Activity Theory: A Versatile Framework for Workplace Research

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During the past decade activity theory has attracted a small but influential group of researchers in two fields that contribute to theory and research in technical communication: human-computer interaction and composition studies. In my STC-sponsored research into electronic editing in technical communication, I am applying activity theory to provide a coherent explanatory perspective on the findings of the qualitative portion of my study. This paper provides a brief introduction to activity theory and applies its analytical framework to help make sense of the qualitative data I gathered on electronic editing practices and attitudes in three different technical communication workplaces.

BACKGROUND

Activity theory (AT) is rooted in the cultural-historical school of psychology that first emerged and took form in Russia from the 1920s to the 1940s. Vygotsky, Leont'ev, and Luria provided the original conceptual framework, building directly on the theories of Marx and Engels relating to the primacy of practice in shaping human consciousness [1, 2]. AT as developed by Leont'ev provided a heuristic approach to ergonomic design in Russia. In the 1980s, the theory as modified by Engeström began to be applied in human-computer interaction (HCI) research in Finland. Today, AT is an important theoretical perspective in HCI throughout Scandinavia, where it has influenced the movement toward user-involved design.

Activity theory has gained a foothold in North America through the community of researchers and theorists centered at the Laboratory for Comparative Human Cognition at the University of California at San Diego. This laboratory and its journal, *Mind, Culture, and Activity*, have promoted multi-disciplinary research in AT, along with studies in situated learning and distributed cognition. As in Europe, the HCI community in particular has begun to show an interest in AT. Bonnie Nardi, who has conducted HCI research using the activity theory framework, recently edited a collection of articles introducing activity theory to the North American HCI community [3].

Nardi contends that the goal of researchers applying AT is not to achieve reliable predictions about human behavior but to shed light on the complex experiential unity of individual cognition and social activity. AT does not offer a fixed methodology. Its conceptual tools can be applied to analyze particular activity systems using a repertoire of methods, including ethnographic field study, interviews, focus groups, case studies, and discourse analysis [2].

AT is also gaining recognition in rhetoric and composition studies through the work of North American genre theorists. David Russell [4] and Charles Bazerman [5] review several landmark studies in workplace and disciplinary writing as exemplars of the "cultural-historical approach," a rubric that can cover an overlapping mix of theoretical perspectives, including situated learning (or practice), distributed cognition, and activity theory. In other work, Russell identifies AT as the particular cultural-historical approach that holds the most promise for the study of writing [6].

Few researchers associated principally with technical communication have published studies that use AT as a framework for investigation and analysis. Clay Spinuzzi may have published the first in an analysis of critical differences between classroom and workplace "activity networks" and their implications for designing effective courses in technical and professional writing [7]. More recently, Spinuzzi has applied genre theory and activity theory in studying the evolution of a particular information systems activity network [8, 9].

I came to activity theory by way of Christina Haas's theory of embodied practice, which grew from her years of empirical research into the effects of using the computer to write and edit [10]. Haas's theory draws from the work of Vygotsky and contemporary neo-Vygotskians who advocate an approach to the study of social activity usually called situated practice. This perspective and Hass's particular spin on it, like AT, are cultural-historical approaches to the study of activity. Haas's embodied practice stresses that culture, technology, and individual cognition are intimately interrelated. "Technologies and other artifacts," Haas contends, "'encode' the knowledge of a community and allow for certain kinds of cultural activity and not others; in this way, then, technologies impact on the individuals who use them" [10: 45].

As I demonstrate in my 1998 article [11], Haas's theory of embodied practice provides an apt hermeneutic for analyzing editing as a generic activity. For analyzing a particular editing process within the activity system of a specific workplace context, on the other hand, AT provides a more comprehensive conceptual framework. In the remainder of this paper I sketch out activity theory's fundamental concepts and then apply this framework to help make sense of the editing practices in three different workplaces I visited as part of my STC-sponsored study of electronic editing.

AT'S CONCEPTUAL FRAMEWORK

An activity system is the unit of analysis in AT. In Leont'ev's original formulation, an activity system relates a subject (one or more individuals) and an object through the mediation of signs and/or tools, which are used by the subject to transform the object into an outcome [12].

