Distributed Creativity Within a Community of Student Instructional Designers

Abstract: This study explored the development of a Communities of Innovation (COI) framework for understanding distributed creativity within a community of graduate student instructional designers. After presenting distributed creativity as a theory of collaborative creativity based on established principles of distributed cognition, I present the Communities of Innovation framework as a potential representation of distributed creativity. I then discuss a study where phenomenological interviewing (Seidman, 2006) and Critical Incident Technique (Flanagan, 1952), were used to explore the experiences of four members of a graduate community of designers with many characteristics emblematic of COIs. Findings included evidence for the inclusion of some aspects of the proposed COI framework. In addition, I identify challenges and recommendations to establishing a COI within a graduate educational setting and possible new directions for research using a variety of different methods to better understand the nature of COIs and how to effectively develop them.

Understanding Distributed Creativity

Creativity research has often replicated and adapted the theoretical frameworks and research methodologies of cognitive science. For example, creativity researchers have drawn on cognitive principles such as knowledge and memory structures, representations, interference, and so on (for example, see Smith, Ward, & Finke, 1995) in an effort to try and understand the nature of human creativity. However, when cognitive scientists began exploring the potential distribution of cognition across multiple people, creativity researchers largely remained behind. While some writers explored the relationship between individual creativity and the overall system (Csikszentmihalyi, 1999) or the group or workplace climate (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Anderson & West, 1996), few have studied the creative process in distributive terms. More recently, there has been a stronger emphasis on group, or collaborative, creativity—a trend offering great promise for traits increasingly valued in our society (West, 2009).

In this paper presentation, I first discuss key principles necessary for understanding the theory of distributed cognition. I then extend Sawyer and DeZutter's (2009) application of these principles to the concept of distributed creativity and discuss the Communities of Innovation framework as an example of distributed creativity. Finally, I discuss findings from a study of a community of student designers where distributed creativity was theorized to occur. I conclude with implications from this research for the design and research of distributed creativity within student communities.

Distributed Cognition

Distributed Cognition theories emerged in the 1990s as companions to situated cognition theories, and in fact bear many similar definitions, constructs, and theoretical foundations (Moore & Rocklin, 1998). Researchers developed this theory as an alternative to traditional information processing models of cognition, which often neglected the impact of social variables, by integrating ideas from anthropology, social psychology, sociology and the Russian cultural-historical school of psychology (Cole & Engestrom, 1993). Salomon (1993) believed there were three reasons for the development of distributed cognition theories: 1) the increasingly important role of technology for intellectual tasks—something that has grown exponentially true since Salomon's original essay, 2) the re-emphasis on Russian cultural-historical theories, and 3) dissatisfaction with the limitations from conceiving of cognition as bounded within individuals.

In the past two decades of theoretical and research-based work on distributed cognition theories, different conceptualizations have emerged. For example, Hutchins (1995) wrote that socially distributed cognition has a parallelism that can't be found in individual processing because multiple complex tasks can be simultaneously completed within a system, but not within an individual. Second, tools (including language) always mediate communication between persons in a system, and this creates a problem of the "bandwidth of communication" (p. 284) between members of the system. Hutchins gave the example of a complex navigation system that had some cognitive processes held interpsychologically between the system members that could "never be internalized by a single individual" (P. 284). Hutchins believed that "all divisions of labor, whether the labor is physical or cognitive in nature, require distributed cognition in order to coordinate the activities of the participants" (p. 176). Nardi (1996) added the understanding of "functional systems" to redirect analysis to

the systems level, or the level of individuals and artifacts, and the coordination between these two. He explained that distributed cognition focused on structure, or representations, both inside and outside a person's individual cognition. Another way of conceptualizing distributed cognition might be through the kinds of interactions used to distribute the processing. For example, Hwang, Hsu, Tretiakov, Chou, and Lee (2009) explored the roles of interaction (productive collaboration), overaction (social, off-task, but necessary conversation between people), and intra-action (distributing thinking within one person through note taking, tool use, etc.). They found that intra-action had the strongest relationship with learning outcomes, suggesting the particularly important role that tools and non-human systems can play in cognition.

Moore and Rocklin (1998) summarized distributed cognition as representing two different frameworks. The first, "individual-plus," conceives of cognition as primarily residing within individuals but influenced by, and occasionally distributed among, the interacting social and artifact (tools) systems. Moore & Rocklin explained that this perspective conceptualizes cognitions as "divided among an individual, objects, and other people" (p. 107).

