

1 Introduction: Studying work as mindful practice

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The authors contributing to this volume represent a growing concern within anthropology, psychology, communications, sociology, sociology of science, and cognitive science for redefining the methods and topics that constitute the study of work. They investigate work activity in ways that do not reduce it to a “psychology” of individual cognition or a “sociology” of communication (whether “micro” or “macro”) and societal structures. The chapters aim to demonstrate approaches that have moved beyond such Cartesian orthodoxies. Mindful practices and communicative interaction are examined as situated issues at work in the reproduction of communities of practice in a wide variety of work settings including courts of law, health care, computer software design, scientific laboratories, telephone sales, control, repair, and maintenance of advanced manufacturing systems, the piloting of airliners, air traffic control, baggage handling, traffic management in underground railway systems, and auto-engine assembly plants.

Sociology of work

In sociological studies of work, two broad traditions may be identified: macrolevel discussions of the impact of technological development on the skills and organization of work and microsociological analysis of locally constructed and negotiated work activities. The macrosociological discussions [sometimes dubbed the labor-process debate (Wood, 1982; 1989)] have moved from general assessments of automation to more differentiated analyses of “post-Fordism,” flexible production, and “lean production” (e.g., Warner, Wobbe, & Brodner, 1990; Womack, Jones, & Roos, 1991; Berggren, 1992).

There is also continuing sociological analysis and debate concerning historical changes in the patterning and social positioning of work (see, for example, Adler, 1992). However, important issues appear to remain outside the conceptual and analytical terms of reference of such discussion. What is missing are issues of human agency embedded in the everyday actions and interactions of people doing work in various organizational positions and settings.

Human agency and interaction

Largely independent of the macrodebate on technology and the labor process, a microsociological discourse on work evolved. Central to this development is the work Everett Hughes (1958, 1971) and other sociologists of the “Chicago” school. They approached work and occupations as locally constructed and negotiated activities. Rooted in the common philosophical foundation of Dewey’s and Mead’s pragmatist theory of action (Strauss, 1991, 1993), this perspective provided the theoretical impetus for a number of detailed ethnographies of work based on participant observation in a range of settings (e.g., Becker et al., 1961; Glaser, 1976; Strauss et al., 1985; Harper, 1987).

The developing ethnomethodological discussion also made work an important focus of microsociological debate and empirical study. Garfinkel (1986, p. vii) wrote that “there exists a locally produced order of work’s things; that they make up a massive domain of organizational phenomena; that classic studies of work, without remedy or alternative, depend upon the existence of these phenomena, make use of the domain, and ignore it.” In exploring the “locally produced order of work’s things,” ethnomethodological debate shifted the focus onto detailed analyses of the use of language and representational practices in interaction (e.g., Lynch, Livingston, & Garfinkel, 1983; Lynch, 1985; Pollner, 1987).

From the general theoretical assumptions of ethnomethodology, conversation analysis (CA) emerged as a rigorous perspective for the study of talk in interaction. Recent CA publications have tackled varieties of talk in institutional settings. Talk-in-interaction is analyzed as “the central medium through which the daily working activities of many professionals and organizational representatives are conducted” (Drew & Heritage, 1992, p. 3).

In these microsociological approaches, contexts and structures of work are regarded as outcomes of local interactions and negotiations. Claiming that social action and interaction are formative of social structure inverts the relationship between interaction and social structures compared to those found in macrosociological arguments (Strauss, 1993, p. xii). However, within the rich texture and detail of microsociological historical issues – constantly addressed in the macrosociological literature on technological development and skills – are very often absent. This is manifested in the absence of studies on major technological and organizational transformations in workplaces. Contrasting the studies of human agency in work with those primarily concerned with transformations of work over time can be characterized as a comparison between agency-driven microsociology-without-history and historically relevant macrosociology-without-agency.

Rejoining agency and history

The chapters in this book signal a change in this regard. Many are certainly rooted in microsociological traditions. They emphasize local interaction, negotiation,

and talk. Yet, they are also representative of an emerging sensitivity to incorporate analysis of transitions and changes in work. They also represent a concern to examine reflexive relationships between situated research practices and transitions and changes attendant upon rapidly evolving new technologies and organizational forms. This new concern is manifest in many studies concerned with “computer-supported cooperative work” (CSCW) (Greif, 1988; Bowers & Benford, 1991; Schmidt & Bannon, 1992; see also Button, 1993).

