epistemic processes**, i.e. a non-naïve understanding of truth, knowledge, and the mind;
6. An ability to **reflect upon** the quality of a **communication** that one is involved in.

Elsewhere (Murray 2003) I have described ethics in terms of two general categories of skills/habits: perspective and integrity. The list of skills above are perspective taking skills. *Perspective* taking includes the abilities to "step out" to reflect on one's own thoughts or ideas, "step in" to (try to) see the world through another's eyes, and "step back" to take a systemic perspective on an entire situation. *Integrity* involves such things as transparency, responsibility, and accountability, which are essential to have a full account of being ethical.[5] To the list of skills/habits above we can add this definition of integrity, based on congruence:

7. **Integrity**: developing congruence between one's words and actions (doing what one says they will do), congruence between one's words from one situation to another (not saying contradictory things in different contexts), and congruence between one's inner beliefs/intentions and ones words (being honest and authentic).[6]

This list is not meant to be exhaustive. It is given to sketch out the scope of the skills/habits I refer to as important to ethical ways of being.[7] In this paper I will not define these skills precisely in an operationalized and measurable way, though such precision would be a prerequisite to empirical research and theory building.

Considering the perspectives of others can involve the unnerving acts of suspending one's own beliefs and/or entering into a cognitive disequilibrium of seemingly conflicting ideas. A certain emotional (some would say spiritual) resiliency in these encounters with "the other" is a necessary supplement to the more cognitively oriented skills.[8] Considering the multiple perspectives of others has strong *epistemological* as well as affective implications. Ethical being is hampered in proportion to the degree that one sees things in "black and white"—as if there can only be one "truth" about something (Kitchener & King, 2001).

Ethics and knowledge building. It is not difficult to relate the above ethically-related skills to trust, social capital, leadership transparency, corporate social responsibility and reputation, action research, and user-participatory design—and from there to customer satisfaction, profitability, growth, etc., if one needs to do that to legitimize the importance of ethical thinking skills in the material, technological, or intellectual marketplace. I will not belabor those connections here.[9] However, there are important links between ethical ways of being and *knowledge building* (which includes intentional learning in organizational and academic settings).[10] As more and more of society's work (and individual's play) revolves around information, knowledge, and learning, the quality of knowledge building and organizational learning becomes more critical.

Philosopher Jurgen Habermas claims that for collaboration to move us in the direction of more adequate (if still tentative) truths it must have certain properties that are fundamentally ethical/moral (Habermas 1993, 1999). These properties include: that sufficient mutual understanding regarding key concepts and assumptions is established; that all important or relevant points are heard; that dissenting opinion is not suppressed; that speech is honest and without hidden agenda; that the power dynamics of the situation are reflected upon; and that participants actively engage in opening up to the sometimes unsettling world views of others. Problems in any of these areas can result in systematic bias or distortion in the outcomes of knowledge-building. Thus, moral constructs such as freedom, equality, empathy, sincerity, inclusivity, reciprocity, integrity and mutual regard are deeply entangled with the knowledge building processes of discovering ever more adequate truths.

Technology for the cognitive skills of ethics. The working hypothesis of this paper is that features can be added to existing online tools that will *scaffold and prompt* for the use of ethical skills/habits, and will thus support the *learning and adoption* of those skills/habits. Software can enforce or promote behavioral protocols and can reify (make explicit) social values and conceptual frameworks related to ethics.[11] There are two complimentary types of outcomes. First, technology can enforce or structure *interactions* and communications so that users follow some protocol but do not necessarily learn anything in the process. Second, technology can support an *internalization* of skills and values, thus scaffolding learning as well as behavior (above I imply that the first can lead to the second).

Note that the ethics-supporting software features described here are intended for *well-defined groups with sufficient shared goals or values*. Possible example communities include: employees of a company that orients strongly around ethical values, a community of scholars furthering some field of knowledge, participants in an international diplomatic deliberation, conflict resolution forums, or fact-gathering volunteers in an NGO. If those in a group's leadership role want to encourage certain values in the group, *and* there is sufficient buy-in from group members to engage in the learning curve of trying something new, then these collaborative technologies can play a pivotal role in transforming or sustaining ethically-sound thinking/practices in a group.

