Improvising Organizational Transformation Over Time: A Situated Change Perspective

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In this paper, I outline a perspective on organizational transformation which proposes change as endemic to the practice of organizing and hence as enacted through the situated practices of organizational actors as they improvise, innovate, and adjust their work routines over time. I ground this perspective in an empirical study which examined the use of a new information technology within one organization over a two-year period. In this organization, a series of subtle but nonetheless significant changes were enacted over time as organizational actors appropriated the new technology into their work practices, and then experimented with local innovations, responded to unanticipated breakdowns and contingencies, initiated opportunistic shifts in structure and coordination mechanisms, and improvised various procedural, cognitive, and normative variations to accommodate their evolving use of the technology. These findings provide the empirical basis for a practice-based perspective on organizational transformation. Because it is grounded in the micro-level changes that actors enact over time as they make sense of and act in the world, a practice lens can avoid the strong assumptions of rationality, determinism, or discontinuity characterizing existing change perspectives. A situated change perspective may offer a particularly useful strategy for analyzing change in organizations turning increasingly away from patterns of stability, bureaucracy, and control to those of flexibility, self-organizing, and learning.

(*Groupware; Improvisation; Situated Practice; Technology-based Organizational Change*)

Introduction

Organizational transformation—substantially changing an organization's structure and practices—has always been of interest to researchers and practitioners. For decades, however, questions of transformation remained largely backstage as organizational thinking and practice engaged in a discourse dominated by questions of stability. Oriented around the organizing principles of mass production and bureaucracy, such a discourse emphasized routinization, standardization, control, and automation. Today however, many organizations face an altered economic, political, and technological world, a world in which flexibility, customization, and learning are the watchwords, and visions of agile manufacturing, virtual corporations, and self-organizing teams are prominent. In such a world, stability is out, change is in.

As the backstage becomes increasingly center stage, it seems appropriate to examine the kinds of models that currently inform our understandings of organizational transformation, and to consider their adequacy in the light of this new organizational stage. A range of perspectives on organizational transformation have developed over the past few decades (see Pettigrew (1985) and Wilson (1992) for extensive reviews). However, many of these perspectives—grounded as they are in the prior discourse of stability—are often poorly suited to a world where change is no longer a background activity but a way of

1047-7047/96/0701/0063$01.25

organizational life. These perspectives embody assumptions about agency, context, technology, and change which may be inappropriate given the different social, technological, and economic conditions emerging today. To illustrate, consider three perspectives that have influenced studies of technology-based organizational transformation—planned change, technological imperative, and punctuated equilibrium.

Planned change models presume that managers are the primary source of organizational change, and that these actors deliberately initiate and implement changes in response to perceived opportunities to improve organizational performance or "fit" with the environment. Such models have dominated the organizational change and development literatures, and include force field analysis (Lewin 1951), contingency frameworks (Burns and Stalker 1961, Galbraith 1973, Dunphy and Stace 1988, Miles and Snow 1984), innovation theories (Hage and Aiken 1970, Zaltman et al. 1973, Meyer and Goes 1988), and practitioner-oriented prescriptions for organizational effectiveness (Deming 1986, Peters and Waterman 1982, Hammer and Champy 1993). This perspective has been criticized for treating change as a discrete event to be managed separately from the ongoing processes of organizing, and for placing undue weight on the rationality of managers directing the change (Pettigrew 1985). From the vantage point of the new organizing discourse with its presumption of frequent change, learning, and self-organizing, such disembedding of change from the ongoing stream of organizational action, and heavy reliance on foresightful managerial action are problematic.

In opposition to the voluntarism of planned change models, the *technological imperative* perspective affords little discretion to managers or any other organizational actors. Technology is seen as a primary and relatively autonomous driver of organizational change, so that the adoption of new technology creates predictable changes in organizations' structures, work routines, information flows, and performance (Blau et al. 1976, Carter 1984, Huber 1990, Leavitt and Whistler 1958). These organizational notions of a "technological imperative" echo a broader strain of technological determinism evident in socio-historical studies (Winner 1986), economic analyses (Heilbroner 1967), and contemporary culture (Smith and Marx 1994) where the seduction of a "technological fix" is largely taken for granted. The absence of any significant role for agency in this perspective undermines possibilities for proactive organizational change, which is problematic for the new organizing discourse where assumptions of agility and flexibility require actors to explore, learn, and innovate new alternatives for working and organizing over time and in different circumstances. In addition, the deterministic logic of the technological imperative is incompatible with the open-ended nature of many new technologies which assume considerable user customization (Malone 1995), and thus user construction of capabilities and effects.

Punctuated equilibrium models arose in opposition to gradualist models which posit that organizational change is slow, incremental, and cumulative (Meyer et al. 1993). In contrast, punctuated equilibrium models assume change to be rapid, episodic, and radical. Gersick (1991, p. 12) writes that: "relatively long periods of stability (equilibrium) [are] punctuated by compact periods of qualitative, metamorphic change (revolution)." Punctuated discontinuities are typically triggered by modifications in environmental or internal conditions, for example, new technology, process redesign, or industry deregulation. Such punctuated models have informed macro studies of long-term shifts in various industries (Abernathy and Clark 1985, Romanelli and Tushman 1994, Tushman and Romanelli 1985), while elaborations of this perspective have proposed a hybrid of the punctuated equilibrium and gradualist logics (Miller and Friesen 1984, Mintzberg 1987, Pettigrew et al. 1992, Tushman and Anderson 1986). Both the punctuated equilibrium perspective and its hybrids raise difficulties for the new organizing discourse because they are premised on the primacy of organizational stability. Whether improving an existing status quo or shifting to a new one, the assumption underlying these models is that the preferred condition for organizations is some sort of steady state or "equilibrium" (Mintzberg 1987). This presumption of stability (which is also shared, although more implicitly, by the planned change and technological imperative perspectives) begs questioning in a context of organizations experimenting with essentially nonstable organizational forms, processes,

and technologies (e.g., self-organizing, flexible, customizable).