A second framework described by Moore and Rocklin (1998) is that of the "social-only" perspective, which conceives of cognition as so thoroughly distributed that one cannot speak of cognition as an individual process because it resides within the group. This brings a realization that "not only do social and other situational factors have an impact on cognitions that occur in one's mind, but that the social processes *themselves* should be considered cognitions (Greenberg & Dicketman, 2002, p. 19, emphasis in original). Cole and Engeström (1993) expanded this framework with a description of Activity Theory, emphasizing cognition and problem solving as occurring through the interactions between individuals, the environment, and the tools or artifacts (conceptual and physical) of the environment. From this view, the "natural unit of analysis for the study of human behavior is activity systems" (p. 9)—or in other words, the study of cognition within social contexts. Thus, when discussing distributed cognition, there are various interpretations of how distributed the cognitive processes must be, leaving room for additional research and clarification.

Theoretical Application to Distributed Creativity

Traditionally, the psychological study of creativity focused on individual perspectives, taking its cue from information processing cognition models (Mandler, 1995). A trend towards representing individual creativity with cognitive terms and models has also gained support (Smith, Ward, & Finke, 1995; Ward, Smith, & Finke, 1999). However, beginning in the late 1980s and 1990s, some creativity researchers started describing creativity in ways similar to the "individual-plus" model of distributed cognition. For example, Csikszentmihalyi (1999) developed a systems model of creativity, explaining that individual creativity is influenced and defined by the system in which it resides. Other researchers explored the role of the social climate within an organization that might enable innovation (Anderson and West, 1996; Amabile et. al, 1996), or how knowledge is structured and managed within creative enterprises (McAdam, 2004).

Sawyer and DeZutter (2009) have recently described distributed creativity differently, in a way comparable to the *social cognition* branch of distributed cognition. They argue that "creativity is embedded in social groups" and "significant creations are almost always the result of complex collaborations" (p. 81). They defined distributed creativity as pertaining to collaborating groups that collectively produce a creative product, in either predictable and constrained, or unpredictable and unconstrained, environments. They believe that collaborative emergence, or the unpredictable and unexpected emergence of distributed creativity, occurs when activities have unpredictable outcomes; interdependency within the group such that a person's actions are influenced and constrained by the actions of others; and collaboration (equal member contribution).

A possible framework representing Sawyer and DeZutter's conception of distributed creativity within adult learning and working communities could be that of Communities of Innovation (West, 2009). This framework was developed by combining principles drawn from theoretical and research-based discussions in psychology, social learning theory, and organizational development. It proposes that innovation emerges in communities that have the following characteristics:

- Dynamic expertise, characterized by "continuous efforts to surpass one's earlier achievements and work at the edge of one's competence" (Hakkarainen, Palonen, Paavola, & Lehtinen, 2004, p. 243)
- Group flow, which Sawyer (2008) described as including: 1) a shared goal, 2) close or deep listening to each other, 3) complete concentration, 4) being in control of the group's actions and environment, 5) blending of individual egos, 6) equal participation, 7) members' familiarity with each other, 8) constant communication, 9) elaboration of each others' ideas, and 10) frequent failure (and learning from failure).
- Entrepreneurship and ownership. Innovative communities need to develop the unique type of environment that allows enough structure to keep the community together and focused, but enough flexibility to allow individual members to take ownership over their own projects and ideas (Coakes & Smith, 2007; McFadzean, O'Loughlin, & Shaw, 2005)

- Inquiry. Hakkarainen et al. (2004) found that "all models of innovative knowledge communities . . . highlight the role of problems and questions that guide the process of knowledge creation" (p. 197).
- Group reflectiveness. Hakkarainen et al. (2004) argued that both interpersonal and intrapersonal reflection was important and others incorporated similar ideas in their models (Bielaczyc & Collins, 2006; Engeström, 1999; Sawyer, 2008).
- Diversity. Justesen (2004) described diversity in techne and cognition as so critical that she described it as "innoversity." Others have echoed these sentiments (Bielaczyc & Collins, 2006).
- New community boundaries, visions, and goals. In COIs, it is more likely that members network with persons both within and outside the community (Sawhney & Prandelli, 2000) and are less controlled by management and typical beauracracy (Benton & Giavagnoli, 2006).
- "Hacker"-like motivation. Himanen (2001) and Raymond (2003) explained that hackers care deeply about their work and quality, becoming so intensely motivated by their projects that it becomes almost playful or joyful. Hacker-like motivation can be found in areas outside of computer programming where innovation emerges.

