Computer-Supported Collaborative Learning (2014)

Dialogic foundations of CSCL

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The dialogical perspective provides an important theoretical framework for CSCL. The strain of this approach most influential in CSCL arose in the throes of the Russian revolution. In the social and intellectual ferment of revolutionary Russia—during the decades preceding and following 1917—groups turned to the theories of Marx (1867/1976) not only to leave behind feudal relationships, but also to leap over the capitalist stage of economic development. While the official soviet philosophy developed a dogmatic version of Marxism-Leninism and even Stalinism, theoreticians like Vygotsky (1930/1978) and Bakhtin (1986) remained true to the social impetus of Marx' thought. They provided social, developmental, dialectical approaches to psychology (Vygotsky, 1934/1986) and linguistics (Voloshinov, 1973) that complemented Marx' revolutionary philosophy, history, economics and politics. In particular, these two authors—and the circles of researchers around them—pioneered dialogical outlooks that overcame the ideology of individualism, which is associated with capitalist culture.

Philosophies propounded in the early days of the bourgeois era, like reflections by Descartes (1633/1999) of an isolated mind or the social contract among individual citizens postulated by Rousseau (1762) led to views in which (i) minds are possessions of individuals and (ii) communications are exchanges between individuals. Vygotsky countered the first of these views (i) by demonstrating how the higher psychological faculties of human cognition develop historically and evolve culturally through discourse and labor by groups of people; the mind is not innate to isolated individuals, but is an evolving composite of skills and practices developed through social interaction. Bakhtin opposed the second view (ii) by analyzing the dialogical character of communication; ideas are not first produced in self-contained individual minds, but emerge from multi-vocal discourse, whether in conversation, in self-talk or in novels. This is a developmental outlook, which views the nature of things as the result of their history—propounded by philosophers like Hegel, Nietzsche, Wittgenstein and Heidegger as well as scientists like Darwin, Marx and Freud.

For both of the Russian researchers, language—a thoroughly social product and essential mediator of cognition—is the focal phenomenon. According to Vygotsky, thinking is a mediated and internalized form of self-talk, a dialog with oneself. In Bakhtin's writings, the cultural and historical forms of language speak through us: The voices of countless social groups are sedimented in the words, phrases and genres of our speech. For an individual to "have an idea" is for meanings which have previously been incorporated in a community's language to be brought together in a multi-vocal and dialogical interaction. Although an adult can formulate new meaning, develop an idea or elaborate an argument as an individual achievement, such abilities are originally learned in small groups or dyads. Even as an individual act, the

use of language in thought, speech or writing retains the dialogical character of all language as a historically evolved and culturally established medium of communication among people.

Dialogical philosophy has strongly influenced CSCL theory. Not only the Russian theorists Vygotsky and Bakhtin, but also the American pragmatists Dewey (1920) and Mead (1934/1962) provided seminal analyses of dialogical interaction and of the intersubjective grounds of meaning making. CSCL researchers like Sfard (2008) and Wegerif (2006; 2007; 2013) have taken up these theoretical directions. The perspective of dialogicality provides visions of collaboration and conceptualizations for the analysis of collaborative learning. Conversely, contexts of CSCL, with their technologically mediated forms of discourse and interaction, provide new forms of discussion and offer innovative access for exploring dialog. The first two of the following studies investigate the nature of dialog in specific CSCL settings, building on other recent dialogical studies in *ijCSCL* (e.g., Ligorio, Loperfido & Sansone, 2013; Lim, 2012; Silseth, 2012). They focus on the group as the unit of analysis, studying group processes and looking at the interaction more than the characteristics of the participants as individuals.

The other two studies in this issue also investigate discussion in CSCL settings, but taking a different methodological approach, drawing from the cognitive tradition with its neo-Cartesian conception of mind, empiricist and rationalist epistemology derived from Locke and Hume, and neo-Kantian positivism. Applying multilevel analysis, the third paper considers the group level as well as that of individuals. However, it examines how the opinions and actions of individuals may or may not be influenced by other people in group settings, treating the interaction as an external condition impacting the individuals, in contrast to a dialogical focus on the group-level interaction itself as constitutive of the participants. The final paper explains group outcomes through group awareness and trust, but measures awareness, trust and other variables through individual psychological questionnaires administered outside the groups. Group outcomes are, here too, treated as caused by individual behaviors rather than by group processes and effecting individual mental states rather than emerging out of group interaction or materializing in group products.