All three of the perspectives reviewed above also neglect what—following Mintzberg's (1979, 1987) distinction between deliberate and emergent strategies—may be termed "emergent change." Where deliberate change is the realization of a new pattern of organizing precisely as originally intended, emergent change is the realization of a new pattern of organizing in the absence of explicit, a priori intentions. Such emergent change is only realized in action and cannot be anticipated or planned (Mintzberg and Waters 1985). Because they are abstracted from the ongoing and grounded activities of organizational actors, the three perspectives on technology-based organizational transformation do not easily account for emergent change. Yet, the notion of emergence is particularly relevant today as unprecedented environmental, technological, and organizational developments facilitate patterns of organizing which cannot be explained or prescribed by appealing to a priori plans and intentions. The variety of economic and social activity that has appeared on the World Wide Web in the past two years is just one recent and powerful example of such emergence.

The current discourse on technology-based organizational transformation thus embodies assumptions which are problematic in the light of an organizing discourse emphasizing emergence, flexibility, and self-organization. A perspective that posits change rather than stability as a way of organizational life may offer a more appropriate conceptual lens with which to think about change in contemporary organizations. I outline such an additional perspective in this paper, suggesting that it affords a particularly powerful analytical strategy for examining and explaining technology-based organizational transformation.

A Situated Change Perspective

The new perspective proposed here is premised on the primacy of organizing practices in organizational change. While earlier practice-based research challenged the conventional wisdom that incremental changes always occur gradually (Tyre and Orlikowski 1994), the research discussed here questions the beliefs that organizational change must be planned, that technology is the primary cause of technology-based organizational transformation, and that radical changes always occur rapidly and discontinuously. While recognizing that organizational transformation can be and often is performed as a deliberate, orchestrated main event with key players, substantial technological and other resources, and considerable observable and experiential commotion, I want to explore another kind of organizational transformation here, one that is enacted more subtly, more slowly, and more smoothly, but no less significantly. Such organizational transformation is grounded in the ongoing practices of organizational actors, and emerges out of their (tacit and not so tacit) accommodations to and experiments with the everyday contingencies, breakdowns, exceptions, opportunities, and unintended consequences that they encounter. March (1981, p. 564) notes:

> Because of the magnitude of some changes in organizations, we are inclined to look for comparably dramatic explanations for change, but the search for drama may often be a mistake . . . Change takes place because most of the time most people in an organization do about what they are supposed to do; that is, they are intelligently attentive to their environments and their jobs

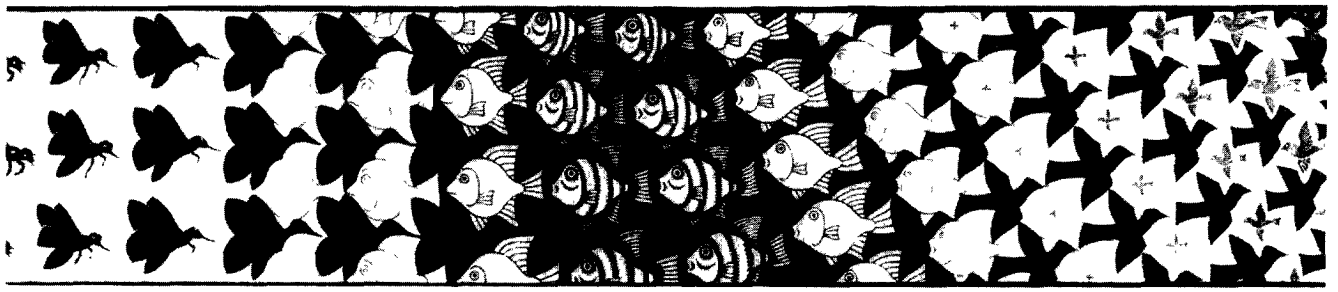
Barley (1988, p. 51), similarly writes:

> . . . because forms of action and interaction are always negotiated and confirmed as actors with different interests and interpretations encounter shifting events (. . .), slippage between institutional templates and the actualities of daily life is probable. In such slippage resides the possibility of social innovation

In this perspective, organizational transformation is not portrayed as a drama staged by deliberate directors with predefined scripts and choreographed moves, or the inevitable outcome of a technological logic, or a sudden discontinuity that fundamentally invalidates the status quo. Rather, organizational transformation is seen here to be an ongoing improvisation enacted by organizational actors trying to make sense of and act coherently in the world.

Invoking the notion of improvisation to understand organizational transformation owes much to Weick's (1993) claim that our ideas about organization design are based on an inappropriate architectural metaphor which portrays it as "as a bounded activity that occurs at a fixed point in time," focusing on "structures rather than processes . . . [where] structures are assumed to

Figure 1 **Metamorphosis**



be stable solutions to a set of current problems" (1993, p. 347). Instead, Weick proposes the metaphor of theatrical improvisation, where organization design (1993, pp. 348–351):

> . . . tends to be emergent and visible only after the fact Thus, the design is a piece of history, not a piece of architecture. Design, viewed from the perspective of improvisation, is more emergent, more continuous, more filled with surprise, more difficult to control, more tied to the content of action, and more affected by what people pay attention to than are the designs implied by architecture

The notion of change as ongoing improvisation resonates with the focus on situated action taken by practice researchers (Hutchins 1991, Lave 1988, Suchman 1987). In contrast to the classical view of change as a process of managerial planning, design, and intervention, Hutchins, for example, argues that "several important aspects of a new organization are achieved not by conscious reflection but by local adaptations" (1991, p. 14). In research on information technology, Rice and Rogers' (1980) concept of "reinvention" and Ciborra and Lanzara's (1991) notion of "designing-in-action," similarly echo some of the situated and improvisational ideas invoked here.