Ideally, the subject's motive becomes the stabilizing feature of every activity system. The motive situates the subject intentionally with regard to the object, which is both the thing transformed by the activity and the activity's purpose, as in "the object of the game."

Contemporary activity theory defines activity systems as structured collaboration with long-term and/or continuously renewed objects, such as building a house, to use one of Kuutti's examples [2]. Analysts decompose the activity system into the principal tasks constituting it, which in AT are called actions. *Actions are goal-directed processes carried out consciously.*

An activity system consists of networks of actions; these, in turn, consist of linked *operations*, well-defined routines developed as habitual responses to conditions both evoking and mediating an action. Many actions become operations with time and practice. But an operation can also revert to the level of action, involving conscious attention, when conditions impede the execution of the action through the unconsciously performed operation [2].

Engeström, a major theoretician of contemporary AT, has expanded the basic subject-tool-object activity system model by adding two other mediated triads [13]. In Engeström's expanded activity system model, the subject's activity is constrained by its relation to a community of practice as mediated by conventions, policies, and rules. Meanwhile, the division of labor mediates the community's relationship to the object. Engeström's model also broadens the concept of tools/symbols to "mediating artifacts." In Figure 1 below, I have explicated the seven principal components of his model in terms applicable to the information development process.

I think of the basic activity systems triangle in Figure 1 as the standard lens of activity theory. It keeps an entire activity system within the frame. This standard lens has macro-focus capability, however, and can be used to "zoom in" to the level of one or more goal-directed processes (actions) that make up the activity system.

Editing in technical communication is usually a goal-directed process within the activity system of developing information products. Thus, editing is an action within an AT framework, not an activity system itself. An action within an activity system can be conceptualized in the same basic terms, however, with a subject working to transform an object into an outcome using a process mediated by artifacts. It is a close-up view of part of the activity system. For editing, the principal mediating artifacts would be the tools and procedures used to detect and communicate changes that should be made so that the finished product meets the pre-established technical and quality specifications.

Internal Contradictions and Multiple Perspectives

Studying an activity system involves a search for the system's "contradictions," the term in AT applied to dissonance within an element of a system, or any misfit between elements, or between the activity system and other systems to which it is linked. According to Kuutti,

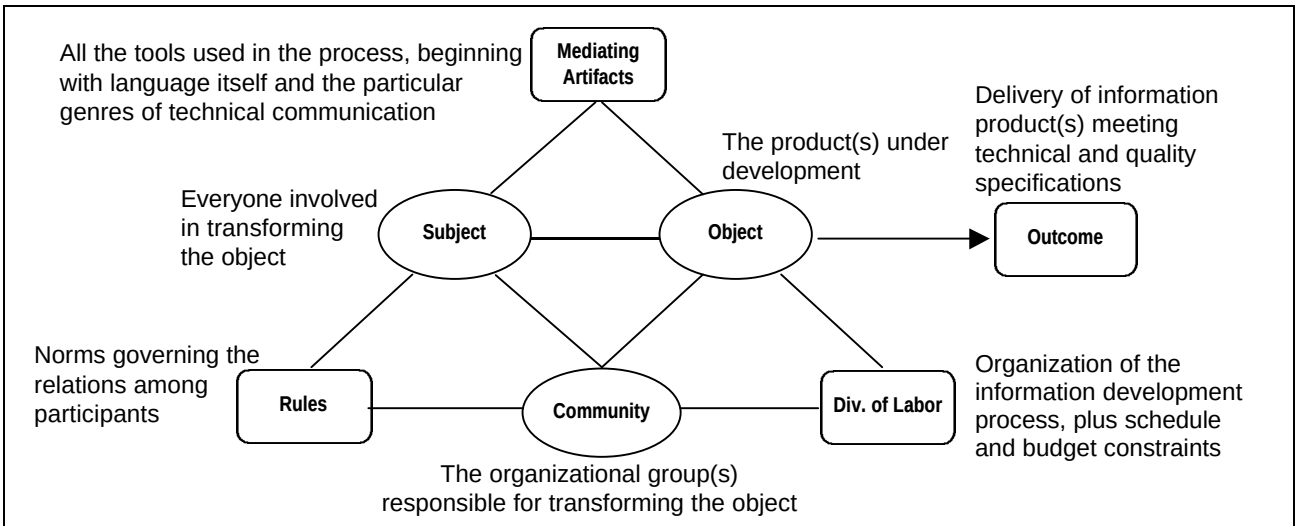

FIGURE 1. Engeström's Expanded Activity System Model Applied to Information Development

"Contradictions manifest themselves as problems, ruptures, breakdowns, clashes. Activity theory sees contradictions as sources of development; activities are virtually always in the process of working through contradictions" [2: 34].