Example features supporting ethical thinking skills

Below I illustrate several simple software features within the "technology supporting ethical thinking skills" theme. These examples cover a broad range of contexts to illustrate the scope of the theme. Versions of some of these ideas already exists in isolated software applications, but there is no coherent field of inquiry, no attempt to do rigorous empirical research, share best-practices and lessons learned, or identify the key orienting research questions. My purpose in describing these examples is to give the reader a concrete sense of the scope of the emerging research field. While these examples highlight single illustrative features, real systems will usually incorporate many such features. These features do not make use of sophisticated or novel technologies, as these are not needed to make the key points. But advanced methods from research in adaptive systems, machine intelligence, collaborative filtering, etc. could be incorporated to make them more effective.

As I describe these software features I will mention some "general principles" that serve as base assumptions and as reasonable hypotheses to be tested empirically.

1) **Supporting multiple perspectives**. Imagine an adult learning class in which the instructor places a high value on students considering multiple perspectives and alternative viewpoints. The instructor uses a template-based tool (like WebCT) to create web pages for the class. This web site design tool has a simple feature to support the consideration of multiple perspectives in students. Every web page with content has a button/link in upper right corner titled "Other perspectives and alternative ideas" which leads to additional content. Depending on the context, the link might lead to competing scholarly theories, alternate ideas authored by other classmates, etc.

General principle #1: *Salience without use. The visual presence of the feature itself can have an effect, even if it is not used.*

Students are not forced to use this link. However, its constant visual presence serves as a reminder that, whatever they are reading, there might be (and probably are) other perspectives on the issue.

General principle #2: *Salience— usage—internalization. Feature salience supports feature use; which in turn supports an internalization of the intended behavioral/thought habit.*

The addition of a simple technology feature supports learning by providing clear and persistent cues or structures. For example, the existence of the multiple perspectives feature will lead to some degree of use, which will lead to some degree of increase in students thinking/communicating with an awareness of multiple perspectives. The effect may of course be small, in part because general thinking and communicating skills develop slowly (and see principle #3).

General principle #3: *Need for social/contextual supports. Individuals in the "learning community" will need instructional support and models of proper use. They will need feedback after use and will need to discuss new tools and norms among themselves to fully understand the tool's purpose. Practices and procedures must be adopted to accompany the new tools.*

A technological feature by itself is not likely to produce change or learning without sufficient support in the social system (Wenger 1998). For example, with the "multiple perspectives" feature above, the instructor might discuss multiple perspectives in class and have a class discussion about how students used the multiple-perspectives link feature.

2) **Supporting task accountability**. Suppose that, due to pervasive inefficiencies in getting things accomplished, an organization decides to start placing a higher value on responsibility and accountability in members' communications. Leadership sets a goal that participants will clearly specify the person responsible and the date of completion for any action plan. Members may have only sporadic success in reminding each other to adhere to these new guidelines in private conversations, in meetings, and in memos. But it is possible to modify the group's email software such that email messages contain a template for specifying the responsible person[s] and the date due (similar to the action workflow approach described in Winograd & Flores 1986).

As indicated in Principle #1, this feature could be ignored, but its existence would provide both a constant reminder to include this information, and a structured consistent place to enter and find this important information.[12] And from Principle #2 we can imagine that, through the repeated reminding and use provided by electronic interactions, members of this organization might internalize the desired behaviors and values and learn to specify responsible persons and due dates in their *off-line* interactions.

We need not debate the merits or the oversimplification of this example—it is given only as another illustration of how a simple technological feature can serve to cue and structure ethically-oriented behavioral/thinking habits.

3) **Articulating certainty levels**. Imagine a community that regularly uses an on-line forum to discuss important issues. The discussion forum is a typical one except for the following additional feature: when one posts an idea or a response, one can select from a menu of four choices to describe their "certainty" in their idea. The choices are, from most to least certain: "fact/observation/data," "opinion/inference," "guess/hypothesis," and "question/request." [13] Users are not required to use this feature, but the group's stated policy encourages its use. This feature encourages a type of metacognition and epistemic sophistication (Murray & Ross 2006). A user who types a strongly opinionated post is thus encouraged to pause and reflect on whether his idea is actually his opinion as opposed to a hard fact. Tagging a strong statement as an "opinion" can tempter its emotional intensity. The author benefits from the reflective moment, and the reader benefits because, for example, one does not react as strongly to a communication that was explicitly (just) an opinion. If used extensively in a community of learning, the associated reflective skills may improve.[14]

Many online forum tools include the ability to label forum postings in this way, and the labeling categories mentioned above were used in a community forum that I was involved in creating.[15] Anecdotal reports from users indicated that the feature had its intended effect of easing tensions for both author and reader for controversial discussions.