The kind of change process I intend with the notion of situated change is well illustrated by Escher's *Metamorphose* series (see Figure 1) where, as the artist explains, through the passage of time, "a dynamic character is obtained by a succession of figures in which changes of form appear gradually" (Escher 1986, p. 120). Each variation of a given form is not an abrupt or discrete event, neither is it, by itself, discontinuous. Rather, through a series of ongoing and situated accommodations, adaptations, and alterations (that draw on previous variations and mediate future ones), sufficient modifications may be enacted over time that fundamental changes are achieved. There is no deliberate orchestration of change here,[1] no technological inevitability, no dramatic discontinuity, just recurrent and reciprocal variations in practice over time. Each shift in practice creates the conditions for further breakdowns, unanticipated outcomes, and innovations, which in their turn are responded to with more variations. And such variations are ongoing; there is no beginning or end point in this change process.

A view of organizational transformation as situated change is grounded in assumptions of action, not stability. Organizations are enacted. They are constituted by the ongoing agency of organizational members, and have no existence apart from such action (Giddens 1984). Every action taken by organization members either reproduces existing organizational properties or it alters them. Through sustained adjustments in organizing practices—however unintentional and unacknowledged—social changes can be enacted. Change is thus inherent in everyday human action. This basic premise of the situated change perspective echoes March's observation that "in its fundamental structure a theory of organizational change should not be remarkably different from a theory of ordinary action" (1981, p. 564). Informed by Giddens' (1984) notions of structuring, Weick's (1993) improvisational metaphor, and the insights of practice research, this paper outlines a per-

[1] While Escher, as artist, clearly orchestrated the metamorphoses exhibited, he has depicted the transformation process as driven by a situated momentum

spective on change as inherent in everyday practice and as inseparable from the ongoing and situated actions of organizational members. Such a perspective emerged as central to my analysis of an organization implementing and using new information technology.

In the research study described in this paper, I examine how subtle shifts in action by organizational actors transformed—over a two-year period—aspects of their work practices, organizing structures, and coordination mechanisms, and I explore the implications of such shifts for the organization. My analysis laid the groundwork for a practice-based perspective which offers a conceptual lens with which to focus on types of transformations not discernible to the perspectives of planned change, technological imperative, and punctuated equilibrium. The situated change perspective is offered as a complement to, not a substitute for, the existing change perspectives. In most organizations, transformations will occur through a variety of logics. Indeed, the study discussed reveals elements of planned and punctuated change triggered by managerial action around the implementation of new technology. More significantly, however, the study reveals the critical role of situated change enacted by organizational members using the technology over time. Such a practice logic has been largely overlooked in studies of organizational transformation, and appears to be particularly relevant to contemporary concerns of organizing; hence, it is the focus of my attention here.

Research Setting and Methodology

Site

Zeta Corporation[2] is a software company headquartered in the Midwest, with sales and client service field offices throughout the United States and the world. Zeta is one of the Top 50 software companies in the US, with $100 million in revenues and about 1,000 employees. The company produces and sells a range of powerful software products, which run on a variety of computing platforms. These products provide capabilities of decision support and executive information analysis, and are used by thousands of corporations around the world.

The focus of my study was the Customer Support Department (CSD) which is part of the Technical Services Division headed by a senior vice-president. The CSD is a 53-person department run by a director and two managers, which has traditionally had a very cooperative culture, reflecting a collegial management style and a shared interest in solving customer problems. The mission of the CSD is to provide technical support via telephone to all users of Zeta's products, including clients, consultants, Zeta field service representatives, and other Zeta employees. This technical support is provided by Customer Support Specialists (hereafter referred to as specialists), all of whom have been extensively trained in Zeta's products and in techniques of technical support. The department has grown from 10 specialists in 1990 to its current high of 50 specialists. All the specialists have college degrees, mostly in computer science, engineering, and business information technology. Many of the specialists view their current position as an entry point into the high-tech industry, and few intend to make technical support a career. Although turnover of specialists in CSD is high (as in other companies), the rate has declined over the past two years. When specialists leave the CSD many stay within Zeta, moving laterally into departments such as product management and field service.

Customer support at Zeta, as is often in the case in technical support (Pentland 1992), is a complex activity. Customer calls are rarely resolved with a brief answer. They typically require several hours of research and include searches of reference material, review of program code, and attempts to replicate the problem. Some incidents will require interaction with members of other departments such as development and quality assurance. Problems identified by specialists as bugs are sent on to product development where they will be assessed for criticality and if appropriate, scheduled for correction. The volume of calls to the CSD has increased significantly in recent years due to new product introductions and the growing range of operating platforms supported. Currently, the department receives an average of 100 calls a day, although volumes fluctuate by time of month, season, and maturity of product. Specialists, working in four-hour shifts, rotate their time "on the

[2] Names of the organization, its departments, members, products, and technology applications have all been disguised

phones," so that in any one day about 20 specialists will take calls from customers.

In January 1992, an initial purchase of the Notes technology (from Lotus Development Corporation) was made to explore the feasibility of using Notes as a technological platform for tracking customer calls. At the time, the CSD was using a home-grown system (Inform), but significant problems with its use made replacement a priority. On the acquisition of Notes, an implementation team including a developer newly assigned to the Technical Services Division, one of the CSD managers, and several specialists designed and tested a trial call-tracking system within Notes. By mid-1992, the Incident Tracking Support System (ITSS) had been developed, and evaluations of its use in practice began. Two phases of this evaluation were conducted: an experimental pilot from July to September 1992, and an expanded pilot from September to December 1992. By the end of 1992, the decision was made to commit to the use of Notes as the platform for tracking all customer calls, and additional licenses for Notes were bought. This set the stage for a full roll-out of ITSS to all members of the CSD, and the enactment of the organizational changes which are the focus of this discussion.