These principles, drawn from these and other sources, were organized into the Communities of Innovation framework, and formed the basis for this study, which was an initial exploration of how robust this framework could be when applied to a higher educational setting.

Research Questions and Methods

The purpose of my research agenda was to study the nature of distributed creativity from a Communities of Innovation perspective, within student design communities in the context of higher education. Specifically, my research questions for this study were:

1. Do elements of a community of innovation emerge among members of a graduate instructional design studio?
2. If so, how do members of this community describe those elements? If not, what do members report might have impeded the development of a COI in this setting?

Research Design and Participants

This study combined phenomenological interviewing (Seidman 2006) and Critical Incident Technique (Flanagan, 1952) to study the emerging distributed creativity during one semester of a design Studio for graduate-level instructional designers at a large, Southern university. This Studio consisted of three courses: A beginning course focused on gaining expertise utilizing design technologies; a second course involving an individual design project, and a third course involving a larger, group design project. There were high levels of collaboration among students within each course, as well as students between the different courses as newer students were required to serve as assistants for the more experienced students' projects, and more experienced students were required to mentor newer students in their projects. All three courses met together for general instruction and discussion of design principles each week. From this setting, four students (Jamie, Robin, Boyd, and Lori), representing all three Studio courses, were selected as case studies based on their background and inclination towards collaborating in their creative works.

Data Collection Methods

A combination of methods were used to explore the nature of distributed creativity within this Studio community. This research study followed Seidman's (2006) strategy for phenomenological interviewing, except for one modification. Seidman outlines a three-interview process. The first interview is designed to understand the participant's background relevant to the experience at hand. I conducted this interview at the beginning of the semester about the participants' previous engagements in creative and collaborative school activities. Seidman then recommends a second interview for specific details about the experience itself, and a third interview where the participant and the researcher co-interpret the experience to understand its significance and meaning.

In lieu of Seidman's (2006) second interview, and in order to better understand the specific details of how ideas developed through group collaboration, each participant recorded a weekly 5- to 10-minute voice memo detailing the "critical incidents" (Flanagan, 1952) of their group design activities. In other words, they explained 1) what happened that week that was significant to their project, 2) who was involved in the incident, and 3) why this incident positively or negatively impacted their project. This method enabled the students to provide more thorough details into their weekly group collaborations than they would have been able to remember in a single interview. This information was triangulated with an analysis of the students' design experiences as reported in their required weekly design journals. I also observed first-hand many of the participants' interactions with their peers.

I then concluded the semester by conducting the third of Seidman's interviews and co-interpreting with the participants how their group actions enabled or frustrated the creative process. In addition to these data sources, I interviewed the Studio instructors in order to understand their rationale, goals, and perspectives on the Studio setting.

Data Analysis Methods and Rigor Guidelines

Data were analyzed using constant comparison coding techniques for forming categories and theories derived from categories. This analytic method is similar to the form of analysis suggested by Flanagan (1952) for Critical Incident data, which I collected via the student voice memos. Initial categories were derived from the COI model (group flow, hacker ethic, entrepreneurship, etc.). Additional categories were created from the analysis process to describe emerging significant events or patterns in the participants' experiences. Trustworthiness was developed through member checking case study reports with the participants, asking independent coders to analyze uncoded portions of the data to confirm emerging themes, peer review of the theoretical and methodological frameworks, and triangulation of methods and data sources.

Findings

Findings included the emergence of several elements of the Community of Innovation framework in the experiences of the participants (flow, hacker ethic, and entrepreneurship). In addition, new themes emerged representing additional ideas that could be added to the framework (perspectives on collaboration and mentoring, interactive idea generation, sense of community, learning through design criticism, and idea prototyping). Finally, some COI elements were not found in this study (see Figure 1).