The empiricist approach of cognitive research implicitly postulates that if dialogical situations influence knowledge creation and stimulate ideas, then it should be possible to find these effects in standardized situations that allow for experimental testing of the relevant conditions. The positive potential of collaboration emphasized by the dialogical tradition has not always proven measureable under the highly controlled conditions of the empiricist approach (Cress, 2008; Jeong & Chi, 2007). With regard to the task of brainstorming, for instance, group discussion in laboratory studies has even been shown to lower efficiency (see Mullen, Johnson & Eduardo, 1991). The same holds true for certain processes of knowledge exchange, where studies repeatedly show that people in experimental situations often do not take into account arguments provided by others (e.g., Winquist & Larson Jr., 1998).

The contrasting approaches illustrated in this issue of *ijCSCL* document that there is no single theory or methodology defining CSCL. Rather, the field thrives on the "dialog" among different approaches (Arnseth & Ludvigsen, 2006). Seemingly incompatible conceptualizations may work complementarily (Sfard, 1998) and multi-vocal methods may supplement each other's limitations (Suthers et al., 2013). In other cases, opposing assumptions and contradictory results can lead to irreconcilable differences. The issues addressed by CSCL are subtle and complex; it takes a village of scholars—around the world, over stretches of time and using different approaches—to discuss and understand them, as exemplified in this issue. The dialogical view is an important voice in that conversation, but there are a number of contending theoretical and methodological voices as well.

Dialogical Polyphony in CSCL

The field of Computer-Supported Collaborative Learning began with a vision that collaborative learning could be transformed from an occasional additive for individual instruction into a primary force for group

learning. In addition, inspired by the promises of artificial intelligence and of computational models of cognition, pioneers of CSCL envisioned software tools that could significantly aid research in collaborative learning, for instance by automating the analysis of student discourse and even by the assessment of individual-student learning within groups. While we have subsequently discovered much about the complexity of human language, the social character of cognition, and the situated nature of discourse—which tend to pose serious limitations to automated analysis—CSCL researchers are still exploring how software algorithms can be applied to the examination of collaborative interaction. PolyCAFe—presented in our opening article—represents a current artifact within this agenda, along with the reflections of its developers about the structure of CSCL chats.

The developers of PolyCAFe and article authors, *Stefan Trausan-Matu, Mihai Dascalu,* and *Traian Rebedea*, have adopted the metaphor of polyphony from the field of music to conceptualize the ephemeral interpenetration of individual and group contributions to discourse. As previously stressed in these editorial pages (Stahl, 2013a; 2013b), the relationship among the different units of analysis remains one of the great, unresolved questions in CSCL. We have increasingly recognized that supposedly individual cognition is thoroughly social, while we still have a lingering tendency to hear group discourse as consisting of individual contributions. However, this is similar to sitting in a concert of a Bach fugue and alternatively focusing on the voice of one instrument or the synthetic flow of the ensemble. The genius of Bach's works was to orchestrate single notes of individual instruments to create a meaningful integrated sound within the throbbing temporality of a performance. The technical term for this accomplishment is polyphony: the coordination of multiple synchronous voices as a coherent unity. Perhaps inter-animation of productive collaborative discourse in text chat can be analyzed in analogy to the counterpoint of polyphonic compositions. Just as Bach's music resolved tensions in its harmonics and rhythms through techniques of polyphonic control, groups can negotiate conflicting views and converge discordant perspectives through specific discourse practices.

The PolyCAFe analysis software operationalizes several factors that contribute to collaboration according to the authors' theory of polyphonic discourse. Instances of the factors are identified using current techniques of automated quantitative analysis of text. Visual representations of these factors (learning analytics) are then displayed in screens for researchers, teachers or potentially even participating students. These views highlight utterances and discourse passages that are key to the unfolding collaboration. Founded on an interactional and developmental view of discourse, this system pictures the relationships among the interacting voices in historical, temporal visualizations.