This volume also highlights that interest in such issues extends beyond debates exclusively focused within various aspects of the sociological literature. Situated studies of work practices in transformation has become the focus of research across a range of literatures including psychology, communication, cognitive science, computer science, linguistics, anthropology, and education. Discipline boundaries cease to contain the areas of research when the concern is not so much in “doing” a discipline but with the way human practices emerge as work: as societally located and socially intelligible actions of reasoning and communication. In exploring issues that transcend disciplinary orthodoxies, previously underrepresented theoretical traditions, such as activity theory (Engeström, Mietinen, & Punamäki, in press), become topical and new theoretical approaches, such as distributed cognition (Hutchins, 1994), are articulated and examined.

Practice

“‘Practice! Practice! More practice!’ Such is the inscription on the flag of the new battalion of students coming from the sociology, philosophy, and history of science” (Latour, 1993, p. 487). It is no accident that the notion of “practice” has become central in such related fields of inquiry as social studies of science and technology (Pickering, 1992) and culturally oriented studies of learning and cognition (Lave, 1988; Lave & Wenger, 1991; Chaiklin & Lave, 1993). Analyzing culturally mediated work practices does not accommodate directly issues of agency and history within the same analytical stance. Rather, it is a beginning of a search for more integrative and boundary-crossing units of analysis, conceptual tools, research methods, and alliances. As Pickering (1992, pp. 6–7) points out, what is needed are “new conceptual frameworks, frameworks built out of concepts that speak directly to practice.” The search leads to questioning such basic dichotomies as subject:object and nature:society.

Mindfulness

Various aspects of analyzing work as culturally mediated practice may be distinguished. First, taking local human agency into account requires a consideration of the “mindfulness” of human action (remembering, reasoning, seeing, learn-

ing, inventing, etc.). The human practices of work are analyzable in terms of the social intelligibilities of mindful practices.

However, “mind” enters work in a very different manner than within Cartesian and “cognitivist” notions of rational planning and goal-oriented action. Cartesian rationalism breaks down with the recognition that the “cognitive” does not reside inside the heads of individuals. “Cognition” is analyzable as distributed between individuals and between humans and their artifacts (Cole & Engeström, 1993; Hutchins, 1994; Latour, 1987; Middleton & Edwards, 1990; Resnick, Levine, & Teasley, 1991). Cognitive action incorporates the manipulation of artifacts and representational media in the communicative construction of socially intelligible meanings. Work practices are ineluctably communicative practices (Weick & Roberts, 1993). The extent to which such action is termed private and “internal” mental process is a function of the manner in which individuals are located as participants in culturally mediated practices.

Artifacts

Dichotomies between instrumental and communicative actions are not very useful in this perspective. Work practices are mediated by technological artifacts. Artifacts range from notational systems and special vocabularies to machines and buildings (Gagliardi, 1990). Many of them have the potential of “making people smart” (Norman, 1988); none of them guarantee it. Information technologies provide a crucial demonstration of these two aspects of artifacts – the semiotic and the instrumental forming layers of mediation in new and complex ways.

Artifacts can come to embody the stable and structural in work practices. In Leont’ev’s (1978) terms, they may be seen as “crystallized operations.” However, artifacts are not just there. They are invented, purchased and put in use, they wear out, they are discarded and replaced by new ones. Thus, there is an ongoing dialectic between what is taken to be structural or processual, stable or dynamic, representational or discursive forms in work practices. The authors represented in this volume variously address these dilemmas of work action: of stabilization in routine or skilled performance on the one hand and disruption, innovation, and change on the other.

Expertise

The notions of expertise and skill are put in a radically new light in the chapters of this volume. Cognitivist accounts of expertise as stable individual mastery of well-defined tasks (Chi, Glaser, & Farr, 1988; Ericsson & Smith, 1991) give way to a view of expertise as ongoing collaborative and discursive construction of tasks, solutions, visions, breakdowns, and innovations.

Continuity and change

Both continuity and change can be analyzed within a single work practice, as internal systemic achievements. However, an analysis of a local practice often leads to the discovery of “a whole social network of resources beyond the confines of the . . . setting” (Laufer, this volume). It becomes necessary to trace the connections of the work practice to other practices and thus to discover and construct networks of practices. While challenging both theoretically and empirically, such a move does not have to lead to an abandonment of the principle of local agency. In social studies of science and technology, the actor network theory of Callon (1992) and Latour (1992; see also Grint, 1991) represents an attempt in this direction.

