

Representing Activity in Distance, Asynchronous CSCW

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INTRODUCTION

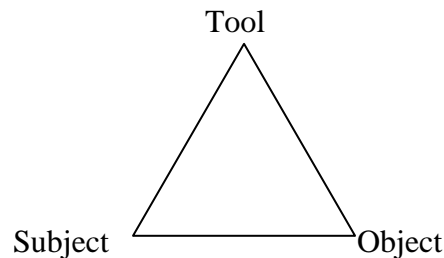
The study of computer supported collaborative writing (or computer mediated collaborative writing) has grown over the past ten years. In this time, much work has focused on how certain electronic communication tools affect computer supported collaborative writing (CSCW) and, especially, computer supported collaborative learning (Beck, Erkins, Kock, Lee, Sharples). Little of this work has applied Activity Theory (AT) to this analysis. Some studies have discussed the application of AT to CSCW relative to how specific software tools are designed and used or in the use of synchronous tools (Clases/Wehner, Collins, Zager). This paper considers dynamics of AT relative to the use of asynchronous communication tools such as email and discussion boards to mediate distance, asynchronous collaborative writing and attempts to develop a new representation of AT related to this kind of collaboration, which is growing within business, industry and academia. It considers some dynamics of AT theory discussed in computer supported collaborative work and cognitive psychology relative to CSCW, followed by a closer look at certain dynamics specific to distributed, asynchronous CSCW. Finally, a diagram that attempts to describe these various dynamics of distance, asynchronous CSCW is offered. Such an analysis can help professionals understand various dynamics related to this kind of collaborative work.

ELEMENTS OF ACTIVITY THEORY

Initial scholarship of AT discussed abstractions of variables associated with human activity; these included an understanding of the subject's internalization of

external events/experiences and externalized processes associated with the activity, an understanding of the object of the subject's efforts—that is, what is motivating the activity toward some end, and how the subject uses tools to accomplish that object (Leont'ev and Vygotsky 1978). Generally, AT describes the specific context in which consciousness is realized and developed through the use of tools that mediate actions toward completion of a given activity; Figure 1 shows this representation.

Figure 1: Original Diagram of Activity Theory

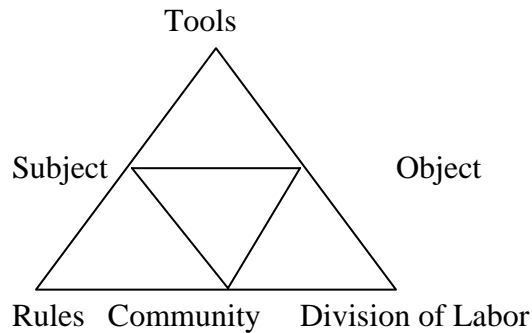


Two important attributes of AT are that it recognizes dynamic relations among its components and it is not prescriptive. As Nardi (1996) states, “AT says that the constituents of activity are not fixed, but change as conditions change...AT does not describe or predict each step of an activity” (75). An analysis of activity that applies AT, then, can consider a change in a situation/condition and how participants respond to that change. An interesting feature of AT, according to Engeström (1993) is that “AT does not offer ready-made techniques or predictions for research; rather, its conceptual tools must be concretized according to the specific object under scrutiny”(Nardi 7). A researcher must use induction of a given case in applying AT, and one analysis of such a case can be different from another analysis.

Enhancing the original model, Engeström (1987) posited that the community to which one belongs and rules associated with how that community might behave in

completing a given activity and how work on an activity is divided would influence how one uses tools to complete a task. Figure 2 shows this representation.

Figure 2: Engeström's Diagram of Activity Theory



AT in COMPUTER-SUPPORTED COLLABORATIVE WRITING

This section identifies a number of dynamics pertinent to CSCW settings, especially asynchronous, distance CW, and their impact on how activity in such a setting can be represented. Collaborative writing entails new dynamics within AT because of the negotiations of rules, division of labor and function of community within the workgroup. Also, there is generally a system of interdependence among members of the group that includes cooperation, coordination and co-construction. Sharples (1993) points out that, “not only do collaborative writers have different strategies for writing that need to be reconciled, but they also form a social group, with its own personality and dynamics” (9).