The research on PolyCAFe is also noteworthy as a CSCL design-based research project that has been largely driven by theory and that has further developed that theory through empirical findings of an iterative sequence of classroom trials. The cycles of theory, software prototyping, classroom intervention, analysis of interaction and re-design—in which all components co-evolve through their mutual coupling within the extended research-and-design trajectory—are emblematic of much CSCL investigation. Another common characteristic of such research is its international background: the PolyCAFe line of inquiry began a decade ago when the Romanian first author was a visiting scientist at the VMT Project in the US, where he studied Bakhtin avidly and began to discuss polyphonic dialog (Trausan-Matu & Rebedea, 2009).

Dialogical Engagement in CSCL

The next exploration of dialog in CSCL is a case study that shows how mediation by collaboration software can transform the nature of dialog and, in turn, the dialogical pedagogical approach can alter the nature of the interpersonal interaction. In their reported research, *Benzi Slakmon* and *Baruch B. Schwarz* investigate how a group of initially disengaged students begin to engage in a school-course discourse, thanks to scaffolded dialogical group processes.

Like the polyphonic analysis of the previous paper, this presentation emphasizes and analyzes the temporal flow of the interaction within small groups of students. Whereas the polyphonic approach involved factors of the discourse that are susceptible to identification by software algorithms—such as repetition of words—this one takes advantage of ethnomethodologically informed conversation analysis—adapted to CSCL—to trace more subtle linguistic moves. It uses this approach to understand the ways each student group creates social order at different phases of their interaction trajectories: how the students position each other as peers, how discourse norms are established, and how participation in meaning making evolves. In addition, it takes into account the social status of different students, focusing on disengaged students, whose "off-topic" comments are so often excluded from consideration in educational research.

Given the interest in the role of the teacher in CSCL interactions (e.g., Asterhan & Schwarz, 2010; Greiffenhagen, 2012; Onrubia & Engel, 2012; Song & Looi, 2012), it is striking that the authors argue that the trajectory that led from disengagement to engagement was facilitated by student peers—in ways that a teacher could not do precisely because of the teacher role. In addition, a number of characteristics of the CSCL software contributed to the possibility of this transformation, although it was not clear that the argumentation support of the software as such was decisive in overcoming the barriers to discourse.

While this paper presents a small case study, it is taken from the international Argunaut and Digalo projects, involving labs from France, Germany, Greece and the United Kingdom, as well as the Israeli authors and their colleagues throughout the past decade.

Dialogical Attention in CSCL

Even a strong dialogical view recognizes that certain aspects of discourse are best considered in terms of individual behaviors, while others are appropriately analyzed in terms of group dynamics, depending largely on the aim of the analysis. For instance, the polyphony model includes individual voices and the argumentation model allows for more or less engaged participation of individuals. Cognitive studies generally focus even more on the individual actor, although they may take into account influences on the individuals from a group level. In the contribution by *Alyssa Friend Wise*, *Simone Nicole Hausknecht*, and *Yuting Zhao*, the knowledge-building quality of the group discourse is analyzed primarily through statistical measures of the online, asynchronous, text-based listening and speaking of the individual students.

Initially, this quantitative study from Canada is skeptical about the occurrence of effective dialog in threaded-discussion settings. The paper starts by referring to findings in the literature that have shown that students often do not attend well to others' posts. The authors propose a "theory of online listening," arguing that accessing others' contribution is an active and constructive selection process by an individual, similar to "listening" in a face-to-face setting. They analyze data from an online discussion lasting six weeks. Using multi-level mixed-model linear regression, the study takes into account variables on both the group and student level.

The authors found little evidence for an influence of the group on students' listening behavior, but high inter-individual differences. A cognitive interpretation could be that students' differences in listening behavior are less a matter of the dialogical situation than of their individual competencies. The study further found that students' listening behavior is correlated with their personal speaking behavior.

A central recommendation of the study is to emphasize the importance of deep, repeated attention (listening) to postings of others in order for a student to make valuable and productive contributions of her own (speaking). This makes sense in that effective collaborative knowledge building requires co-attention to a shared topic (Stahl, 2013c, Sec.8.2). To attend to a topic the same way as a particular prior posting, one must read that posting carefully; only then can one respond appropriately to it (discursively,

content-fully and reflectively), whether in a critical or supportive way. Attention at the individual level is a precondition of joint co-attention at the group unit of analysis.