Would the extra effort of marking all of one's postings with a confidence rating be worth it in terms of added communicative benefits? What type of participants have the capacity to rate their confidence in a way that is consistent and accurate? These questions can only be answered through scientific trials.

General principle #4: *Developmental limits. There are developmental constraints on the complexity and abstraction of people's reflections (Kegan 1994). These may limit the usefulness of features supporting ethical thinking skills in some contexts.*

4) **Transparency in on-line moderation**. Imagine again a community that regularly uses an on-line discussion forum, but this time the community is more amorphous and in constant flux. Such forums are often rife with "junk" postings, and need a moderator to act as a gate-keeper. Forum moderators have tremendous power to influence the nature of the on-line discussion in their selection of what messages to delete. Here is an example of a feature that, through moderator transparency and accountability, mitigates such abuse of power and enhances group trust: the moderator does not "delete" postings, but instead they move them to one or more peripheral folders that are open for inspection. (Example names for such folders might be "profanity," "spam," "flaming," and "too tangential".) The moderator's choices are then public.

General principle #5: *Increased cognitive and task load. The addition of features that encourage participants to "go meta", i.e. reflect on, be explicit about, or discuss truth, certainty, biases, group process, etc. could add both cognitive load from the additional depth of thinking (Sweller 1988), and add content load with the extra discussion engendered.*

Excessive thinking about thinking, dialoging about dialog, or theorizing about theories can sabotage any collective enterprise (so-called "analysis paralysis"). For example, the moderator transparency feature above creates an opportunity for protracted discussion about the validity of the moderator's choices. Also, the "confidence levels" feature described in example #3 above could instigate lively philosophical discussion about when an idea can be said to be an objective "fact" or "observation." The proliferation of such extra discussions may or may not be aligned with the group's goals, and an appropriate balance between content and meta-content (or meta-dialog) must be found in each situation. As with most innovations, adopting the tools described here is not without risks and tradeoffs.

5) **Explicit modes of inquiry**. Imagine a knowledge base or web site that includes information on a variety of topics, some of which are controversial. The software used to create this web site allows any paragraph (or any item of information) to have a button (link) to "Validation Information" placed next to it. Users would click on this link to read information that would help them determine the degree of trust, certainty, or validity of that item of information.

General principle #6: *Epistemological concerns such as the validity of information in a knowledge base and the modes of validation that people use to agree upon shared knowledge have strong interactions with ethical concerns.*

Note that the system does not have to bias any particular validation mode. A scientist can find (or add) supporting or refuting information based on empirical work, and a religious fundamentalist can find (or add) supporting or refuting information based on the authority of scripture. But *both* of them are supported in reflecting on how they validate information and the fact that they use entirely different validation modes, which could help them clarify their differences and engage in more productive dialog

Online environments for communication and collaboration have many known limitations compared to face-to-face interaction, such as decreased communication bandwidth from losing intonation and gesture, and the potential for information overload with many participants. Online environments also have many known advantages, including geographically unlimited access to participation and automatic archiving of communications.[17] Here I

want to emphasize a lesser known advantage of online over face-to-face environments: when communication and collaboration happen through digital technology, the *communication medium itself* can be structured and managed to support desired skills/habits. In verbal communication all we can do is remind each other of our communicative goals and values. Technology can more directly organize and constrain the process and content of communications. Paper-based forms and templates are another way to organize and constrain communications, and digital technologies are a powerful extension of this basic idea.

Related Research and Projects

In this section I will sketch out some of numerous threads of research that bear upon the highly interdisciplinary "cognitive tools supporting ethical thinking skills" theme. I organize my overview of related research into two areas: (a) epistemology, cognition, and communication (i.e. non-software research), and (b) software systems. Because the modern life-world is so centered upon information, knowledge, and communication, being ethical often requires a certain level of sophistication in one's understanding of epistemic concepts such as truth, knowledge, and belief. Recent work in philosophy and the psychology of epistemological understanding can help us articulate epistemic factors that support ethical behaviors. Research in cognition and communication is key because pragmatic approaches to ethics must avoid being overly idealistic in their conception of human generosity and human intelligence, and in their assumptions about how quickly people can learn skills and change communication habits. Basic research in higher order thinking skills, emotional and social capacities, and communication and dialog, are providing clues that will help us understand how and why people interact the ways that they do, all of which may inform methods to support ethical styles of interaction.