Data sources

Many of the chapters in this volume use transcripts of conversations from work practices as their primary data. These strips of discourse are regularly embedded in thick ethnographic descriptions of the institutional setting and flow of work actions. Several chapters focus on the dilemmatic, argumentative, and contradictory aspects of talk at work, pointing to the nature of work practices as continuous problem solving and resolution of local crises. The transcripts also bring out multiple voices from the communities of work practice. Many of the papers exemplify an effort to conduct what Clifford (1988) termed “dialogical” and “polyphonic” ethnography, “surrendering large spaces of the ethnographic text to direct . . . transcriptions of the informants’ voices” (Hess, 1992, p. 9). In some of the chapters, the multivoicedness of work practices is highlighted by means of systematic comparisons. These include analytic contrasts between the viewpoints of workers situated in different locales and roles, between novices and experts, between two plants, and between cultural setting.

Modalities in presentation

Throughout the chapters, transcripts of talk are complemented and enriched by visual representations of work settings and specific sequences of interaction. This complementarity of textual and graphic modes of representation is a distinctive expansion of the more traditional models of discourse and conversation analysis. The visual representations employed by the various authors range from straightforward use of photographs to diagrammatic conceptual models. It seems that focusing on the mediational roles of artifacts clearly calls for multiple modalities, for “thinking with eyes and hands” (Latour, 1986). Visual representations serve a reflexive function in that they break down the tight flow of written argument, forcing both the writer and the reader to stop and look, and then to re-align the two modalities.

Doing work and research

The chapters illustrate the study of work as produced in the local pragmatics of communication concerning “what it is to know what to do” as distributed within the reproduction and continuing creation of communities of practice. In doing this, the chapters demonstrate an integration of previously separated domains: work as a topic for members of communities of practice and as a topic of study. Thus, a particular concern of the volume is to examine the reflexive relationship between research methodologies that analyze work as situated practice and their impact on that practice.

Settings

The empirical chapters in this volume explore “the doing” of thinking, learning, and communicating in a variety of work settings. Two theoretical chapters (by Susan Leigh Star and Arne Raeithel) provide concluding theoretical commentaries on the issues raised and findings presented in the empirical chapters.

“Distributed Cognition in an Airline Cockpit” by Edwin Hutchins and Tove Klausen (Chapter 2) is a case study that illuminates the analytic possibilities of a new approach in cognitive science. In his earlier research on the organization of work, Hutchins developed a theory of distributed cognition that takes as its unit of analysis a culturally constituted functional group rather than an individual mind. This theory reconceptualizes “information” as the propagation of representational states of mediating structures that make up the dynamic and substance of any complex system. These structures include internal as well as external knowledge representations, (knowledge, skills, tools, etc.). This approach permits descriptions of knowledge generation by tracing the movement of representations of states of affairs through a system and characterizes the organization of the system that affords performance, as individual members and as a functioning group.

In previous work Hutchins (1990, 1995) examined the distributed nature of navigation procedures on a large ship. In the study presented here, the focus shifts to another complex work setting, that of flying an aircraft. Again, the emphasis is on the way members of the air crew and ground staff handle uncertainty in the coordination of their actions in safely flying the aircraft. The functional group of the cockpit crew exercises its expertise in flexible ways within conventionalized patterns of command and division of labor. Hutchins and Klausen argue that to understand the flexible expertise within a cockpit system involves more than an account of any putative cognitive properties of the individual pilots, second officers, and air traffic controllers. The cognitive properties of the functional group that makes up the cockpit system “are also determined by the physical properties of the representational media across which the task-relevant repre-

sentational state is propagated, by specific organization of the representations supported in those media, by the interactions of metarepresentations held by the members of the crew, and by the distributional characteristics of knowledge, and access to task relevant information across the members of the crew.” Crucial, then, to such an analysis is a consideration of the technological artifacts that afford varieties of representations concerning the current state of the plane over the duration of any particular journey.