Table 1 Number and Type of Interviews in Zeta in Phase I and II

	Phase I	Phase II	Total
Senior Management (division and department)	2	3	5
Group Management	4	4	8
Specialists	7	20	27
Technologists	1	6	7
Other Members (developers, QA, etc.)	—	4	4
Total	14	37	51

Data Collection and Analysis

Data collection at Zeta was conducted in two phases. Phase I (see Gallivan et al. 1993) took place at the time of the two pilots (August–December 1992), while Phase II occurred two years later (July–December 1994). Both phases involved the use of unstructured and semistructured interviewing, observation, and document review. Fifty-one interviews of 60–90 minutes in length were conducted across the two phases. All interviews were recorded and transcribed. Participants spanned vertical levels and functional groupings, and included specialists from the CSD, both CSD managers, the CSD director, the Technical Services senior vice-president, the technologists responsible for the new technology, and members of the product development, product management, and quality assurance departments (Table 1 shows a breakdown by function, level, and phase). Observation took the form of sitting with specialists when they were on and off the phones, and taking notes on their work practices, particularly their use of the Inform and ITSS technologies. Specialists were encouraged to talk aloud about what they were doing, and these descriptions were supplemented with questions probing particular issues. Materials reviewed included the set of user manuals for Notes and ITSS (which provided detailed information on the design and functionality of the technology), the report documenting the feasibility of acquiring a new incident tracking system (which revealed the intentions underlying the implementation of ITSS), management reports generated in ITSS (which showed the kinds of resource and output tracking conducted by the CSD managers), and samples of the ITSS database records (which allowed an examination of the types of documentation being generated by specialists).

I used qualitative techniques to analyze the data (Eisenhardt 1989, Miles and Huberman 1984, Pettigrew 1990, Strauss and Corbin 1990), informed by the overall focus on practices, change, and structuring and a more detailed attention to grounded concepts. I first read all the interview transcripts, observation notes, and documentation to identify issues and topics that related to work practices and change. After analyzing and aggregating these to arrive at a set of common or recurring themes, I then reexamined the data in terms of the new set of common themes, paying particular attention to the enactment of change, the role of technology, and the passage of time. The feasibility report completed in 1991 and the Phase I data collected during 1992 allowed me to distinguish between deliberate and emergent organizational changes, and to determine the timing of deliberate changes. The timing and order of emergent changes were more difficult to establish but were assessed from participants' interviews and the schedule

of technology updates. I shared my preliminary findings with the specialists and managers of the CSD, and they provided helpful comments which confirmed and elaborated the identified issues and themes.

The focus of analysis in this study was the everyday practices of the specialists and their managers, and while work practices were observed during on-site data collection, the ongoing changes enacted over the two years were not observed first hand. Ideally, a study of such changes would involve the sorts of extensive and intensive participant observation enabled by techniques of organizational ethnography (Van Maanen 1979, 1988). This was not possible in the current study, but the data collected proved adequate to distinguish five different situated changes.

Results

My analysis suggests that the organizing practices and structures of Zeta's CSD changed considerably over the two years following implementation of the ITSS technology. The transformation, while enabled by the technology, was not caused by it. Rather, it occurred through the ongoing, gradual, and reciprocal adjustments, accommodations, and improvisations enacted by the CSD members. As will be detailed, their action subtly and significantly altered the organizing practices and structures of the CSD workplace over time, transforming the texture of work, nature of knowledge, patterns of interaction, distribution of work, forms of accountability and control, and mechanisms of coordination. Five metamorphoses may be distinguished during the two-year period, and while this analytical division provides a convenient way of anchoring a discussion of CSD's transformation, it is conceptually imprecise because the organizational changes were (and continue to be) fluid and ongoing, so that any sharp partitioning of change is misleading. The process of gradual transformation in the CSD was practically enacted in a much less discrete and organized fashion than can be suggested textually. Depiction of the overlapping and ongoing nature of this transformation is attempted in Figure 2 which shows the situated changes as enacted through a structuring process over time.

The structuring process underlies the ongoing production and change of social practices. It posits a recursive relationship between the everyday actions of human agents and the social structures which are both medium and outcome of those actions. Figure 2 depicts the social structures focused on here, the organizational properties of Zeta and the CSD. These included authority relations, division of labor, strategies, incentive systems, evaluation criteria, policies, work culture, etc., which represented the institutionalized aspects of the Zeta and CSD social systems. These constrained and enabled the production of ongoing practices by members of the CSD, while also being changed over time by those practices, as suggested by the variation in shading of Figure 2. Technology is not specifically depicted in Figure 2, but it played a critical role in mediating the changes in practices and structures. The conceptualization of technology drawn on here is informed by structurational analyses of technology in organizations (DeSanctis and Poole 1994, Orlikowski 1992), and posits technology not as physical entity or social construction, but as a set of constraints and enablements realized in practice by the appropriation of technological features (Orlikowski 1995). Information technology in the CSD plays a role similar to that of organizational properties—shaping the production of situated practices, and being shaped by those practices in turn.

Each of the CSD's five metamorphoses can be characterized by: (i) an analysis of the practices which enacted the changes, including the organizational properties which influenced and which were influenced by those changes; (ii) the specific technological features which were appropriated in use; and (iii) the unanticipated outcomes which resulted from the changes and which influenced further changes. The following metamorphoses are discussed:

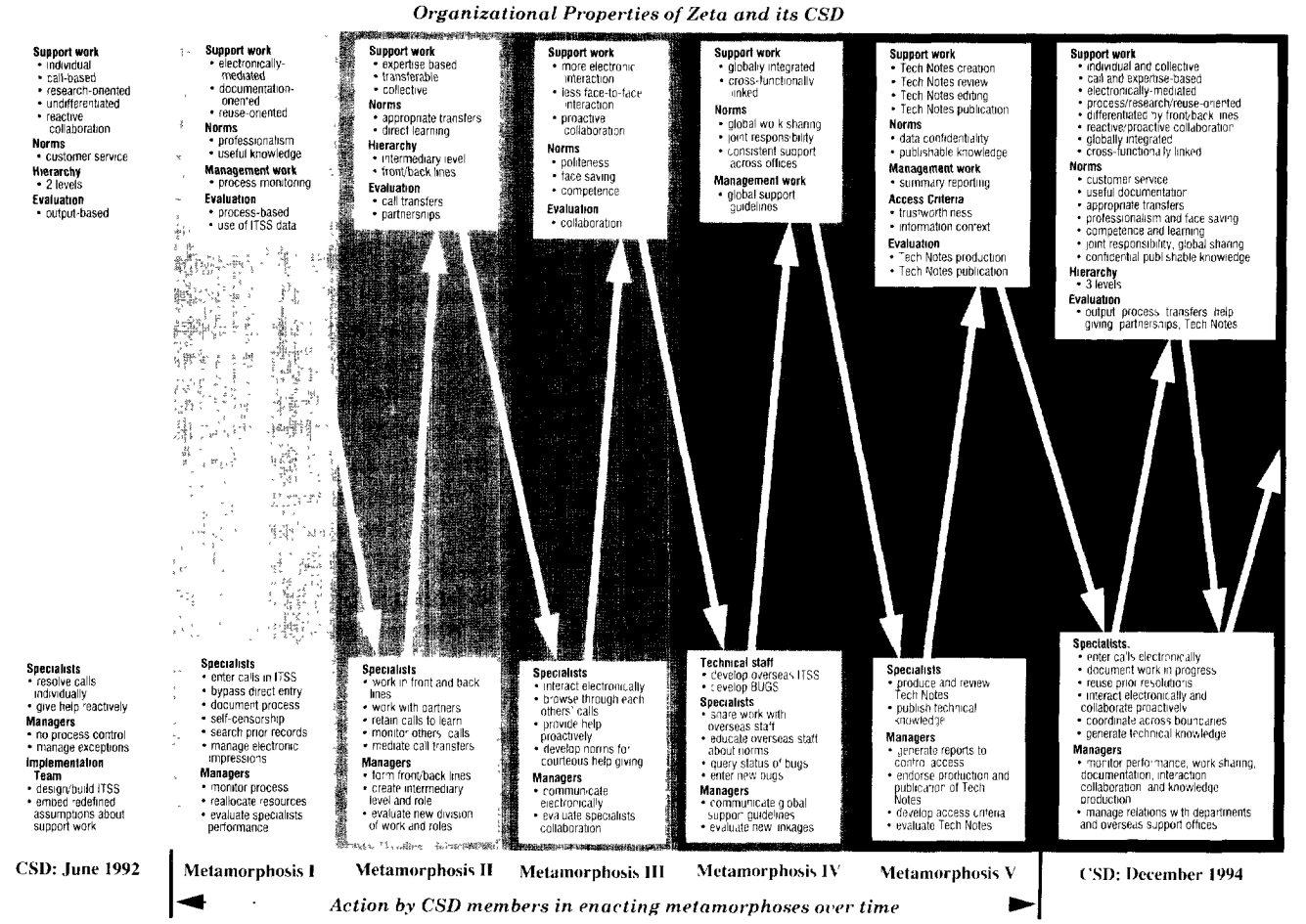
Metamorphosis I: the organizational changes associated with the shift to electronic capture, documentation, and searching of call records in the ITSS database;

Metamorphosis II: the organizational changes associated with the redistribution of work from individual to shared responsibility;

Metamorphosis III: the organizational changes associated with the emergence of a proactive form of collaboration among the specialists;

Metamorphosis IV: the organizational changes associated with expanding into a global support practice, and

Figure 2 Practice-based Model of Organizational Transformation at the CSD



with creating interdepartmental and cross-functional linkages;

Metamorphosis V: the organizational changes associated with controlling access to and distributing extracts of the knowledge contained within the ITSS database.

A brief overview of the work practices within the CSD before the arrival of the new technology is useful background for the subsequent discussion of metamorphic changes.

Work in the CSD before Implementation of the New Technology

The acquisition of the Notes technology and the creation of an incident tracking system within it marked a significant technological and ultimately organizational change for the CSD. There was no division of labor within the department. Specialists who had been in the CSD for at least a year were informally regarded as "senior specialists," and recognized as being more knowledgeable and experienced. All specialists took calls, scribbling problem descriptions on slips of paper and then working on the problems individually until they were resolved. The process of work was not documented or reviewed in any way. Problem-solving was the central activity of customer support. While specialists were expected to record their call resolutions in the Inform database, entry was haphazard at best. The records actually entered typically exhibited limited detail and questionable accuracy, and as a result searching in this database was

Figure 3 Sample Record from the Inform Database

PROBLEM REPORT

Problem Number 9871457 User Problem Number
Bug/Enhancement Number

Name JENNY	Date 10/31/90	Time 11 00AM
Others Duane King		
Client Name John Doe	PHONE 999-000-1234	
Company Acme Co	STATUS	
Time Spent 30-45 min	Answered Date 10/31/90	Time 11 30AM
Product Omni	Version No 3 0	Operating System

Description	READ DIF FILE INTO WORKSHEET UNRAVEL INTO VARIABLE UPDATE REORGANIZE RECEIVED SYSTEM ERROR ARGET01 PROBLEM HAS *OCCURED EXPORT/IMPORT DATABASE*
Solution	TOLD HIM THIS WAS NOT GOOD! SHOULD EITHER 1) RESTORE FROM BACKUP AND CHECK DB OR 2) EXPORT/IMPORT DB
Problem Category	

often unproductive. Figure 3 displays a sample record from the Inform database.

Managers performed no monitoring of the specialists' work process, evaluating them essentially on output. They were frustrated by their inability to track calls, analyze the status of particular calls, assess the department's workload, balance its resources, and identify issues and problems before they became crises. Managers' motivation in acquiring a new incident tracking system was influenced by these frustrations. As one manager recalled:

> We were totally unable to produce any type of weekly reporting or any statistics about who called us and why We weren't quickly able to categorize any of our problems We had a system, but you questioned the data that was in there because it was cumbersome to get the data in there . [Also] if a month had gone by, I had no clue what had gone on So I would have to go and find the specialist who had worked on the problem and ask them to either remember what had happened or try and find some piece of paper that might have been written down.