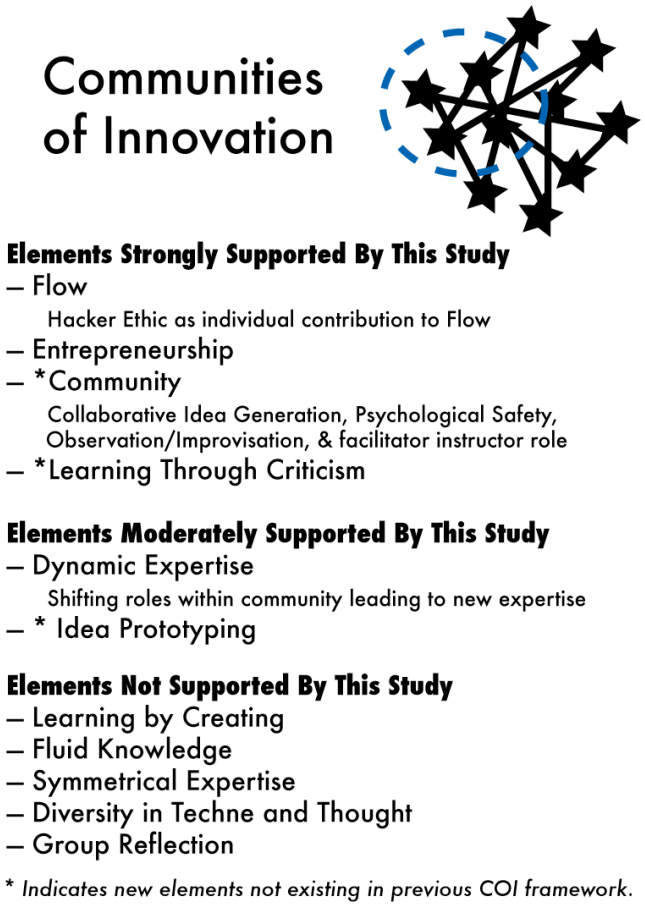

Figure 1. Revised Communities of Innovation framework

Existing COI Elements Supported by the Data

Flow

While Group Flow (Sawyer, 2008) was theorized to be specifically important to COIs, it was difficult to detect Group Flow in this study (12 coded statements). This could be due to the lack of group flow or to the difficulty of capturing it within the questions and self-reports used in this study. However, individual flow (Csikszentmihályi, 1990) emerged as a significant theme (30 statements, found in all four case studies' experiences), and was coded as situations when participants reported being completely engaged to the point of losing consciousness of their surroundings and time, in part because they felt competent to complete the task, understood the bounds and rules of the activity, and found it personally enjoyable. While the flow experience was mostly described as individual, it appeared to be fostered by community characteristics such as project ownership; student agency; and a fertile, creative environment.

Hacker ethic

Hacker ethic was coded when statements described the participants' work as interesting, playful, or completed because of a desire for quality or satisfaction rather than a grade, or involving high levels of enthusiasm. From the literature (Himanen, 2001; Raymond, 2003) and this research, I interpreted flow as an experience that happens to people, whereas a hacker ethic is something innate that a person brings to an experience. Data in this study supported this distinction, but participants often indicated that both existed simultaneously. All four participants described having a hacker ethic for learning the skills needed to complete high-quality projects, although Jamie least so (6 coded statements compared with an average of 22 statements for each of the other three).

Entrepreneurship and autonomy

Entrepreneurship/autonomy was coded when participants discussed the ability to create their own projects, define their own goals, or take ownership in their work. All participants indicated that Studio enabled them to become innovative by allowing autonomy in selecting and designing projects. Boyd remarked, "It [Studio] lets you have your own goals not compared to somebody else" and "they really give you free reign" over tools, learning design/theory, etc. He continued, "Really the only thing that can impede you . . . would just be your own limitations."

Collaboration and mentoring

"Collaboration," defined as repeated interactions focused on achieving a goal such as developing a project component or learning new skills, was evident in 173 comments. All four participants reported that collaboration was crucial to developing their projects, although they defined collaboration differently and benefited from different kinds of collaborative relationships. The participants often indicated a desire for even more collaboration (32 statements). Interestingly, despite all four participants being very comfortable with Internet technologies and two of them living far away from the university, only Lori indicated collaborating with friends on the Internet, while the others strongly preferred face-to-face collaborations.

Some of the collaborations reported by the participants were minor interactions with other community members that either pulled the participants away from or reinforced a particular decision, or gave emotional support for a chosen action. These small nudges in a particular direction were coded 34 times. Sometimes, however, the participants indicated more dedicated, consistent, and one-on-one collaboration that was coded as mentoring (30 statements). All participants reported some degree of mentoring, usually to support their technical skill development.