Lucy Suchman’s pathfinding book, *Plans and Situated Actions* (1987), adopted an ethnographic analysis based on insights drawn from ethnomethodology in the analysis of human–machine communication. The overall conclusion of her analysis of our interactions with complex technologies was that the structure of action could not be explained either in terms of existing cognitive schema or as determined by institutionalized social norms. The work Suchman reports here (Chapter 3) adopts this perspective in an analysis of the way shared work spaces are interactionally produced in the service of joint work. The airline industry once again comes under close scrutiny, but this time it is work activity of the ground-operations room of a mid-sized metropolitan airport in the United States. Handling the vagaries of schedule changes and breakdowns cannot be predetermined or dealt with in a random manner. Suchman’s aim is to examine the accomplishment of order within episodes of routine trouble through a detailed analysis of a particular episode of a plane arriving at a gate and the routine difficulties encountered in coordinating deplaning the passengers. She examines how participants formulate an awareness of the problem from their own particular organizational and physical locales, and then develop a shared orientation to the situation and establish places for the achievement of coordinated work necessary to overcome those routine problems. She reveals how the centers of coordination cannot be conceived of as preestablished but are continually reconstituted within the complex dynamic of relations of technology, persons, and space.

Charles Goodwin and Marjorie Harness Goodwin (Chapter 4) analyze the relations between skilled work and the material environments within which it occurs. Their data is drawn from a parallel study of the same work situation examined by Suchman. They share a concern to understand the ordered accomplishment of resources that are deployed in the coordination of jointly realized work. Their extension of conversation analytic insights to the taken-for-granted assumptions of how the objects of working practice (planes) are actually “seen” by ground-control operatives challenges the preconceptions of studies that assume those objects to have a nonproblematic status, either as objects of working concern or as a priori analytical categories. They approach seeing as an activity constructed within the complex dynamic of the operations room. In doing so they demonstrate that it is analyzable as an emergent property of the ordering of communicative interactions rather than dependent upon preexisting cognitive schema or cultural categories. In examining how airport personnel look at planes, behav-

ior as minute as a momentary glance becomes significantly structured by organizational practices, by the tools mediating their contact with the working environment, and by the local community that sustains their working practice. Practitioners must learn to see in organizationally appropriate ways the routine scenes of their work. Goodwin and Goodwin argue that formulating task-relevant views is crucial to the accomplishment of collaborative work.

These authors apply conversation analytic techniques to human interactions while acknowledging their being situated within a material world shaped by the historical activities of others. In doing this they explore links between conversation analysis (CA), activity-theoretical concepts drawn from the writings of Vygotsky and Leont'ev, and the growing discussions on distributed cognition.

Two chapters (5 and 6) are also concerned with technological mediation of collaborative work. However, they address their discussions of empirical findings directly to implications for the design and development of technologies to support complex cooperative work activities.

Christian Heath and Paul Luff (Chapter 5) share the analytical approach of the previous two chapters in being concerned with ethnomethodologically oriented investigations of work practices and conversational interactions. They argue that despite technical advances in the area of system support for cooperative work, over the past few years there still has been relatively little understanding of the organization of collaborative activity in real-world, technologically supported work environments. They discuss the possibility of applying recent developments within sociology, and, in particular, the naturalistic analysis of organizational conduct and social interaction, as a basis for the design and development of tools and technologies to support collaborative work. Focusing on the Line Control Rooms of London Underground, a complex multimedia environment in transition, they begin to explicate the informal work practices and procedures whereby personnel systematically communicate information and coordinate a disparate collection of tasks and operations. Their investigations form the basis for the design of new tools to support collaborative work in the Line Control Rooms, technologies that are intended to be sensitive to the ordinary conduct and practical skills of London Underground personnel. This emphasis on ordinary work practices and situated conduct is argued to be the key to successful technological reform that has in the past been insensitive to such local and apparently mundane issues.

Susanne Bødker and Kaj Grønbaek (Chapter 6) are also concerned with tools for cooperative work. However, their direct concern is with development of computer software that is capable of supporting complex cooperative work situations. The chapter illustrates their approach by examining the design of computer support for casework in a technical department of a Danish municipality. Their analysis is doubly reflexive. They are embedded as researchers within the cooperative processes they are both designing, researching, and producing tools for.