The dynamics in collaborative writing entail much negotiation between co-authors. In the planning phase, co-authors need to negotiate the document's constraints and goals in order to arrive at a compatible understanding around which each can frame their contributions. Further, in the drafting stage, co-authors may need to compose text as an understanding of the text's dynamics changes. Participants need to consider that one draft may affect the dynamics of the rest of the work, necessitating change in other co-

authors' previously-completed work. Revision entails not only making actual changes to text, but also discussing possible changes. CSCW facilitates text-based discussion of text; for example, discussion may occur within email exchanges, but more specific comments/discussion may also be documented through a track-changes tool.

Halverson (2002) also provides four guidelines for the development of theory related to CSCW specifically.

“Theory in CSCW should provide a conceptual framework that helps us make sense of and describe the world (descriptive power). This includes describing a work setting as well as critiquing an implementation of technology into that setting. Second, we need rhetorical power. Theory should help us talk about the world by naming important aspects of the conceptual structure and how it maps to the real world...The third attribute is inferential power...inferences may be about phenomena that we have not yet understood sufficiently to know where or how to look...An important fourth attribute has to do with application: how we apply the theory to the real world for essentially pragmatic reasons. (245)

Halverson observes that AT meets all these attributes. She also observes that, “In AT, the perspective of the individual is at the center of everything. AT focuses on the cognitive process of an individual situated in a social, cultural, historical, and artifactual world” (247). So, while AT describes the relationship of an individual's internal cognitive processes and their externalization toward completion of a given activity, it can be applied to describing relationships between participants in CSCW.

Mapping Distance Asynchronous CSCW in AT

In order to map the variables to consider in developing a representation of AT that considers elements associated with distance asynchronous CSCW, the six (6) variables of Engeström's model need to be developed further. Identifying each variable and distance asynchronous CSCW-related items:

Subject: Scholarship indicates that this can be either an individual or the group collectively. How this is established within the analysis serves as the basis of the rest of the construct.

Mediation: this would be the tools used by either the individual or the entire group, depending on how subject is defined. Relative to CSCW, it includes all computer systems involved in the activity.

Object: this is generally characterized in all the literature as the desired outcome around which actors are developing the collaborative document/text.

Community: In distance CSCW there are actually two communities: the member's permanent community and the temporary community of the group itself. Both need to be considered.

Rules: In CSCW rules may apply to the group's parameters relative to identifying document needs and ways the group will address those issues.

Division of labor: An individual writer can establish his or her own division of labor to make his or her responsibilities more manageable, and the group can divide labor relative to who does what portions of the document and how involved certain people are in the collaborative writing process.

A REPRESENTATION SCHEME FOR ASYNCHRONOUS, DISTANCE CSCW

There are various attributes inherent in distance asynchronous CSCW that would impact a representation of AT. Sharples et al (1993) point out that writers participating in a collaborative writing project may have differing strategies for writing that need to be reconciled, but they also form a social group with its own personality and dynamics (9). When considering collaborative activities, AT can be applied at the individual level or at the group level. Because of dynamics within CSCW both need to be considered when trying to understand the various relationships AT attempts to explain.

There is a synergistic effect, also known as a gestalt effect, within collaborative environments. Synergy is characterized as the notion that the whole is more than the sum of the parts. With the inclusion of each additional member of a CSCW group the

internalized elements of each member/subject and how each uses their own tools affects interactions and processes that contribute to the activity in manifold ways. Consequently, a representation scheme that uses only the group as subject will not do justice to the individual attributes of each of the group members that contribute to the activity.

Likewise, a scheme that uses only the individual as subject will not be able to capture the group dynamics inherent in CSCW. With the addition of each new member to the group dynamics increase in manifold ways. There are six (6) variables considered in the Engeström diagram (subject, tools, object, community, rules and division of labor), and there are twelve (12) different sets of interactions (double arrows between variables). With the addition of each member's individual AT diagram those six (6) variables and twelve (12) interactions are duplicated, but there are also interactions between the diagrams. So, for each additional member of the group there are twelve (12) more interactions and six (6) more variables that contribute to the group-level dynamics and that may affect individual dynamics. Additionally one must also include the group's own negotiated rules and division of labor and how the group uses common tools and how that may be different from how each member uses their own tools to which others may not have access.