While a small research group conducted this study, it is firmly situated within a research agenda that extends even beyond CSCL to investigate knowledge building in asynchronous threaded discussions. Using coding schemes developed within the broader research community and hypothesizing popular expectations about the influence of careful listening on productive speaking in discussion forums, the authors provide quantitative evidence to support and refine previous assumptions. The literature on knowledge building in threaded discussions has often been discouraging, which is concerning given the widespread use of such systems for e-learning, for instance in Blackboard and MOOCs. It is, therefore, significant that the authors reflect on suggestions of their findings for the design of software features and collaboration guidelines to help students increase their collaborative knowledge building. The authors believe that software features that support good listening combined with guidance in good listening practices can lead to effective online dialog. This paper is part of a research agenda aimed at designing supports to improve the effectiveness of knowledge-building discourse in Web-based forums.

Dialogical Trust in CSCL

The final paper, written by *Tanja Engelmann*, *Richard Kolodziej* and *Friedrich W. Hesse*, presents a laboratory experiment that was conducted under highly controlled conditions. These conditions are designed to eliminate or randomize other possible factors, so that hypothesized variables can be measured and correspondences among statistically aggregated values can be calculated with generalizable results. The clearly defined task and the laboratory setting make it possible to measure and compare group efficacy and group effectiveness between experimental conditions.

This study involves a well-defined, artificial problem to be solved by triads of students. The participants have little or no social relations with each other. They are asked to solve the problem rationally by putting together a puzzle of propositional facts—which have been distributed among the triad members—and come to conclusions, which are either right or wrong. An awareness tool named KIA is used by the triads, in which subjects display concept maps of their own share of the distributed knowledge to each other (experimental condition) or just to themselves (control condition).

The study considers the group level and analyzes how group effectiveness and group efficiency in this problem-solving task are affected by the mutual trust of the group members and their awareness about the knowledge distribution within the group (as represented in KIA). The study considers trust as a personal trait, self-reported through items of standardized questionnaires, whereas individual awareness is manipulated through the software tool KIA. Group efficacy and effectiveness are measured by the solutions the groups produced. The results show that high trust may have a negative effect on the group result, if group members are not aware of the knowledge of their group partners. Without this awareness, high trust leads to less cautious behavior, involving less critical regulation, which in turn results in more mistakes done by the group members. Thus, effective collaboration requires shared awareness. This conclusion confirms that productive collaboration requires that the social setting provide certain group pre-conditions—including shared awareness of the distribution of group knowledge among individuals.

Dialog in the CSCL community

The differences of perspective and approach within CSCL research are well illustrated in this issue. The laboratory experiment from Germany, for instance, provides several contrasts to the dialogical approach of the second article. By comparison to the decontextualized laboratory subjects, the disengaged Israeli students are in situations dominated by social relationships, and level of trust as observed in the group

dynamics determines whether the students engage in bullying insults or respectful discourse about the course curriculum's posed moral questions, which have no correct or erroneous answers. Disengagement is overcome here through the establishment of trust using discourse norms: "Yoel and Dor's peers did not show any discomfort with the change they introduced, nor did they demonstrate suspicion or alienation towards them.... As an in-group trustworthy member [Yoel] mediated the gap between the 'external' teacher's voice … and his peers' genre." The breakthrough for the previously disengaged students was a clear result of the culture of trust that spread from the teacher to some groups of students, from them to specific individuals who joined those groups, and ultimately to the groups of the disengaged. In this way, trust is viewed as a group phenomenon, whose trajectory is analyzed as the interaction style of one group is passed to another group, through the mediation of group practices internalized by individual group members. Trust in the dialogical approach is observed in group interaction, rather than being measured by psychological tests administered to isolated individuals.