Contemporary cognitive theories imply that methods for improving ethical thinking and communication skills should include learning-while-doing approaches that provide feedback or other types of support in authentic collaborative contexts. Digital environments provide an excelling context in part because communication and collaboration are done increasingly within digital media. Research and development of computer-based systems spans a number of ethics-related areas, including: software supporting reflective thinking and inquiry skills; tools for visualizing conceptual and evidential relationships in dialog; support for group decision making; online systems for democratic debate and public deliberation; and virtual reality and role playing games with ethical themes.

All of the software projects listed overlap with the focus of our theme, but very few have a scope aligned completely with our theme. This scope and focus can be defined as the intersection of the following areas of inquiry:

- **Ethical** aspects of interacting and making decisions, including fairness, mutuality, inclusion, bias, self-understanding, trust, etc.
- **Knowledge building**, creating understanding, aggregating and analyzing opinions, etc.
- Higher order **thinking skills**: metacognition, reflective thinking, critical thinking, argumentation skills, multiple perspectives, etc.
- Focus on **authentic** (or adult "life-long") collaboration, decision making, work, citizenship, or relationship contexts.
- Technological features and affordances that support ethical thinking skills through novel **structures** or **protocols** as opposed to through content that appeals to ethical themes.[18]

The scope of work related to the ethics/thinking-skills/collaborative-tools theme is large but work at the *intersection* of these areas is much smaller. More cross fertilization of ideas among the sub-domains will result in advances in our core area of focus. Below I give an overview of related research and theories from the areas of epistemology, cognition, communication, and software.

Research in cognition, epistemology, and communication

Meeting the modern challenges of collaboration and negotiation in complex situations requires an understanding of the nature and limitations of one's own beliefs, and also an understanding of beliefs or truths in general—their limitations and how they are arrived at. Work in cognitive science and in philosophy is helping us understand more about the **indeterminacies of knowledge** and thought processes. For example, research findings show how concepts are graded rather than black and white, how claims are graded rather than true/false, and how knowledge evolves through social processes (Rosch & Mervis 1975; Lakoff & Johnson 1999; Searle 1995).

One's belief about what is ethically/morally valid, both in terms of judging past occurrences and prescribing for the future, is largely based upon what one *believes to be true* about the world. Thus, one's approach to "truth," how it is evaluated, how it is found, whether it can be known with certainty, etc., are critical to how one acts in an ethical sense. Above we mentioned that a large part of ethics has to do with how an individual or group reacts to exposure to inevitable diversity in beliefs or worldviews. Thus, in the modern context the ethical aspects of collaboration are closely related to epistemological questions such as:

- How do we proceed when participants, scholars, leaders, theories, or worldviews differ?…When participants view phenomena from different perspectives?
- How do we process and integrate knowledge and information that is inherently uncertain, ambiguous, divergent, or complex?
- How do we validate ideas and models that are not based strictly on empirical data and the scientific method? In what sense is a statement, model or perspective *true* vs. *useful* or *meaningful*?

Perennial philosophical questions concerning mind, truth, meaning, and knowledge are becoming more germane and salient in collaborative work. Below we will elaborate on the interdependence of knowledge building and ethics ("mutual regard"), and the "epistemic sophistication" that is needed to address questions like those above.

Mutual understanding, mutual agreement, and mutual regard. In the introductory section I described the range of human collaborative activities as including "knowledge building, decision making, problem solving, policy/rule/law creation, and civic/democratic deliberation" and the range of collaboration purposes as "determining what is *true* or meaningful, what is ethically or normatively *right* or just, what is practically *useful*, and what *actions* will be done." Most authentic contexts will include a combination of these elements. For our purposes here we will conceptualize this range of activities and goals in terms of three constructs: mutual *understanding*, mutual *agreement*, and mutual *regard* (Murray 2006a). (By mutual agreement I refer to how people go about determining where they agree and don't agree, not simply a state or goal of being in agreement.)

Habermas' theory of Communicative Action describes how most communication involves overlapping validity claims about comprehensibility, truth, normative acceptability, and the speaker's sincerity (Habermas, 1981).[20] His theory of Discourse Ethics goes on to elaborate upon the connections between knowledge building and ethics (Habermas, 1999). For Habermas , the validity of a claim is related to the *procedure* used to acquire or justify that knowledge, and validity can not be determined except through actual iterations of human dialog (and not simply through arm-chair perspective taking). Thus "mutual agreement," as used here, is about the *process* of finding agreement (which can result in clarifying commonalities, arguing for claims, and/or agreeing to disagree).