Engeström notes that contradictions within an activity system are usually experienced as breakdowns or innovations at the level of actions, though they can only really be understood by studying the entire activity system. He argues that "it may be very fruitful to move from the analysis of individual actions to the analysis of their broader activity context and back again" [13: 32]. The goal is to achieve a better understanding of the internal contradictions spurring or blocking change. Engeström views the normal, healthy evolution of activity systems in terms of "expansive cycles," a concept of collective learning equivalent to Vygotsky's "zones of proximal development" for individuals [13: 34]. "The internal contradictions of the given activity system in a given phase of its evolution can be more or less adequately identified," Engeström maintains, "and any model for the future that does not address and eliminate those contradictions will eventually turn out to be nonexpansive" [13: 34-35].

I have sketched out the basic conceptual framework of AT and described in general terms how I apply it to a generic information development process within a technical communication workplace. In the next section I use this framework to analyze the qualitative data about electronic editing practices and attitudes that I collected from three very different workplaces.

MY RESEARCH INTO E-EDITING

Over the past two years, I have been studying the practices and attitudes of technical communicators with regard to their use of computers to edit the work of others. Between April and July 1999, I surveyed a random sample of 1,000 STC members in the writer-editor category. I first sent the survey by plain text email and attached HTML form to the 684 members in the sample for whom I thought I had valid email addresses. I received completed surveys from 446 respondents, a 65% response rate. I then mailed the same survey as a paper booklet to 328 members of the sample (everyone in the sample for whom STC did not have an email address plus those from the email group whose email addresses were invalid). I received 134 completed surveys from the postal survey, a 41% response rate. (A report on the survey results can be found at http://english.ttu.edu/dayton/.)

The survey data show that hard-copy editing is still the dominant mode of editing being used by STC members. About 52% who edit others' work use hard-copy markup and annotation most of the time; another 10% usually mark up and annotate hard copy and then enter their edits in the electronic file, using the hard copy as a record of the changes they make to the electronic copy. Though traditional hard-copy editing is still the method most often used by STC members, about 37% of the survey respondents who edit others' work do so electronically often or very frequently, and another 33% edit electronically at least occasionally.

The data suggest that certain factors tend to encourage the use of electronic editing. Two of the strongest are working at a distance from authors and editing documentation designed for online delivery. However, even when these factors are present, a significant percentage of survey respondents reported that they edit hard copy exclusively, or blend on-screen reading with hard-copy markup. Personal preference for hard-copy editing appears to be more important in predicting whether an STC member uses electronic editing.

In short, the survey data suggest that STC members implement electronic editing in a surprising variety of ways. To help explain these findings, AT directs our attention to the various ways that editing gets embedded within the activity systems of specific workplaces.

Editing at Three Different Workplaces

Prior to administering the final version of the survey, I visited three different workplaces and interviewed 18 technical communicators about editing practices and attitudes. During the interviews, I asked many questions to understand the "nuts and bolts" of the editing procedures at these workplaces—what would be designated as actions and operations within an AT analysis. I also explored individual and corporate motives for developing the editing methods being used and for occasionally choosing to use different methods. Finally, I also asked questions about aspects of the organizational culture that might have an impact on how editing was performed and valued.

I analyzed the transcripts of the tape-recorded interviews with Atlas.ti, a software application designed to help researchers code, retrieve, organize, and reduce qualitative data. In the remainder of this section, I describe the three workplaces and how each constructs the action of editing within its unique activity system of technical information development.

