Dewey's Contribution to the Foundations of CSCL Research
Timothy Koschmann
Southern Illinois University School of Medicine
tkoschmann@siu.edu

ABSTRACT
In this paper, I review two studies (Roschelle, 1996; Baker, Hansen, Joiner, & Traum, 1999) which I believe to represent paradigmatic examples of CSCL research. I offer a critique of these studies based on the theory of inquiry developed by the American pragmatist philosopher John Dewey. Inquiry, for Dewey, represented an exceedingly broad category of activity of which joint problem solving is a special case. I conclude by proposing a description of what I think research in CSCL is, or at least should be, about. This description can be used to distinguish what is done in this field from traditional research in education on learning outcomes, research based on classical information processing theory, and conventional research on social interaction.

Keywords
Deweyan inquiry, conceptual change, common ground, social interaction, theories of meaning

INTRODUCTION
When asked to prepare this keynote presentation, I was informed that the chosen theme for this conference would be "Foundations of the CSCL Community." My charge, therefore, would be to write something that spoke to where we came from as a research community and where we might be going. After deliberating on this matter for some weeks, I have decided to proceed in the following fashion.

First, I have selected two examples of what I, at least, consider to be paradigmatic CSCL research. I will briefly describe each of these studies and then provide a critique, not of the research per se, but rather of the theoretical framings within which the research was conducted. I will base my critique on a reading (mine) of certain works by the American pragmatist philosopher and educator, John Dewey. I will conclude by offering a description of what I believe to be the distinguishing features of research in CSCL.

TWO STUDIES OF LEARNING IN COLLABORATIVE SETTINGS
The first paradigmatic example of CSCL research can be found in a chapter written by Jeremy Roschelle (1996). It describes a longitudinal case study of two high school students (Carol and Dana) and their use of a program that graphically simulates the trajectories of Newtonian particles. In analyzing the interaction of these two students, Roschelle drew on two quite different research traditions. On the one hand, he employed ideas from the literature on conceptual change in cognitive science. He defined conceptual change as "learning to register deep features of situations" and "restructuring systems of physical metaphors" (p. 210). At the same time, he drew on the literature of Conversation Analysis which, he argued, has established that meaning is "constructed, monitored, and repaired" through "conventional structures of face-to-face interaction" (p. 210).

Blending these two traditions together, Roschelle conjectured that "conversational interaction provides a means for students to construct increasingly sophisticated approximations to scientific concepts collaboratively, through gradual refinement of ambiguous, figurative, partial meanings" (p. 210). This hypothesized process, he reasoned, has four features: (a) the construction of a deep-featured situation at an intermediate level of abstraction from the literal features of the world, (b) the interplay of metaphors in relation to each other and to the constructed situation, (c) an iterative cycle of displaying, confirming, and repairing situated actions, and (d) the applications of progressively higher standards of evidence for convergence (p. 211). How convergent conceptual change is possible using "only figurative, ambiguous, and imprecise language and physical interactions" (p. 212) is the puzzle that motivated his study.

Roschelle's data consisted of videotapes of the two students working in front of a computer monitor over two one-hour sessions in which the students worked their way through a series of pre-defined "challenges." He also recorded interviews with the participants after the sessions. His analysis focused on five brief exchanges from the computer sessions. For each exchange he describes the "conversational action" capturing not only the lexical components, but also timing, prosodic features, and affiliated gestures; the "conceptual change" evidenced in the exchange; and, finally, the displayed "shared knowledge."

The second study that I will discuss can be found in a chapter authored by Baker, Hansen, Joiner, and Traum (1999) and published in a collection edited by Dillenbourg (1999). Unlike Roschelle's study, this study involved pairs of students communicating through a program that structured their interactions. Rather than communicating face-to-face, they were
required to perform a shared task while communicating through a designed interface. The interface provided a graphics tool kit that allowed the students to construct graphs collaboratively. They could also send messages to each other. One group of subjects was provided with a chat-like facility; the other group was given a selection of buttons that could be used to generate messages of the type typically needed to complete the task. The task involved jointly producing a graph to represent energy transfer in a simple electric circuit.

Like Roschelle, Baker et al. sought to bridge two different research traditions in framing their analysis. From the tradition of Cultural-Historical Activity Theory (CHAT), they derived the notion of learning as appropriation. Appropriation, as they describe it, involves learners' use of culturally-provided tools, both "material tools, such as pens and computers, and semiotic tools, such as sign-systems" (p. 31). They specify, "appropriation … takes sign-mediated assistance from other members of the culture, who scaffold children's first attempts with the cultural object in such a way that they gradually move from being able to use tools under guidance to being able to use them on their own, and in their own way" (pp. 31-32). The second theoretical influence for their analysis came from work in psycholinguistics on common ground and grounding. Baker et al. wrote:

A common ground of mutual understanding, knowledge, beliefs, assumptions, pre-suppositions, and so on, has been claimed to be necessary for many aspects of communication and collaboration. Grounding is the process by which agents augment and maintain such a common ground. (p. 33)

The purpose of their study was to "understand how these processes—grounding and appropriation—that operate on quite different timescales, lead to collaborative learning" (p. 32).