Recognition of the difficulties of collaboration is not new to CSCL. Probably the oldest and most robust finding in the history of CSCL—and that of collaborative-learning research or even educational innovation more broadly—is its problematic character. No experienced educator assumes that just putting students into groups to talk with each other will result in rich dialog, effective knowledge building or substantial learning. On the contrary, studies using diverse methods show that subtle guidance and the development of a classroom culture of certain social practices is necessary (Hakkarainen, 2009; Law, Yuen & Tse, 2012). One of the oldest theories of cooperative learning was that a group has to go through a painful process of "forming, storming, norming and performing" in order to interact productively (Tuckman, 1965). It typically takes a good teacher at least three years to master the facilitation of collaborative learning (or most other transformational pedagogical innovations). Each of the four articles in this issue recognizes that group interaction requires fine-tuned supports and practices in order to avoid the many possible negative results (dissonance, disengagement, superficiality, mistrust). They each propose a technological and/or procedural support (PolyCAFe, Argunaut, listening supports, KIA) to help overcome these problems.

Measuring the effectiveness of dialog or collaboration is not a straightforward affair. It highly depends upon the details of the setting and the group practices. Methodological concerns related to this were expressed early in the history of CSCL, for instance by Dillenbourg, Baker, Blaye and O'Malley (1996, p. 189):

> For many years, theories of collaborative learning tended to focus on how individuals function in a group. More recently, the focus has shifted so that the group itself has become the unit of analysis. In terms of empirical research, the initial goal was to establish whether and under what circumstances collaborative learning was more effective than learning alone. Researchers controlled several independent variables (size of the group, composition of the group, nature of the task, communication media, and so on). However, these variables interacted with one another in a way that made it almost impossible to establish causal links between the conditions and the effects of collaboration. Hence, empirical studies have more recently started to focus less on establishing parameters for effective collaboration and more on trying to understand the role that such variables play in mediating interaction. In this chapter, we argue that this shift to a more process-oriented account requires new tools for analyzing and modeling interactions.

These considerations raise thorny issues for CSCL research of any flavor: How can a study that has been organized as part of a short-term research project duplicate the conditions of a classroom with a culture that takes years to establish? Can experimental situations or technological interventions induce dialogical situations with the same kinds of interaction, group processes and individual effects as authentic classroom discourse? Do statistical computations sometimes aggregate across significant temporal variations between pretest and posttest, thereby obscuring potentially interesting transformations or group processes taking place in between? To what extent does the highly situated character of discourse and its dependence upon its unique conditions limit the possibility of algorithmic analysis? Are disappointing results of studies of knowledge building often the consequence of the choice of particular

elements being studied, perhaps using a software prototype that is suboptimal or subjects who are not adequately acculturated or guided?

A design-based research approach may begin to address some of these issues because it does not assume a fixed set of conditions, but aims to co-evolve better theory, pedagogy, software and analysis procedures through iterative cycles of re-design. Concern for orchestration of the affective, motivational and pedagogical context may also be needed (Dillenbourg, Järvelä & Fischer, 2009). Despite any differences among them, the four articles herein all represent interim reports from on-going efforts to support the still elusive vision of CSCL. It would, no doubt, be a mistake to interpret studies like these as summative assessments of the potential of computer-supported collaborative learning, as though the journey of CSCL had already attained its end.

It is often said that case studies and controlled experiments can provide complementary perspectives, suggesting the use of mixed methods or even multi-vocal research. Of course, to produce synthetic results, the approaches must share some common ground as well, so that they can effectively talk to each other (Suthers et al., 2013). The assumption of archival journals of a field, like *ijCSCL*, is that the published literature builds an ever-growing body of knowledge, which results in deeper understanding of a topic like collaborative learning. As you read the following contributions, you may want to consider the extent to which they complement each other. You may also think about the ways in which they diverge in their conception of collaboration and of collaborative learning by the ways they set up their interventions or experiments for research and by how they analyze the resultant data. Does the dialog of CSCL sound to you like a composite of classical harmony or postmodern dissonance?

This editorial introduction led to a lively discussion among the four of us. We hope it will stimulate dialog within the CSCL community. The September issue of *ijCSCL* will continue these reflections by looking in more detail at the range of methodological approaches in the CSCL literature.

Meanwhile, we look forward to seeing you in Boulder at the Learning Sciences conference, ICLS 2014, and to engaging together in the many forms of interaction that will take place there.

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