Computers, Inc. I spent the better part of two days, on visits several months apart, learning about the editing procedures used by the technical publications group at a large computer manufacturer in the Southwest. I interviewed the manager, three editors, and two writers. This group produced very large documentation sets consisting of 40-50 books covering both software and hardware and ranging from a dozen to 250 pages. Writers developed or revised books in FrameMaker on Unix machines and passed hard copy to the editors.

Editors passed the marked-up documents with marginal queries back to the writers. Writers would usually incorporate accepted edits and suggestions themselves. Editors then took a second look at the hard copy. After any remaining edits or issues were resolved, build support took over the FrameMaker source files and performed a production edit online prior to and in the process of converting the files into DynaText books, which were then collected into documentation sets and published on compact discs.

After converting from all hard-copy to predominantly online documentation several years earlier, Computers, Inc.'s editors, who had championed the change-over to online documentation, began to edit the FrameMaker docs online. They soon abandoned that method. Reading on-screen text was slower and more tiring, and they found it especially difficult to check labeled hardware illustrations. They went back to hard-copy edits of the FrameMaker docs, but included two more quality control checks of the DynaText books, proofreading online mainly to check links and the appearance of the converted format.

When I asked the three editors I interviewed if they would be willing to edit the FrameMaker docs online, they said they would if they were provided with good tools, techniques, and training. None of them saw any compelling reason to change their procedures, though, and all felt that editing their manuals online with the tools and techniques available to them at that time would be more inefficient, more physically stressful, and let more errors slip into the final documents. They noted the lack of a convenient change-tracking system in FrameMaker, but for them the main drawbacks to electronic editing were ergonomic. They argued that paper gave them superior portability, readability, and interactive flexibility than working with FrameMaker on Unix machines.

The two writers I interviewed generally agreed with the editors about the ergonomic advantages of hard-copy reading and editing. One writer stressed that he was against electronic editing because he wanted to enter the edits himself. He did not know of any method for marking provisional edits for review in FrameMaker files. Even if FrameMaker added a change-tracking function like the one in Microsoft Word, this writer did not think he would trust a process using it. He wanted to retain control of the source files that he alone developed.

From an AT perspective, editing at Computers, Inc., evolved when the activity system in which it was embedded changed the outcome from exclusively paper to mainly online documentation. The particular tools and procedures mediating this change in the ultimate outcome, however, kept the object being transformed in the familiar form of FrameMaker documents through the first two edits. The editors began to edit these documents online but experienced a breakdown in procedures because of the added strain and awkwardness of reading and marking up lengthy manuals on-screen. There was no exigency, such as having to work with authors at a distance, compelling the editors to accept the new electronic procedures, which over time would have become unconsciously performed, routine operations. Instead, the editors restored the smooth functioning of their re-engineered activity system by reverting to paper edits for the FrameMaker docs and using on-screen editing for two quality control checks of the documentation once it had been put into its online delivery medium.

Computers, Inc., puts a high value on the quality of its documentation sets. All five members of the technical publications group I spoke with, and their manager, stressed that their editing procedures ensured the top quality demanded by their company. They did not think that the electronic editing methods available to them for their particular configuration of software tools would allow them to maintain that level of quality.

I found that the editing procedures at Computers, Inc., fit well with the mediating tools and procedures and the underlying motive of the activity system governing information development. I would predict that this system will remain stable until disrupted by the introduction of new procedures designed to shorten the development cycle or to provide a different type of documentation, such as XML-based docs assembled on the fly according to user-defined criteria. In the first case, the object might not change, but the underlying motive would devalue quality in favor of faster turnaround. The second possibility would change the object of the activity system and probably require a major change in software and hardware tools. In either case, re-configuring the components of the activity system could create exigencies favoring the adoption of electronic markup.

The Lab. In July 1998, I paid a two-day visit to a national laboratory in the Southwest. Technical writer-editors in the Lab work for scientific and technical experts from many disciplines. A large central support group contracts out their services to internal clients. The writer-editors in the support group central office tackle a wide variety of assignments for a constantly changing clientele. Field writer-editors are assigned to separate administrative units and work with clients within that unit much like long-term contractors.