Later in the chapter, Baker et al. make a distinction between pragmatic and semantic grounding. They explained:

Pragmatic-level grounding is part of learning to collaborate: one learns to understand generally what the other will be trying to tell us. Semantic-level grounding … relates to attaining mutual understanding of what is meant by certain terms and expressions; it thus relates more closely to learning in a specific knowledge domain by means of interpersonal interaction. (pp. 45-46)

Based on this distinction, the authors offer the following conjecture: "collaborative learning will be associated with a gradual transition from the use of language as a medium for grounding communication (pragmatic) to grounding on the level of the medium itself (semantic), leading to appropriation of the medium" (p. 46). The authors provide two transcripts, one involving students using the chat interface and another involving students using the structured interface. Both transcripts are rather sparse, however, and the analysis fails to address the authors' conjecture with regard to transitions from pragmatic to semantic grounding and appropriations of the medium.

The Roschelle and Baker et al. chapters have certain similarities. Both display a concern with the practices of learning rather than focusing on learning outcomes, as is more typically the case in educational research. There is also a common theme of intersubjectivity that runs through both studies—the Baker et al. chapter is explicitly about grounding procedures, while the Roschelle chapter involves assessing "evidence for convergence" (p. 211). They are useful examples for discussion here because each has connections to currently active areas of research in CSCL. The topic of common ground, for example, has received considerable attention in recent publications (Arnseth, Ludvigsen, Wasson, & Mørch, 2001; Dillenbourg & Traum, 1999; Mäkitalo, Salo, Häkkinen, & Järvelä, 2001). In the ways that Roschelle's subjects formulate theories and test predictions, his study has connections to ongoing research on scientific argumentation (Bell, 2002; Felton & Kuhn, 2002). Similarly, the use of structured conversation tools in the Baker et al. study has connections to a time-honored issue in CSCL research, namely that of procedural facilitation (see Koschmann, 2002). It is an issue that continues to have significance for current research (cf., Bell, 2002; Guzdial & Kehoe, 1998; Suthers, Toth, & Weiner, 1997). Finally, because the Baker et al. study involves communication through a designed interface, it has relevance to recent discussions of reflexive awareness in computer- and video-mediated environments (Kato et al., 2002; Smith, 2002). As a result, they are both important papers worthy of our careful scrutiny. I have certain misgivings, however, about how both papers were framed theoretically.

Roschelle's study defines learning as cognitive change.¹ By positing the existence of conceptual structures and treating learning as a process of changing these representations, an implicit form of dualism creeps into his analysis. For example, Roschelle observed at one point in his analysis, "Carol's response to Dana (#2) therefore marks the first appearance of a

¹ Before launching into a critique of Roschelle's chapter, it is perhaps worth noting that the chapter was a reprint of an article that was previously published in 1992 (Roschelle, 1992a) which in turn was based on his dissertation work completed in 1991 (Roschelle, 1991). To fully appreciate the novelty of this piece of work, therefore, it is important to evaluate it as a historically-situated contribution.
new conceptual structure" (p. 219, italics added). In documenting a subsequent episode he added, "This wrong proposal is an indication that Carol's conceptual structure was not yet complete" (p. 229). But, where do these structures reside and how are we to know them? Furthermore, through references to "the scientific meaning of acceleration" (p. 212, italics added) and to the students' need to "construct increasingly sophisticated approximations to scientific concepts" (p. 210) we are left with the impression that there is one and only one canonical representation shared by the scientifically literate. An analysis of conceptual change, therefore, not only assumes that everyone possesses a conceptual structure but also that this representation is either right or wrong (i.e., "scientific" or misconceived). The problem this poses for the analyst, however, is that the subjects' conceptual structures are mental abstractions, not available to inspection. To his credit, Roschelle never claims to have privileged knowledge of Dana and Carol's conceptual structures, but he does advance theories about them that he then attempts to support empirically. My concern, therefore, is not with the analysis itself, which I find exemplary, but rather with how the analysis was framed theoretically.

When we turn to the Baker et al. chapter, a different set of problems arise. The goal of this study was to show how grounding leads to appropriation. But to do so, we need an adequate model of how grounding works in the first place. Traditional models of "reference repair" (e.g., Clark & Marshall, 1981) provide a less than satisfactory account of how people negotiate mutual understanding in concrete settings (cf., Koschmann, Goodwin, LeBaron, & Feltovich, 2001). Perhaps the problem lies with the underlying notion of common ground itself, which presupposes more than we can ever hope to demonstrate empirically.