ITSS Design and Implementation

In contrast to Inform, ITSS was designed so that specialists would create an incident record in the ITSS database as each call was received, and then regularly update the incident record with the progress being made on the incident. They were to enter not just the problem description and its resolution, but also all the steps taken in the process of resolving the incident. Because ITSS was implemented in Notes, which allows databases stored on a server to be accessed from distributed, networked personal computers, the incident records in the ITSS call database were designed to be accessible by all members of the CSD. The design of ITSS was accompanied by procedural redefinitions of customer support work, and these modifications were introduced to the specialists through a series of training sessions that included hands-on use of ITSS during which specialists directly entered calls into the ITSS database and updated ITSS records by documenting their process of resolving customers' problems.

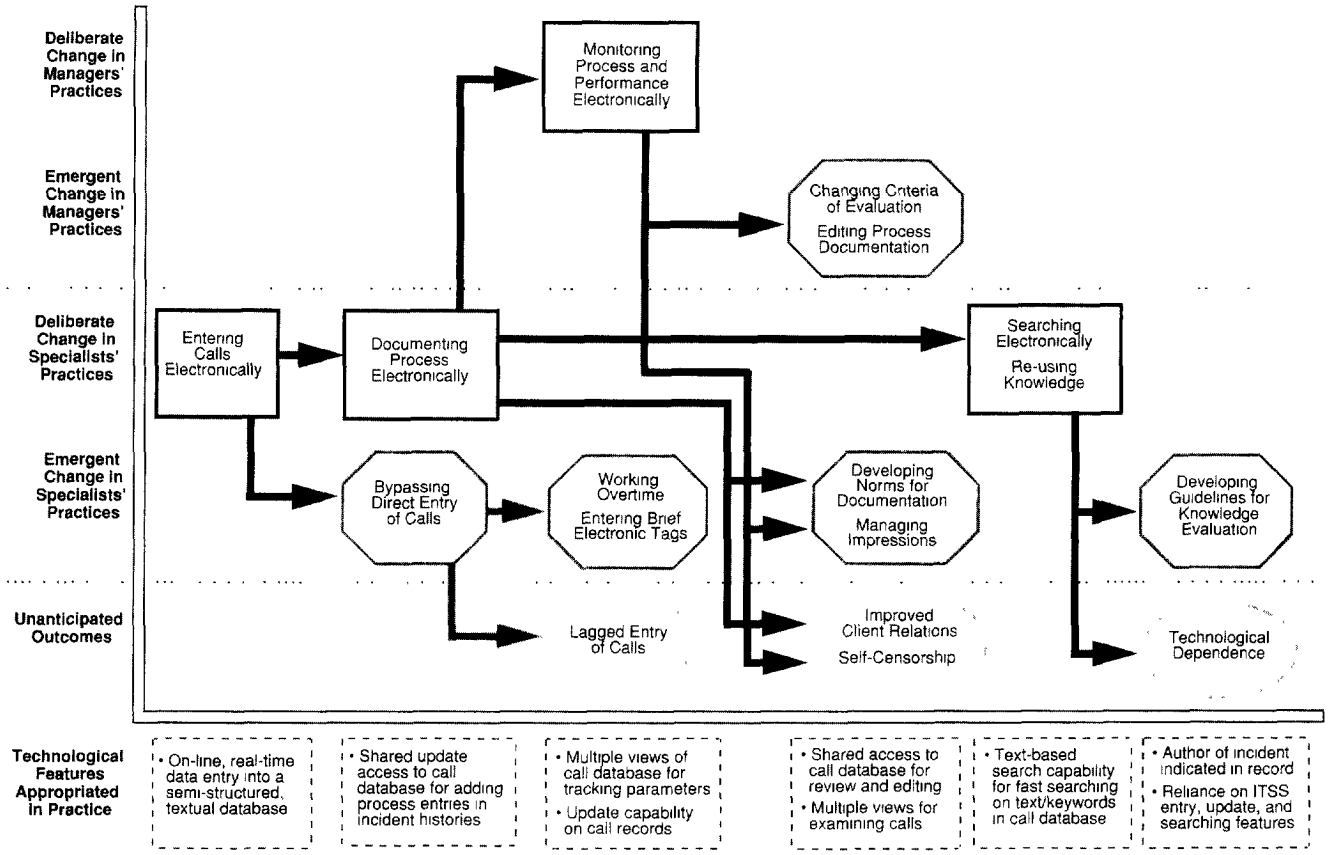
Once trained, specialists began to use ITSS to do their support work, and as they responded to the modifications in their work and appropriated the technological features of ITSS, they enacted some of the changes intended by the implementation team. Other changes emerged as specialists and their managers accommodated issues and breakdowns in the use of ITSS, and improvised techniques and norms to effectively utilize the new technology in their changing work practices.

Metamorphosis I

Figure 4 depicts the first set of metamorphic changes enacted with ITSS in the CSD. As indicated in the figure, these changes were both deliberate and emergent, involved specialists' and managers' work practices, were associated with some unanticipated outcomes, and involved particular features of the ITSS technology. The changes involved those specifically intended by the implementation team: electronic recording of all customer calls taken by the CSD; electronic documentation of work done on those calls; electronic reuse of prior call resolutions to avoid duplication of effort; and electronic monitoring of process and performance to facilitate process tracing and resource management.

Electronic Entry of Calls. One of the premises underlying the design of ITSS was that specialists should enter incidents directly into the ITSS database while on the phone with customers. The ITSS technology, designed to operate as an on-line, real-time database system facilitated such direct entry with its "Compose New Incident" feature which provided a structured data entry screen for recording the new call. Specialists were trained to invoke this feature on receiving a new call

Figure 4 Metamorphosis I—Changes in Support Work and Management Enacted with Use of ITSS Over Time



and enter the customer's data in the structured and free-form fields when talking to them on the phone. While this feature enabled direct entry, some aspects of its design were also constraining, sufficiently so that most of the specialists continued to use paper to record their phone interactions with customers, entering these calls into ITSS at a later time. This practice of bypassing direct entry persisted despite ongoing urging by managers, and despite a recognition by specialists of the advantages of direct entry (e.g., being able to give customers an incident number as reference, being able to get an early indication of the day's workload, being able to record the time calls are received, and avoiding the risk of misplacing calls by misplacing the paper on which they were noted).