For example, the scientific process is an ongoing dialog among peers in which ideas are validated against repeatable data gathering events. Another example is the democratic process, which involves dialog and debate to determine what is best for the public good. Though it may be difficult to judge a claim based solely on the claim's propositional content, the claim's validity can be assessed by looking at the method used to arrive at it (this is particularly true in questions for which one is not a unique expert). In order for collaboration to productively move us in the direction of more adequate truths or morally superior actions, collaboration procedures must have certain properties. For example, in the scientific context, a claim may be validated if an experiment was replicated by several legitimate scientists finding the same results. In the civic or democratic context one important procedural property bearing on the validity of an outcome is whether the perspectives of the major affected stakeholder groups have been represented.

Using this framework we can see how mutual understanding, mutual agreement, and mutual regard are reciprocally interdependent and exquisitely entangled. Clearly, mutual agreement, the collective search for the true (or the good, beautiful, or just) requires a certain level of mutual understanding—participants must understand the terms, models, and examples that each uses. One can also see that, conversely, mutual understanding is not possible without some underlying level of agreement—as all communication builds upon prior shared assumptions or meanings. The links to mutual regard have already been alluded to—attempts to find mutual understanding and mutual agreement can be thwarted and outcomes systematically distorted to the extent that mutual regard is lacking.

It is one thing to claim that the quality of knowledge and decision making relies heavily on how participants attempt to arrive at a full, self-reflective, and respectful understanding of each others' ideas (and frames of mind). But *realizing* this type of communication is quite another thing. At all levels, family, work, global

politics, etc., such sincere and authentic inquiry about the other is hard to find. There are many possible reasons for this, including: the perceived benefits do not outweigh the additional time or energy required; actors involved in situations of power struggles or scarce recourses may find it difficult or undesirable to prioritize mutual agreement, understanding, or regard; the social and educational environment does not contain sufficient examples or incentives to develop these skills; and opening to the ideas of another can involve vulnerabilities there are emotionally or psychologically challenging. But here I wish to highlight another factor of impediment, "epistemic indeterminacy" (ref).

Epistemic indeterminacy. We have seen that effective collaboration in authentic contexts usually involves parties processing multiple perspectives as they look for mutual understanding and mutual agreement (the quality of which can depend on mutual regard). Working with multiple perspectives (or ideas or worldviews) is difficult in part because of the inherent *indeterminacies* of knowledge. In post-modern times we have increasingly come to a deeper understanding of the uncertainties, complexities, ambiguities, unpredictabilities, and paradoxes involved in knowing and thinking. As contemporary citizens we have left the epistemological Garden of Eden in which we could believe that truth was fixed, external and knowable and we have progressively come to understand to our frustration that knowledge is fuzzy, elusive, constructed idiosyncratically by each individual, socially negotiated, determined by historical context and forever subject to revision.

This post-modern understanding of "epistemic indeterminacy" and the limits of knowledge has led many to varying degrees of cynicism, despair , relativism (no idea is better than any other), or fundamentalism (denial of multiple views) as the spectacle of complexity and unpredictability is unveiled. But, in what has been called a post-post-modern or post-metaphysical turn, frameworks have become available that build knowledge (rather than only deconstruct it) with an attitude of humility and caution appropriate to the times.

Though some epistemic indeterminacy is avoidable (and should thus be reduced) it is important to understand that some epistemic indeterminacy is inherent and unavoidable. For example:

- Cognitive psychologists including Eleanor Rosch and George Lakoff have demonstrated that **concepts** have fuzzy or **graded boundaries** that create an unavoidable indeterminacy in the communicative process (Lakoff 1987; Lakoff & Johnson 1999; Rosch & Mervis 1975).
- Similarly, statements or **propositions are often "graded**" and, even though it may seem that they are either true or false, they involve indeterminate grey areas (Lakoff & Johnson 1999).
- Philosophers have shown how **meaning** is idiosyncratic, socially constructed and deviates among different groups (ref), and psychologists have shown how our mental models and frames have an effect upon what we perceive and infer.
- Research into so-called "**bounded rationality**" is shedding light on cognitive biases commonly found in individuals regardless of occupation or intelligence (Kahneman et al. 1982).
- New understandings about the limitations of logical/rational thought and the role of **emotional and intuitive** elements of thought could become invaluable to more effective knowledge-building and problem solving (Goleman 1995, 2006; Damasio 1999, 2003; Matthews et al. 2002; Myers 2002; Gladwell 2002; Elster 1999).
- Both academics and popular authors now commonly take a flexible and modest attitude toward **models and theories**, acknowledging that "the map is not the territory" (refs Senge, Bateson).
- Even the seemingly sturdy logical and scientific processes used by scientists and mathematicians are now understood to have indeterminacies (Kuhn, Lakatos,…).