I will argue in the section that follows that the weaknesses I have identified in these theoretical framings could be overcome by employing a different kind of framework. The framework I have in mind is derived from the writings of the American pragmatist philosopher and educator John Dewey. I will attempt to show that Dewey, in his description of the processes of inquiry, laid the groundwork for a distinctive vision of learning and human problem solving.

DEWEY'S THEORY OF INQUIRY

When one speaks of Dewey's contributions, it is important to note which Dewey we are drawing upon. Dewey was a prolific author and wrote for a variety of audiences. In education, we tend to focus on that middle period in his career when he was most directly involved in education and educational research. Regrettably, less interest has been taken in his later writings after he left the University of Chicago and directed his attention more exclusively to philosophical questions.

In his later writing, Dewey proposed a novel form of logic based on what he described as the "theory of inquiry" (Burke, 1994; Dewey, 1938/1991; Hickman, 1998). Though Dewey began to grapple with the problems of logical theory in some of his earliest work, his biggest contributions appeared in a book entitled Logic: The Theory of Inquiry, published late in his career. Dewey (1938/1991) defined inquiry as follows: "Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole" (p. 108). When Dewey speaks of an "indeterminate situation" he uses the term situation in a technical sense. He wrote:

What is designated by the word 'situation' is not a single object or event or set of objects and events. For we never experience nor form judgments about objects or events in isolation, but only in connection with a contextual whole. The latter is what is called a 'situation'. (p. 72)

A situation is not just a context for problem solving, however, but an "indeterminate" or disrupted setting for action. Burke (1994) wrote, "Situations, occurring in the ongoing activities of some given organism/environment system, are instances or episodes (or 'fields') of disequilibrium, instability, imbalance, disintegration, disturbance, dysfunction, breakdown, etc." (p. 22). When the indeterminate situation is transformed through the processes of inquiry "into a unified whole" the aspects of the original situation that were initially experienced as problematic, what Dewey sometimes refers to as the "subject-matter" of inquiry, are reabsorbed into the background of experience. Inquiry, for Dewey, represented an exceedingly broad category of activity, ranging from the struggles of a one-celled organism to find sustenance to the most sophisticated forms of scientific research. The forms of joint problem solving that we study in CSCL are a species or special case of Deweyan inquiry.

Dewey was critical of (and struggled to break free of) notions of knowledge as a substantive. These notions remain prevalent today and underlie the commonly accepted metaphors of learning as acquisition and instruction as a process of delivery or inscription. Dewey (1938/1991) wrote, "that which satisfactorily terminates inquiry is, by definition, knowledge; it is knowledge because it is the appropriate close of inquiry" (p. 15). "But," Dewey went on, "[that] statement may be supposed, and has been supposed, to enunciate something significant instead of a tautology" (p. 15). In his

---

2 I would like to acknowledge Jeremy Roschelle's role in bringing to my attention the importance of Dewey's theory of inquiry to research on collaboration and learning (cf., Roschelle, 1992b).
discussions on logic, Dewey preferred the use of the term "warranted assertion" (p. 16) in place of 'knowledge.' In later writing (Dewey & Bentley, 1949/1991), Dewey abandoned the use of the term entirely in favor of "knowings and knowns" (p. 47). As described by Burke (1994), knowings are instances of inquiry, i.e. "specific instances of the application of one's dispositions, aptitudes, and habits to solving given problems" (p. 256). Dewey (1939/1991, as quoted by Burke) wrote, "the denotative reference of 'mind' and 'intelligence' is to funding of meanings and significances, a funding which is both a product of past inquiries or knowings and the means of enriching and controlling the subject-matters of subsequent experiences" (pp. 520-521).

One might submit that what we discuss as 'learning' is also closely related to this "funding of meaning and significances," since it is through its ability to enrich and control future inquiry that learning derives its benefit. This view of learning provides the basis for the critique that is being developed here both of learning as conceptual change and of common ground as a repository of shared knowledge.

In some places Roschelle's discussion of conceptual change might seem to be consistent with a Deweyan model of inquiry. He proposed, "the process of conversational interaction affords opportunities for co-participants to negotiate the meanings of metaphors-in-situation. In a case of scientific conceptual change, these meanings are in the relationship between deep-featured situations and theory-constitutive metaphors" (p. 216). This would seem to resonate with Dewey's (1938/1991) assertion that:

[The] means that a conventional symbol has is not itself conventional. For the meaning is established by agreements of different persons in existential activities having reference to existential consequences. … For agreements and disagreements are determined by the consequences of conjoint activities. (p. 53)

Dewey espoused a constitutive rather than a denotative theory of meaning. When Roschelle, in his analysis, speaks of co-participants negotiating meanings, he operates with a theory of meaning consistent with Dewey's. When Roschelle lapses into discussions of "conceptual structures," however, he is vulnerable to Dewey's critique of knowledge treated as a substantive. For Dewey there could be no fixed conceptual structure corresponding to 'acceleration' or 'velocity.' The meaning of these constructs must be constantly created anew in practical activity.