The specialists had a number of reasons for choosing to retain their original work practice of recording calls on paper. For some, limited typing proficiency inhibited direct entry of calls:

> If you're not confident in your typing skills, there's just no way you're going to put a call in online. Because you're going to have typing mistakes, you'll be trying to fix them, and then you can't read what you've typed.
>
> When calls come in, I just jot them down first. I mean I tried both ways, by killing two birds with one stone by entering and listening, but my typing skills, I guess, aren't fast enough so I can't obtain all the information if I type.

Specialists further noted that the navigation of ITSS' structured data entry screen was incompatible with how information was provided by customers. Consequently, specialists found the mechanics of manipulating the ITSS data entry screen distracting when they were trying to understand customers' often complex problems:

> I'm not comfortable typing in the incident as they're telling it. I find it's more of a distraction I'm trying to figure out what piece of the form to fill in and they're talking rapidly about a problem. So my concentration is split and I find myself not being able to ask the right questions or forgetting some piece of information
>
> When I get a call I personally write it down first. I think that is because I'm trying to pay attention more to what the client's talking about and trying to understand the problem. And I think that if I were actually trying to type in that information into ITSS I would lose something . . It's not like, "I've heard this before, I know what this is." I really need to understand what they're doing, because in order for me to either try and recreate it or try and fix it, I really need to make sure I fully understand exactly what they're doing. It's different every time.

In addition, specialists were aware that the ITSS technology and underlying network might fail occasionally. As a result, many of them utilized paper as an improvised (manual) backup system:

> When I take a call I always write it out . [so that] if the network goes down, I've got their phone number on a piece of paper.

This improvisation allowed specialists to continue working on their calls even when the technology became unavailable.

Specialists' continued manual recording of calls (and avoidance of direct entry into ITSS) sometimes created problems when they received many calls in a day, and their subsequent electronic entry lagged behind. Most specialists improvised ways of dealing with backlogged data entry, for example, working after hours to get caught up, or entering brief information initially to tag the call and enter it into ITSS, and then elaborating the description when they had more time.

Specialists' practice in working around the direct electronic entry of calls suggests, to invoke Heidegger, that the ITSS technology is not as "ready at hand" as pen and paper. Both the structured nature of the technology's data entry screen and the act of typing interjected an interface into the activities of listening, interacting, comprehending, and articulating the problem. Specialists ended up focusing on the interface and on manipulating it accurately, an explicit concentration which does not arise when writing free-form with pen on paper. For the specialists (as for most of us), writing with pen and paper in an unstructured manner is familiar since grade school, and hence simply part of the background, taken for granted. In contrast, use of the ITSS technology required typing and screen-manipulation skills which diverted concentration from customers and their problems. The occasional unpredictability of the technology at the time of a call (whether slow or inaccessible) further raised barriers to the feasibility of direct electronic entry. All of these elements served to increase the "unreadiness-to-hand" of the ITSS technology, so that to specialists it appeared as a distinct object and interface that had to be attended to consciously. To avoid such cognitive diversion and concentrate on interacting intelligently with customers while on the phones, specialists had improvised various practices to bypass direct entry and compensate for the time lag when they fell behind.

Electronic Process Documentation. ITSS was deliberately designed to enable users to record, chronologically, the work being done on each incident, as it was being done. Figure 5 shows a sample record from the ITSS database. The top half shows the structured fields in which specialists had to enter specific information (aided by the provision of "pick lists" where the system offers a menu of acceptable values), and the lower section contains the unstructured "Incident History" field in which narrative descriptions of work in progress could be entered to create a chronological trace of the work process over time.

Specialists were now required to record the progress being made on each call in the "Incident History" field of that call's ITSS record. This change in specialists' job requirements was enabled by the edit feature in ITSS which allowed specialists to update incident records previously entered. When specialists completed some activity on a customer's incident, they updated that incident's record in the ITSS database by noting the kind of work done and the steps to be followed next. ITSS was designed to allow this process documentation to be open-ended. The Incident History field in which specialists made their progress updates was unstructured, allowing entry of free-form text. ITSS automatically appended information identifying the time, date, and person making the update, and arranged the updates in reverse chronological order. The ITSS edit feature, however, was restricted in that specialists could only add new entries to the Incident History field, they could not

Figure 5 Sample Record from the ITSS Database

Incident Form

Incident: XX-1-0999
Owner: Gillian Smith Opened: 11/28/94 09:45 AM

Company: Acme Co.
Caller: John Doe Title:
Location: 444 Science Park Rel:
Vista City, MA 02139
Phone: 999-000-1234 Fax: 999-000-9999
Call Back: Phone:

Product: DSX 4.13 {4.1700}
Platform: PC STANDALONE - 486 Environment: DOS 5.0
Module: N/A Workstation. N/A

Incident Description

Title: In DSX 4.x, how do you populate insample for each mrentry?
Description: Insample is dimensioned by geog, time, and mrentry. Doe wants to populate insample differently for different mrentries, but doesn't know how He wants to know how
Res Type. General Question
Resolution.

Incident Management

Assignee: Tom Brown
Status: Work in Progress Close Date:
Time Now: 10 Time Total: 50 minutes
Bug Number: Severity: 4
Interoffice #: T/O Assignee:
Other #s: Transfer Date:
Reviewed: Not Reviewed
Review Date: Reviewer:

Incident History

***** 12/06/94 09:27:25 AM Jenny Jones (US) {Total Time = 50} (Work in Progress) (S4)
[Tom Brown = Assignee] [Gillian Smith, Tom Brown = MailTo]

"INSAMPLE is a keyword in the control file; you can set it as follows:

ControlfileKeyword	ControlFileValue
INSAMPLE	INSAMPLE 01011
INSAMPLE	INSAMPLE 01013

Can be set with however many measures you want.
I've tried to reach Doe at the above #, but unable to. If he calls back we can give him this info. "

***** 12/02/94 12:41:43 PM Tom Brown (US) {Total Time = 40} (Work in Progress) (S4)
[Tom Brown = Assignee] [Gillian Smith = MailTo]

"Not sure if this is possible Will consult with Jenny and see ... might have to wait for Arthur ? We'll see.
Searched GROUCHO for some details. Nothing like this found for 4.13 - only references to the DOS DSV."