Interactive idea generation

In this study, we flagged every instance where participants mentioned a new idea, and coded these ideas as having originated from the participants themselves, through interactions with others, or from materials such as textbooks or tutorials. In general, participants reported mostly receiving ideas through interactions with others, especially other Studio members (134 coded statements, see Figure 2), as well as from connections outside of Studio (37 statements). Participants also drew ideas from assigned textbooks (8 statements), and from searching on the Internet (41 statements). Mostly they reported their ideas were generated interactively with others. Some of these ideas were related to technical issues and learning new technologies. Most ideas were related to minor design changes, usability issues, and aesthetic improvements. Robin eventually changed the entire template for her project because Boyd, in a desk critique, questioned the viability of her previous design. In return, Robin and others offered ideas to Boyd about adding interactive elements to his Web site and improving his font and color choices. Boyd noted, I received some really great feedback, . . . which led directly to changes

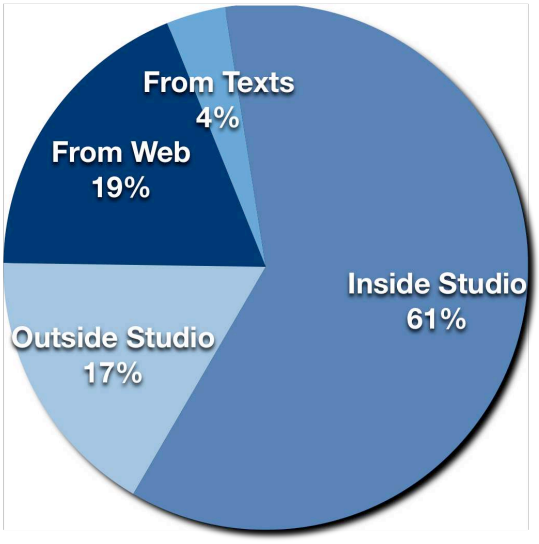

Figure 2. Where participants reported receiving their ideas.

Sense of community

Sense of community was coded a total of 50 times when participants indicated being emotionally or psychologically connected with, trusting, receiving support and encouragement from, and feeling friendly with their Studio peers. [Note: Although collaboration could be another indication of the strength of a community, I coded collaborative events separately to allow specific analysis of those interactions.]

Learning through critiquing

Learning through critiquing was coded when participants indicated learning or gaining insights from the peer feedback process or from evaluating other designs, and it was coded 39 times. For example, Lori mentioned that she and a friend sat in on each others' prototyping meetings with their instructor. During the discussion of her friend's prototype, Lori contributed advice that caused her to reflect on her own project: "In just some of the things I suggested to her I was like wait a minute, I could be

doing that for my project." She further observed, "so much more happens when you can actually sit and talk about your project."

Idea prototyping

Participants discussed the importance of prototyping ideas to facilitate idea generation through observation and improvisation. However, the evidence for including this element in the COI framework is still tentative (13 coded statements in this study). This concept is supported by models of rapid prototyping, which is an approach to design that emphasizes a "rapid, iterative series of tryout and revision cycles . . . until an acceptable version is created" (Baek, Cagiltay, Boling & Frick, 2008, p. 660). Often, rapid prototyping involves users in testing the product, but this study indicated that it was also necessary for engaging members of a COI in developing innovative ideas. Participants suggested that prototyping might be most influential when it begins early in the design process and when sufficient to facilitate one-on-one or small-group discussions about the prototype.

Challenges to Implementing a COI

From this study, several challenges to implementing a Community of Innovation in an educational setting were evident. First, there was a lack of time for completing the tasks sufficiently, causing participants to often focus solely on completing tasks instead of considering the most innovative or effective way to produce their projects. Another impediment for the students was their lack of technology skills, particularly for Boyd and Lori who had innovative ideas but could not develop them due to limited technical skills. Thus, while Hakkarainen, et al. (2004) noted the importance of dynamic expertise that is adaptable to changing problems, there appears to be a need also for domain-specific expertise as a prerequisite to innovative collaboration and improvisation.

Finally, participants reported receiving ideas, social support, and feedback from peers, but this support was usually superficial unless it came from a member of their close peer group. The clearest example was Lori, who described working closely with a dedicated and skilled mentor, but reported almost no collaborations with anyone else. Robin and Boyd did not have dedicated mentors but instead formed a group with Studio friends that provided quality feedback and support. Like Lori, however, they collaborated little with anyone else. Jamie worked closely with her team members, but reported little interactions outside of her team. Thus, COI support and collaboration may impact innovation only among members of local, helpful peer groups within the community. If so, connecting community members with "innovation champions" (Coakes & Smith, 2007) or developing expert networks (Hakkarainen et al., 2004) may prove especially important.