The discussion of grounding in the Baker et al. chapter, like Roschelle's discussion of negotiated meaning, would also seem to parallel Dewey's theory of learning as constitutive. Here as well, however, the framing of the analysis takes a direction that may be at odds with Dewey's theories of inquiry and experience. To speak of mutual knowledge and common ground is to suggest that two or more knowers are having the same experience. But, as we know, my experience of a situation can never in any literal sense be the same as yours. Yet, in many circumstances we must go on, trusting that our understandings are sufficiently in alignment for joint activity to proceed. When this assumption becomes problematic, some negotiation in meaning is called for. One might model this negotiation as reference repair as Clark and Marshall (1981) did, and such a model seems to be assumed when we speak of processes of grounding. Such a model assumes that meaning is fixed and, in a simple sense, denotative. Looking at meaning negotiation from the perspective of Deweyan inquiry, on the other hand, leads to the development of a very different sort of model. Diagnosing discrepancies in understanding, by this view, does not require the introduction of special mechanisms, such as grounding or reference repair. Instead, meaning construction is simply treated as a recursive aspect of the process of inquiry itself. In such a model, meaning is never fixed and settled but is instead continuously open to re-negotiation and re-specification. This does not in itself preclude the construction of computational models of meaning negotiation, as discussed in the Baker et al. chapter, but would likely require a very different form of underlying logic.3

**TOWARD A SCIENCE OF MEANING-MAKING PRACTICE**

Despite the critical analysis presented in the previous section, I consider both the Roschelle and Baker et al. chapters to be paradigmatic examples of CSCL research in the Kuhnian sense (cf., Koschmann, 2001a). That is to say, I think they serve as examples of what makes CSCL research distinctively different from other forms of research currently practiced in instructional technology. To make explicit in what ways these studies differ from other forms of research, I would like to propose a definition of what I, at least, believe to constitute CSCL research. I would offer the following definition: **CSCL is a field of study centrally concerned with meaning and the practices of meaning-making in the context of joint activity and the ways in which these practices are mediated through designed artifacts.** There are several implications that follow from this.

For example, the assertion that we are "centrally concerned with meaning and the practices of meaning-making" sharply distinguishes what we do from more traditional research in education. To study meaning and meaning-making practices in

---

3 See Burke's (1994) discussion of some of the implications of Dewey's logic in the concluding chapter of his book.
the way suggested by Dewey will require documentation of how learners do learning (to borrow a phrase from Jordan and Henderson, 1985). This is quite different from researching learning outcomes isolated from situations of use.

It might be noted here in passing that research on "meaning and the practices of meaning-making" is not, at least not methodologically, at odds with what is frequently termed "cognitive task analysis." Classic information processing theory (cf., Newell & Simon, 1972) was also centrally concerned with documenting meaning in applied settings. By examining meaning-making "in the context of joint activity," however, we do part ways with traditional methods of protocol analysis. As Stahl (2002) wrote:

The point is that for two or more people to collaborate on learning, they must display to each other enough that everyone can judge where there are agreements and disagreements, conflicts or misunderstandings, confusions and insights. In collaborating, people typically establish conventional dialogic patterns of proposing, questioning, augmenting, mutually completing, repairing, and confirming each other's expressions of knowledge. Knowledge here is not so much the ownership by individuals of mental representations in their heads as it is the ability to engage in appropriate displays within the social world. (p. 177)

In traditional forms of task analysis, talk-aloud protocols are used to infer the expert's representation of a problem space. We on the other hand, treat meaning, not as something inferred from action, but rather as an observable and accountable form of meaning in its own right.

Our focus, in CSCL research, on "the ways in which these practices are mediated through designed artifacts" is what separates us from traditional research on language and social interaction. Ours is not a purely descriptive enterprise— we actively participate in the design and implementation of technologies for collaboration and learning.

In this presentation I have argued that we might find some clues in the writings of John Dewey for how we might theorize some of our work in different ways. In other recent talks and papers, I have suggested that additional clues might be found in the writings of Bakhtin (Koschmann, 1999) and Wittgenstein (Koschmann, 2001b). You need to be forewarned, however, that in all cases, suggestions are all that you will find in these recommended sources, not pre-formulated solutions. Much work remains to transform these proffered hints into a viable program of research.

REFERENCES