I interviewed seven technical writer-editors at the Lab about their editing practices and attitudes. All seven believed that editing on the computer was faster, more efficient, and less tedious than hard-copy editing. None of them, however, believed that electronic editing meant "paperless" editing except for very short texts. All of them gave hard copy a significant role in their usual electronic editing procedures. Several remarked that the combination of on-screen and hard-copy reading

enabled them to find more errors than they would find reading only hard copy or only on-screen text. All affirmed that in accordance with Lab policy, the client's preference determined which mode of editing they used.

Six of the writer-editors indicated that most of the editing they did was soft-copy editing. Two of them, however, began their electronic editing procedure with a thorough hard-copy markup. One would then enter the edits in Word with change tracking activated. The other would enter the edits without applying either manual or automatic change tracking. To review changes, the client would consult the marked-up hard copy.

Three writer-editors had developed their own similar but individually distinct methods for marking edits and inserting queries in Word files. They applied typographic formatting changes to highlight and differentiate deletions, insertions, and queries. Two of these writer-editors were familiar with Word's change-tracking feature but did not like it. They said that they and most of their clients found Word's method of marking changes difficult to decipher. Even two of the three editors who preferred to use Word's change tracking mentioned that many clients had difficulty figuring out how to review and respond to copy edited this way. For this reason, these editors did not use change tracking to apply style guide rules or to correct punctuation, spelling, and grammar.

The variety of specific editing procedures I discovered at the Lab is evidence that the Lab does not have a single information development activity system. What it has is a general set of parameters for the work of its writer-editors, who are recruited to take part in the activity systems of many different clients. These clients define their particular information develop processes in slightly different ways within the parameters established by the central support group. The organizational context for editing, then, would seem to defy generalization. However, I applied the AT framework by considering the central support group's parameters for editing as a generic goal-oriented process that the writer-editors must adapt to many slightly different activity systems. In analyzing what the seven writer-editors and one central support group manager told me, I found three contradictions that are potentialities within the standard editing process at the Lab. The effects of these contradictions are felt and responded to by the Lab's writer-editors on a case-by-case basis. In some cases, they may be completely obviated; in others, they may create instability in the relations between writer-editors and SMEs.

The most salient contradiction arises from the paramount goal of the central support group's standard editing process: to give the client whatever the client wants. Even though all the editors were certain that they were more efficient when editing electronically (in combination with hard-copy proofing), if a client requested a hard-copy edit, that's what they gave him. As a result, one of the writer-editors who had been with the Lab less than a year had done relatively little electronic editing there, though she much preferred it. Based in the central office, she had worked mainly for older scientists and engineers who insisted on hard-copy edits and who often wanted their secretaries to enter the approved edits into the electronic copy.

I found another contradiction in the writer-editors' perception of the superiority of electronic editing procedures. All seven writer-editors and the manager asserted that electronic editing was faster for them and, thus, more efficient than hard-copy editing. However, they all made hard-copy reading and/or proofing an important part of the editing process, and two of them usually did a careful hard-copy markup before entering edits into Word. Three others were using their own system of manually applied typographic highlighting to mark changes, rather than use Word's automatic change tracking, which would seem to be a faster, more efficient method. I take all of this as evidence of cognitive dissonance in these technical communicators' attitudes toward electronic editing.

I believe that their high regard for electronic editing was influenced at least as much by the holistic satisfaction of doing their work on a computer as by any clear-cut gains in efficiency provided by their particular procedures. Editing tasks that are sheer drudgery when marking up hard copy can become simple, automated, and highly accurate procedures when working at the computer. This obvious and undeniable advantage to electronic editing can easily get translated into a general claim about superior speed and efficiency, even when an editor's procedures for editing electronically are clearly not designed for speed alone. I think these writer-editors liked working at the computer better than working with pen and paper for a host of good qualitative reasons grounded in their particular work situations. I also think that giving hard copy a significant role in their electronic editing procedures was a common-sense response to compensate for the quality-control and ergonomic tradeoffs imposed by their electronic editing tools.

The division of labor in the Lab's editing procedures harbors a third important contradiction. As we would expect, the subject matter experts who seek the editing services of the writer-editors exercise strict ownership rights over the documents they author, rights carefully respected by the writer-editors. In many cases, however, a writer-editor takes control of the document and supervises its publication once the SMEs have signed off on it. Jobs requiring this transfer of proprietary responsibility, as it were, create an inherent contradiction. When writer-editors are responsible for making the edits in the electronic file and supervising the publication of a document, naturally they do not want SMEs to reject or change back edits that are

matters of required style or correct grammar. This motivated some of the writer-editors I interviewed to avoid change tracking in soft copy for minor mandatory edits that definitely did not change the meaning.