Thus a new understanding of the limits of conceptual categories and the indeterminacies in the meaning of statements is evolving, though it is only slowly making its way into application in dominant modes of discourse.

Lagging behind these new understandings about epistemic indeterminacy, but still making steady headway, are theories that help us understand how to deal with epistemic indeterminacy, both as individual thinkers and as groups engaged in knowledge building. I will call the ability to use skills/habits/attitudes to deal with epistemic indeterminacy "epistemic sophistication." To clarify the links to our main theme: (1) ethical/moral action depends on one's beliefs/knowledge and to ones knowledge *about* belief/knowledge (i.e. one's epistemological understanding); (2) knowledge, especially in the context of collaboration and multiple viewpoints, has significant indeterminacies; (3) therefore, being ethical requires a certain degree of "epistemic sophistication;" (4) epistemic sophistication is among skill sets that can be supported with technology.

Epistemic sophistication. Of particular importance are skills for dealing with "**epistemic indeterminacy**"—the inherent (or revealed) uncertainties, paradoxes, ambiguities, context-dependence, and dynamic unpredictabilities of knowledge and knowledge creation (Murray 2006a,b). These skills have gone by various names, including: negative capability (Keats, 2004), dialectical thinking (Basseches, 2005), proprioception of thought (Bohm, 1996), the believing game (Elbow , 2005), reflective judgment (King & Kitchener, 1994), cognitive empathy (Vetlsen, 1994), self-distanciation (Kögler, 1992), strategist action logic (Torbert & Associates, 2004), and the metasystematic order of hierarchical complexity (Commons et al., 1998). Together we can refer to these skills as "epistemic sophistication" (or "epistemic awareness"). Put simply, epistemic sophistication is about how individuals think and dialog about "I don't know," "I'm absolutely sure," "I disagree" and "prove it!" in productive and respectful ways. Otto Scharmer (in publication) speaks of "letting go, letting be, and letting come." All of these theories imply that the more that one can release the importance of one's own perspective and enter into the perspective of another the more complete and the less distorted will be the synthesis that emerges.[21] These skills are found in many individuals, but the challenge of the day is to discover frameworks, methods and tools that support systematic and community-level development and application of these skills.

Epistemic sophistication also includes some degree of knowledge/skill in understanding the nature of thought and knowledge (including having mature "epistemological understanding" ref and metacognitive skills). Truth is validated through what George Lakoff calls a "metaphorical pluralism" of criteria, including correspondence with objective reality, coherence with other things that are believed, the consensus of experts or group members practical utility and the authority, legitimacy or reliability of antecedent information sources (Lakoff & Johnson 1999). Almost all knowledge building and decision making involves some combination of the above truth-validation modes, and epistemic sophistication involves an ability to recognize and employ the most appropriate validating method for each situation. For example, in different contexts validity may be mostly strongly based on: the scientific model; the opinion of experts or authorities; eye-witness testimony; or a quasi-consensus of participants.

In sum, we can say that epistemic sophistication involves *thinking about thinking, knowledge about knowledge* and *dialog about dialog*, including:

- An awareness of and tolerance for indeterminacy, including ambiguity, uncertainty, disagreement, and paradox.
- An ability to suspend and reflect upon one's own ideas, knowledge, biases, feelings, etc.
- An understanding how validity (truth, rightness, etc.) is determined and now knowledge is built procedurally and through an number of methods, each appropriate to particular knowledge building/decision making contexts.
- Some understanding of the psychological/cognitive factors relevant to learning.
- An ability to reflect upon and discuss the quality of communication, knowledge building, and decision making processes.The skills of epistemic sophistication overlap considerably with the cognitive skills/habits of ethics listed in the introductory section. Again, this illustrates how deeply intertwined are the concerns of ethics and knowledge building.

Again I will emphasize that these skills/knowledge/attitudes, thought they can take advanced forms, need not be deeply complex or philosophical. It is true that most of these skills have been shown to follow developmental learning trajectories, and, in their fullest form, are rather advanced (ref; FOOT). However, in their emerging manifestations, they are not so difficult. All of the following mundane statements (no more sophisticated than what a teenager might say) are indicative of some degree of epistemic sophistication:

- "There are many answers to such questions, its not a black and white thing."
- "A bunch of people can look at something and see really different things."
- "You can't rely on one source of expertise in that situation, its more complex than that."
- "My anger yesterday led me to think that about you, but I don't really believe it."
- "Those people can't simply take on the values and beliefs handed to them; they have to think it through themselves."
- We have to invite the others into the conversation—they have a different way of looking at it and our decision won't work if we leave them out.
- We keep talking around in circles here—I think we mean different things by the same words, lets see...