In addition, the very activity of prototyping is used as a way of exploring and developing the work situation it is being formulated to support. Bødker and Grøn-bæk analyze cooperative prototyping wherein users are involved actively and creatively in design of the computer applications they might subsequently employ and in a reflexive analysis of the work situation they are involved with. The chapter examines situations that occur where openings for learning are created during the design process. The research methodology is based on a view of learning that is principally concerned with identifying innovations in practice in order to expand the range of application of that community of practice (Engeström, 1987). The authors deploy concepts derived from Activity Theory in order to discuss transformations of working practice. This activity-theoretic discussion is elaborated further in the next three chapters (7, 8 and 9) by Leena Norros, Edith Laufer and Yrjö Engeström.

Leena Norros's analysis (Chapter 7) concentrates on the disturbances to practice that occur as a result of the implementation of new technologies in industrial work processes. She argues that no matter how good the design of complex processes is, unpredictable future demands and potential design faults create uncertainty in the functioning of any system. It inevitably falls to the operators of any system to cope with the consequences of that uncertainty. The discussion is based on analysis of the way operators handle disturbances in the flexible manufacture of machine gears. Rather than viewing system disturbances as inevitably detrimental to plant functioning, the analysis demonstrates that they provide a basic resource for transforming both the flexible skills of the operator and the refinement of the production process itself. The analysis provides a basis for developing a model of system disturbance that can be used as a framework for developing operator expertise as part of collaborative working practices. In addition this model highlights that situated practice is enlivened by operator concerns that extend beyond the immediate demands of skilled performance. Operators' accountabilities to others, as employees and breadwinners, colleagues and citizens are also sources of practical uncertainty. The tension between these local and general concerns is examined in the mapping out of a model that both accounts for and can be used as a springboard for the development of operator expertise.

Edith Laufer's and Joseph Glick's contribution (Chapter 8) is also concerned with transformations in working practice from an activity-theoretic perspective. They focus on what is involved in "being" an expert in a community of practice. They provide a detailed comparison of novice and expert functioning in the production of cost estimates for customers seeking to purchase a complex range of manufactured fasteners (e.g., nuts, bolts, screws, washers, etc.). Through detailed ethnography, experimental modeling of the work setting, and interviews, they identify both what it is to do cost estimations on customer's orders and what it is to be an expert cost estimator in comparison to being a novice in this business setting. Their work challenges orthodox cognitive models of novice-expert dif-

ferences as residing primarily in the quality and sophistication of their problem representation. Expert estimation is revealed as involving serendipity and guesswork. If the analytic focus remains on individual actions of what it is to do estimating, then the actions of expert estimators are not socially intelligible, they flout basic information requirements for producing an “accurate costing.” The critical contribution of such guesswork can only be understood within an analysis of what it is to be an estimator within a culture of business practice. Laufer and Glick demonstrate how the analytic concepts developed within the framework of activity theory afford an analysis of work practices that bridges individual–societal dualisms.

Yrjö Engeström’s (Chapter 9) continues the analysis of expertise as realized in joint rather than individual activity. This comparative study of courts of law in Finland and California examines the range and variability of participants’ (both the judiciary and the defendants) orientation or voice in formulating the issues and procedure in drunk-driving cases. Engeström identifies and compares the varieties of voices these two judicial locations generate in dealing with their work loads. Differing deployment of voices and the handling of mismatches between unpredictable features of a case and inflexible procedural rules, judicial instruments, and divisions of labor provide both an analytical framework and participants’ resources for working out what collective procedures might be available to resolve dilemmas within particular cases and current practice. The analysis of disturbances within the flow of routine procedure is again seen to be the key to understanding human expertise as ordered within the contingencies of local rather than general circumstances. Expertise is argued to be understood as formulable as part of ordered social interactions rather than preexisting cognitive schema and as containing the basis for the creative generation of new ways of doing things rather than depending upon the orthodoxy of received wisdom.

The final three empirical chapters deal directly with accomplishment of collectivity in work settings.

David Middleton’s chapter (Chapter 10) examines examples of unscheduled conversations about team work recorded in a multidisciplinary Child Development Centre (CDC) at a British National Health Service (NHS) hospital. The analysis examines the construction of collectivity in team practice that occurs through the argumentative structure and content of team conversations. Two specific issues are discussed. First, an analysis is made of the consequences of conversationally realized argumentation for the way team members generated and maintained common knowledge for current cases and procedures. The analysis then focuses on the rhetorical resources available to team members in improvising interim solutions to unexpected problems. The analytic perspective adopted examines “team practice” as a topic of concern within teams. This involves taking account of the way members formulate what is to do the teamwork. In dealing with uncertainties in the representation of practice, team members’ talk gives