This inherently competitive relationship with SMEs led the technical communication manager I interviewed at the Lab to suggest a new method for electronic editing. To keep SMEs from "un-correcting" grammar and style errors, he envisioned sending PDF files to SMEs rather than the edited Word files. The PDF files would show the edited Word documents with all changes typographically marked. The SMEs would use a combination of Re:Mark and Acrobat Exchange to annotate the edited text online. With this system, the writer-editors would not need to fear that the SMEs could reject some mandatory edits in the Word file, which the writer-editors might then fail to catch after the files were returned to them. The writer-editors would retain tight control over the edited files. It seemed to me that this method would be more cumbersome and time-consuming for the SMEs to deal with than Word files with tracked changes. The only downside the manager mentioned, however, was the expense of the licenses for the two additional software products.

Cadmus Professional Communications. Known as Cadmus Journal Services when I visited their plant near Baltimore in 1998, Cadmus Professional Communications (CPC) specializes in providing production and information management services to publishers of scientific, technical, and medical journals. Beginning in the late 1980s, CPC re-engineered its copyediting, typesetting, and page makeup service, using computers to automate the copyediting process as much as possible and synchronize it with computerized typesetting. Journal manuscripts delivered on diskettes are the object transformed by this activity system, and the motive is to save clients time and money while maintaining a high level of quality. I was told that delivering electronic manuscripts to CPC saves publishers far more in typesetting costs than what they pay for the company's premium electronic copyediting services.

Managers at CPC informed me that their productivity was 25% better than before they adopted electronic editing procedures in 1989; however, shortly after going electronic, they found that using computers to edit was 20% slower than their hard-copy procedures. What brought about such a dramatic improvement in productivity? CPC managers credited the development and continuous improvement of EdiTech services, a suite of software tools for copyediting.

To begin the editing process, a media conversion tool translates authors' electronic manuscripts from whatever word processing format they are in to tagged ASCII text, which can be sent directly to the CPC typesetting system at the end of the process. Magic Redaction, another EdiTech tool, can perform hundreds of copyediting tasks before the editors even open an electronic manuscript. And CPC has developed an array of custom-made editing macros and routines that their editors use to semi-automate many of the most tedious and complex copyediting chores. (For more information, go to http://cjs.cadmus.com/about.html.)

Not surprisingly, CPC editors are enthusiastic about the benefits of electronic editing. They get more done in less time with far less drudgery. After editing a copy of the author's original file, they make a compare file using a macro and this is printed out and returned to the author. Editors use footnotes to insert queries. For standard queries, they have a menu-driven tool to automatically insert them. Some standard queries are journal-specific, with wording provided by the journal. Since the changes made by Magic Redaction are mandatory style and grammar changes, these are not shown to the author in the compare document, which shows charge bars, strikethrough type for deletions, and blue type for insertions.

CPC is a trailblazer in electronic copyediting for their particular type of activity system. After visiting them, I was tempted to hold up CPC as a model for technical editing generally. I talked about CPC's accomplishments with editors at Computers, Inc., asking if they saw any potential for making their editing processes more efficient by using custom-made macros and pattern-searching routines. All three editors agreed that such tools would be an inducement to edit online, but they doubted that their company would invest the resources to develop such tools. In thinking about what kinds of common grammar, style, and formatting errors they could always expect to find, the editor who had been with the company the longest concluded that a customized editing tool would be extremely difficult to program because they worked with so many different kinds of documents and context-bound rules.

CPC's success with electronic editing would not appear to be readily transferable to many other technical communication workplaces. The kind of editing CPC does is the kind most amenable to software assistance: Copyediting aimed at enforcing clear-cut rules that can be reliably flagged by pattern-matching and text-analysis algorithms. Nevertheless, I think that CPC's productivity gains should be regarded as a challenge by other workplaces that invest significant resources in technical and/or scientific editing.