Cognitive tools supporting epistemic sophistication. Above I described several simple technological features that support ethically-relevant cognitive skills. Many of these features apply to the support of epistemic sophistication. Maintaining the ethical/moral integrity of fact-reliant dialogs requires that purported facts be backed up with sources and supporting evidence. Therefore features that support linking to (or citing) sources, and features that support making chains of inference explicit are relevant to ethics. The software example "explicit modes of inquiry" above, in supporting reflection upon validity criterion, is directly related to epistemic sophistication.

Numerous studies have been done that are brining scientists to a deeper understanding of **metacognition and epistemological beliefs** (describing their work in terms of related concepts such as scientific inquiry, self-regulated learning, reflective reasoning, critical thinking, and higher order thinking skills) (see Schommer-Aikins & Hutter 2002; Fischer & Pruyne 2002; Wenk & Smith 2004; Winnne 2001; van Gelder 2005; Facione et al. 1995). These studies are clarifying the many components or sub-skills within "thinking about thinking" and "knowing about knowledge." This clarification is important because the methods used to evaluate and improve these capabilities may differ for different sub-skills. For example, the skill of *monitoring* one's thoughts and problem solving progress is differentiated from the skill of *adapting* one's thinking or learning strategy, which in turn is differentiated from *understanding* the strengths and weaknesses in one's learning style and problem solving skills.

Research on **human emotional and social capacities**, both from brain science and from psychology, sheds light on the design of protocols for mutual regard and recognition (Damasio 1999, Goleman 1995). This research is important because of the strong emotional factors in: trust among collaborators, vulnerability in disclosure, releasing attachment to tightly held beliefs, tolerance and resilience to cognitive dissonance, etc.

Finally, there exists a large body of work studying human **dialog and argumentation**, some of which relates to ethical concerns. Schreier et al. (1995) describe research into how people perceive "argumentation integrity" and fairness and the effect of unfairness and impoliteness on dialog outcomes. Kegan & Lahey (2001) describe communication principles that uncover and move beyond debilitating unconscious belief systems.

Software R&D related to ethical thinking skills

Researchers are developing educational software that fosters **metacognitive and higher order skills** including inquiry skills, self-regulated learning skills, and reflective reasoning skills (White et al. 1999; Winne et al 2006; Azevedo et al. 2004). Several research teams have been developing tutoring systems that help students with the metacognitive skills of self explanation and help seeking (Aleven et al. 2006; Conati & Vanlehn 2000). In general these studies indicate that through appropriate prompts and feedback, software systems can improve metacognitive skills and epistemological understanding, though studies differ on the preconditions necessary for such improvement.

A number of software systems have been designed to support **inquiry skills** (also called "scientific inquiry" and "reflective inquiry"). Edelson et al. (1999) (and see Reiser et al. 2001; Murray et al. 2005) describe a number of educational software systems designed to engage learners in sustained exploration and curiosity about authentic scientific situations. Key features of these projects include: open-ended problems, visualization and reification of important patterns and relationships in information, availability of background knowledge, and social and pedagogical dynamics supportive of student-centered learning.

Software can help students visualize **conceptual relationships or evidential/argumentation relationships** by using graphical networks (or other visual layout schemes) to show how one idea relates to another semantically or how one idea supports or refutes another (Suthers et al. to appear; Sandoval 2003). Software that allows users to see links among ideas or that requires them to label the intention of their speech acts (e.g. as acknowledgment, request, information, argument, etc.) can focus attention on properties of the ongoing dialog and give participants useful insights into group process and group dynamics (Soller 2001). Other systems are being built to analyze complex arguments to summarize them, evaluate their legitimacy, and represent types of uncertainty (Rehg et al. 2005).

Scardemalia (2002) describes software supporting a decentralized model for **knowledge building** communities. This software helps communities of learners identify areas of agreement and contrast, recognize and appreciate diversity of ideas, and negotiate meaning and agreement. This software allows users to post "rise above" comments, encouraging meta-level or "big picture" thinking (for example, about more inclusive principles, higher

level formulations of problems, and observations about the knowledge building process, etc.). Scardemalia claims that such features supports "collective cognitive responsibility" for knowledge building outcomes.