Conclusions: Reexamining the Formative COI Framework

In this study, I employed a formative Communities of Innovation framework, an adaptation of theories about communities of learning/practice and creativity research, to describe the innovative potential of adult groups. Not all of the theorized COI elements were evident in the data. Findings included evidence for some aspects of the proposed COI model (flow and hacker ethic, entrepreneurship, collaboration and mentoring, interactive idea generation, sense of community, and learning through design criticism), moderate support for others (dynamic expertise and idea prototyping), and no evidence supporting other proposed components from the previous iteration of the model (West, 2009—developing adaptable knowledge and expertise, symmetrical expertise within the community, community reflection, shifting interpersonal roles, or benefiting from cultural/ educational/skill/other diversity). There was not evidence that these latter components are not important to a COI, only that they weren't evident in this study.

Based on these findings, the COI framework was tentatively revised to differentiate original elements that were strongly and weakly supported by data in this study, new elements supported by the data, and those original elements that were not supported by the evidence in this research (see Figure 1). This distinction is helpful for designing and researching COIs, as it creates priorities for emphasizing specific elements in a given community.

Implications for Future Research

As Greeno (1997) explained, we need to seek to understand "which combinations and sequences of learning activities will prepare students best for the kinds of participation in social practices that we value most" (p. 9). Because graduates enter a workforce that is increasingly demanding creativity as the currency for success (Banahan & Playfoot, 2004), it is important to continue researching how we can foster effective distributed creativity in higher education in order to best replicate the kinds of social practices and activities graduates will engage in when they fully enter society. The conceptualization of COIs described in this paper is formative. Support for some components was apparent in this study, but several unanswered questions for future research remain, including:

1. What is the nature of group flow and how can it be developed within a community?

Flow was common across participants' experiences, but was usually manifested as individual rather than group flow, which may have been due to methodological limitations. Future research is warranted to delineate

the differences between individual and group flow, articulate the nature of individual and group flow, and examine what influences group flow. To address these questions, conversation analysis—a methodology designed to rigorously capture routine, everyday activities occurring in naturalistic settings in a manner that is reproducible and defensible (Sawyer & DeZutter, 2009)—might be used.

2. How do COI designers balance structure and scaffolding with autonomy?

In this study, autonomy and entrepreneurship were key characteristics of COIs. Yet, this freedom created challenges for participants as they struggled to identify the vision for their projects. Future research is needed to understand how to balance structure and scaffolding, especially for novices, and the autonomy needed to promote innovation. Researchers might employ quasi-experimental studies with control and experimental groups to account for varying levels of scaffolding and structure. Results could be compared according to expert judgments of the innovativeness of the final products, or by utilizing a measure of creative potential (Kim, 2007) or divergent thinking (Runco, 1993). Qualitative methods could explore the nature of the scaffolding found to be most effective, and how participants perceived, experienced, and benefited from this scaffolding.

3. What is the nature of community within a COI and how does this compare with other communities?

Research is needed to articulate the nature of the community within a COI and how this differs from other kinds of communities, such as learning communities and communities of practice. These questions could be studied via social network analysis in order to quantify the social capital of relationships making up COIs.

4. How is knowledge and expertise acquired in a COI?

This study provided tentative findings related to how innovation develops through the peer critiquing process and that how dynamic expertise influences innovation. However, research is needed to verify these findings and extend our understanding of these principles. Case study methods could prove valuable for documenting how dynamic expertise is developed, relying on a combination of critical incident recall and close researcher observation with a small participant sample. Video analysis may also be helpful in capturing the nuances of expertise development. Conversation analysis could again be useful in microanalyzing the discourse.

5. What is the value of COIs? Do they produce more innovative ideas or products?

A significant, and largely unanswered, question concerns whether COIs stimulate more innovation than other social structures. Researchers could use historical approaches by first identifying major innovative ideas and working backwards to analyze archival data concerning the social structure surrounding the innovation. Another approach would be for experts to review the products generated by a COI and other kinds of communities to develop a reliable instrument for analyzing the innovative potential of group ideas.

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