The first step in moving a workplace toward more automation in editing would be to compile a database of the most common grammar, style, and formatting errors that have fixed or only slightly variable patterns and linguistic contexts. Using such a database, expert editors, working with programmers, could develop grammar and style clean-up programs like Magic Redaction and additional semi-automated tools to systematize and speed up copyediting.

CONCLUSION

A growing number of researchers in a wide range of fields value activity theory for its descriptive conceptual framework and the insights it provides into the myriad reasons why human behavior and consciousness so effectively evade totalizing theoretical explanations.

As my qualitative study of technical editing practices demonstrates, AT offers a pragmatic, flexible framework for analyzing the work of technical communicators *in situ.* It offers workplace researchers a model of activity as context that, I believe, bridges the traditional divide between theory and practice.

Here is a theoretical approach to workplace research that is both pragmatically empirical and consistent with a postmodern research ethic. It accommodates a range, or mixture, of qualitative methods, which can be selected to afford maximum flexibility in designing workplace studies. It values triangulation between a holistic view of an activity system and particular viewpoints within that system. It further encourages the construction of multiple perspectives by emphasizing the social, procedural, and technological mediation of relationships among activity system components.

Finally, as Nardi has noted [3], not the least of AT's attractions is that it provides a simple, concrete, and yet highly adaptable conceptual vocabulary. In so doing, it holds out the promise that researchers using qualitative methods could begin to build a more enduring and readily sharable knowledgebase, one that makes visible the commonalities in the continuously evolving activity systems of technical communication workplaces.

REFERENCES

(1) Engeström, Y., and Miettinen, R. "Introduction." In Y. Engeström, R. Miettinen, and R. Punamäki (Eds.), *Perspectives on Activity Theory* (pp. 1-16). Cambridge, UK: Cambridge University Press, 1999.

(2) Kuutti, K. "Activity theory as a potential framework for human-computer interaction research." In B. A. Nardi, (Ed.), *Context and Consciousness: Activity Theory and Human-Computer Interaction* (pp. 17-44). Cambridge, MA: MIT Press, 1996.

(3) Nardi, B. A. (Ed.). *Context and Consciousness: Activity Theory and Human-Computer Interaction.* Cambridge, MA: MIT Press, 1996.

(4) Russell, D. "Writing and genre in higher education and workplaces: A review of studies that use cultural-historical activity theory." *Mind, Culture, Activity* 4, 1998, 224-237.

(5) Bazerman, C. "Discursively structured activities." *Mind, Culture, Activity* 4, 1998, 296-308.

(6) Russell, D. "Activity theory and its implications for writing instruction." In J. Petraglia, (Ed.), *Reconceiving Writing, Rethinking Writing Instruction* (pp. 51-77). Mahwah, NJ: Lawrence Elbaum Associates, 1995.

(7) Spinuzzi, C. "Pseudotransactionality, activity theory, and professional writing instruction." *Technical Communication Quarterly* 5, 295-307.

(8) Spinuzzi, C. "Grappling with distributed usability: A cultural-historical examination of documentation genres over four decades." *ACM SIGDOC 1999: Tradition and Change in Documentation, Conference Proceedings* (pp. 16-21). New York: The Association for Computing Machinery, 1999.

(9) Spinuzzi, C. *Designing for Lifeworlds: Genre and Activity in Information System Design and Evaluation.* Unpublished dissertation. Iowa State University, Ames, IA, 1999.

(10) Haas, C. *Writing Technology: Studies on the Materiality of Literacy.* Mahwah, NJ: Lawrence Erlbaum Associates, 1996.

(11) Dayton, D. "Technical Editing Online: The Quest for Transparent Technology." *Journal of Technical Writing and Communication,* 28, 1998, 3-38.

(12) Leont'ev, A. N. *Activity, Consciousness, and Personality.* (Marie J. Hall, trans.). Englewood Cliffs, NJ: Prentice-Hall, Inc., 1978.

(13) Engeström, Y. "Activity theory and individual and social transformation." In Y. Engeström, R. Miettinen, and R. Punamäki (Eds.), *Perspectives on Activity Theory* (pp. 19-38). Cambridge, UK: Cambridge University Press, 1999.

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