All of the above software projects have epistemic goals of helping students gain a deeper **understanding of the nature of knowledge** and knowledge building processes. For example, directly or indirectly they teach that data sources and data gathering methods should be looked at critically; that information has a certain amount of imprecision or uncertainty; that knowledge is constructed socially; and that scientific theories and "truths" evolve over time. They encourage question asking over answer finding. These skills and propensities are very relevant to the ethically-oriented aspects of knowledge building, as mentioned above.

Researchers at the MIT Media lab are developing a number of systems for us in **group decision making**. The Second Messenger system provides participants with graphic visualizations of important properties of group dynamics, such as the percentage participation by each speaker (Norton et al 2004.). Pentland (2005) describes a so-called "socially aware " software system that tries to analyze tone of voice, facial movement, and gesture, which could be used to provide encapsulated summaries of the emotional tone of a dialog.

Online tools for **democratic debate and public deliberation** (so-called cyber-democracy and e-deliberation) are also being tested. Some projects are studying how to make media and journalism more democratic and participatory (Lasica 2003). Dahlberg (2001) describes on online discussion forum structured to support reflexivity, "ideal role taking," sincerity, inclusion, and the exchange of "criticizable moral-practical validity claims." The e-liberate system supports Roberts Rules of Order for on-line deliberation (Schuler 1996). The above systems emphasize deliberation and dialog aspects of democracy—others emphasize voting, polling, and survey methods (Astrom 2001; Norton et al 2004).

On-line systems are incorporating proven (off-line) approaches to **mutual understanding**. The RedBlue project at the Public Conversations Project (publicconversations.org) reifies a highly successful protocol for creating conversations of mutual understanding and recognition among participants at opposite ends of a political or values spectrum. The method grounds dialog in shared values, creates understanding through personal stories, and encourages participants to reflect upon biases and grey areas.

Many projects study how **trust, reputation, and credibility** are built and measured in online environments. Reputation managers (Resnick et al. 2000) calculate how much trust others put in a person, web site, company, or product, based on user ratings or on citations (links). Collaborative filtering and recommender systems (for example GroupLens, Konstan 1997) try to predict people's preferences based on the principle that "those who agreed in the past tend to agree again in the future."

Finally, immersive **virtual reality and role playing** games are being developed on ethics-related themes. For example Beal et al. (2005) describe two immersive virtual reality systems designed to help users understand social norms and develop rapport with people of other cultures. A number of commercial games are being developed under the rubrics of "serious games" and "social impact games" (see the wikipedia.org entry on Serious Games).

Conclusions

There is a dialectic or reciprocal relationship between technological artifacts and human development (see Activity Theory: Jonassen & Rohrr-Murphy 1999; Vygotsky 1978). The technologies (or artifacts) that we create and use alter the environment that we act within and end up *creating us* as much as we create them. This dialectic occurs mostly inadvertently (we create and use technologies to solve problems and meet needs, not to change ourselves) but it need not be unconscious. Digital technologies afford unique opportunities to consciously tailor the medium/environment of communication to support learning processes. When imposed hierarchically such tailoring can seem like repressive social engineering, but when created collaboratively and used willingly (i.e. with perceived legitimacy, as suggested here) it can be empowering and transformative.

People do not always live up to their own expectations or standards in ethical terms. Some of this deficit is due to very personal factors, but some of it is also a function of how supportive the environment is—the degree to which it supports individuals in maintaining an awareness of and consistency with the values they espouse. Environmental supports include the "culture" of whatever organizational or social context we are in, but also include

artifacts, like speed limit signs, nutritional labels on food packages, and posted incentives for charitable donations, that reify these values. Group use of technology to systematically improve mutual understanding and regard is a straightforward extension of this.[22]

It would seem that the explicit support of mutual regard and recognition through a combination of empirical research (into cognition, knowledge, emotion, and communication) and technological innovation is quite at odds with most current sociocultural trends (in politics, businesses, mass media, etc.)—and moving "against the tide." In contrast to this cynical perspective, perhaps the very radicalness of the project makes the pursuit of such an R&D agenda even more needed, or at least intriguing. To frame our theme in an even more provocative fashion: "can technology help individuals develop consciousness and groups develop collective wisdom?" It seems plausible that it can.

A confluence of research and application in may areas has created an opportunity to combine results from diverse fields into an interdisciplinary focus on "collaborative technologies supporting cognitive skills for ethics." The CSCL/Learning Sciences research community would be a natural place for these threads to be woven together to set an integrated collaborative research agenda.

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