An appropriate representation of AT that describes the activities of a distance, asynchronous CSCW project needs to integrate both individual and group subjects and dynamics therein as well as the computer-dependent nature of the tools used in mediation.

Attempting to integrate many of the issues and concerns identified above, Figure 3 shows a representation of AT relative to CSCW that addresses some features of

distance, asynchronous CSCW, which is further broken down in Figure 4 for clarification of the individual elements as well as group elements.

Figure 3: Proposed Diagram of AT in CSCW

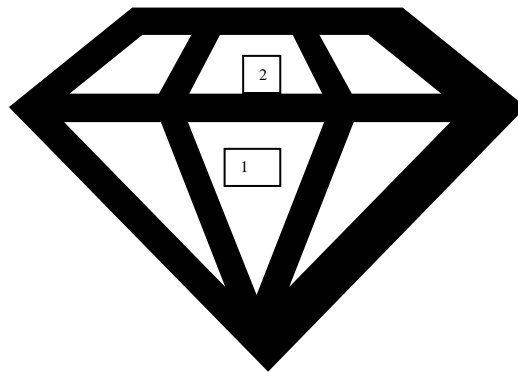
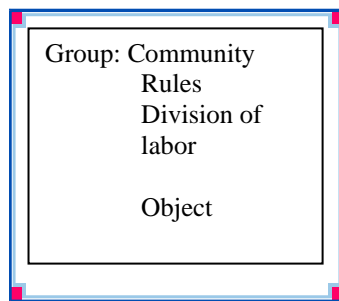
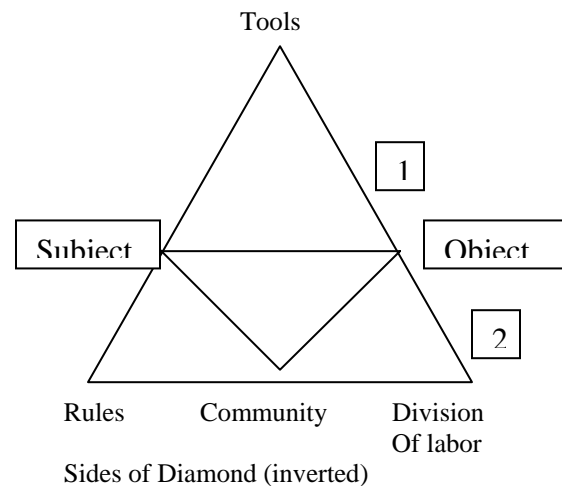


Figure 4: Dissection of Proposed Diagram



Top of Diamond



Sides of Diamond (inverted)

Each side represents each writer as an independent AT unit relative to the elements of subject, tools and object (1), using tools in their own way and influenced by their own community and understanding of rules and division labor (2). Also, different participants may have access to different software/tools as they each create portions of the text for which they are responsible. There are, consequently, individual tools used in the mediation of individual activity/tasks. To facilitate collaborative flow of information

between members there must be compatibility between some tools used by members; these are common tools which are represented by the bottom point of the diamond. Because the CSCW group is a temporary group or community, they must negotiate a set of temporary rules and division of labor for the purpose of completing the object using the tools available to them; these negotiated rules and division of labor and the common group object are represented in the top of the diamond. How each member can influence any other member's actions and knowledge is reflected within the diamond by lines connecting the various elements involved between the individual AT triangles. The number of sides of the diamond can increase with the addition of each member of the group and is dynamic throughout the activity, but the representation remains the same as it grows. All individual dynamics are inter-related and affect the group dynamics, while all individual sections are permanently affected by the group dynamics as information exchanged among group members becomes internalized by each member.

The diagram allows for the individual dynamics that are part of the CSCW activity and also acknowledges the group-level dynamics; there is interaction between sides internally (representing interaction among group members and consequential modifications to internalized elements), and the common rules and division of labor guide the group-level community efforts.

While Engeström's diagram has become the generally accepted abstraction for AT, it is necessary to build from that representation scheme more descriptive diagrams that address context-specific activity dynamics. The diagram presented here has attempted to offer more information to describe the dynamics of activity in a distance, asynchronous CSCW context. Other forms of CSCW may be represented differently.

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