***** 12/02/94 11:59:21 AM Martha Robinson (US) {Total Time = 20} (Work in Progress) (S4)
[Tom Brown = Assignee] [Tom Brown, Gillian Smith = MailTo]

"Tom, can you please take a look at this call? Apparently Doe called back and would like an answer soon.
If you can't take it please let me know. Thanks, Martha "

***** 11/29/94 10:11 06 AM Gillian Smith (US) {Total Time = 10} (Open) (S4)

"Talked to Arthur He has worked with this issue before, and explained that it's complicated. He will refresh his memory and get back to me."

edit any previous entries made. Once an item had been added to the Incident History field, it remained there permanently. This history could not be rewritten, and as we shall see, the permanent nature of this recording led to some self-censorship on the part of the specialists.

An interesting unanticipated outcome of electronic process documentation within ITSS was that it altered the CSD's relationship with its customers:

> It has dramatically changed communications with customers We are no longer guilty until we can prove we're innocent We have all the facts at hand So when customers call up and say "I called two weeks ago and nobody ever called me back," either a specialist or a manager can just immediately say "Well, let me look at the database I see that you called last Tuesday at 4:13 pm and we called you back at 5 06 pm and closed your call " We get countless calls like that, people ranting and raving without any specifics, and the minute we can get specific and tell them what we did or didn't do for them, they immediately retract their statements and start being nice It's a great shield for the support people, their butts are covered That's not something we anticipated

Process documentation, electronic or other, had not previously been part of specialists' work practices. The definitions of support work had been changed to reflect the requirement to document process electronically, and evaluation criteria adjusted accordingly. These new organizational conditions (communicated via intensive training on the use of ITSS) changed specialists' understanding of their jobs, and once ITSS was fully deployed, all proceeded to appropriate ITSS to document their work process. In this action, the specialists enacted the deliberate change intended by the implementation team, thereby generating the audit trail deemed necessary to make specialists and their managers more accountable for the work of the CSD. Through such ongoing enactment, specialists reinforced and eventually institutionalized a new set of work practices, substantially mediated by information technology and expanded to include documentation. In the process, specialists had also become accountable, institutionally, not just for their output but also for their work in progress.

Electronic Monitoring. With specialists producing electronic process documentation of their work in progress, managers were able to use the ITSS technology for dynamic monitoring of call load, work process, and individual performance. In this, they were strongly influenced by the institutionalized properties of Zeta, which required them to provide various statistics on departmental workload to justify their headcount, to show that they were utilizing their resources and new technology effectively, and which held them accountable for providing quality technical support to customers. To conduct their monitoring, the three CSD managers appropriated various features of ITSS, particularly the View feature which facilitated the presentation of ITSS data in multiple ways. The ITSS technology was also constraining in that there was not a strong statistical capability, so that only straightforward counts and categorized reports could be obtained. Anything more complex required the data to be extracted into another system and manipulated there.

In monitoring specialists' process documentation through ITSS, managers changed their work practices to reflect the window they now had on specialists' ongoing performance, a view that had not been possible before. This deliberate change in managers' practices occasioned an emergent change in how they evaluated specialists. They now assessed technical competence and problem-solving strategies (at least, as these were documented):

> We evaluate their technical skills Notes is part of the way we do that: looking at the calls they close and how well they resolve them. Where did they go to look for help? Do they get in and get their hands dirty? I also look at problem-solving skills reviewing their calls and seeing what history and thought process they've gone through.

In addition, managers began to evaluate the process documentation itself, not merely using it as an indicator of actions and strategies. In this way, they reinforced the new definition of the customer support job as comprising both problem-solving and documentation. Indeed, keeping process documentations up to date was presented as just as critical, or even more important than problem solving, as one manager observed:

> I explain to [the specialists] that it's more important that they document the call than solve it quickly And I give the example of the executive vice-president of development walking into my office and asking me what's wrong at a particular site And I can double-click, and I've got the information right there. And if that's up to date, we're golden, and we look good. And if it's not, and I have to go chase somebody down to get the most recent information, we don't look good, and that database all of a sudden isn't valid He'll never trust it again

In their on-line and ongoing examination of the ITSS database, managers occasionally entered comments or edits to improve the quality of the documentation or to communicate with specialists. For example, a specialist I was observing received electronic mail notification that one of his incidents had been updated. On accessing the record, he found that one of the managers had made the following entry in the record's Incident History field:

> Milt, is this one closed out? Please update, thanks, Isobel

Specialists responded to this electronic monitoring by developing norms about what and how to document, and managing impressions of themselves through their electronic text.

Norms for Process Documentation. While the requirement of process documentation had been well established, the precise nature and representation of this documentation was left largely unspecified. As noted above, the technology imposed few restrictions in the Incident History field, allowing the entry of free-form text of unspecified length. The implementation team indicated that they had also not provided any documentation guidelines, preferring "to keep things voluntary and democratic." This technological "freedom" was both enabling (allowing a variety of expressions and formats) and constraining (allowing inconsistency and ambiguity). As a result, documentation during the early period of ITSS use was characterized by considerable variability in quality and detail as the specialists experimented with different styles and details in their descriptions of process. Over time, however, a number of informal norms about effective process documentation emerged, influenced by the occasional comments or edits made by managers in the ITSS records, and by the experience of specialists who realized in practice the value of documenting well and consistently. A vivid illustration of the latter was the story, recounted many times, of the specialist who was working on one of her calls, searched in ITSS and located an incident which exactly matched the error message she was researching. Delighted, she accessed the incident history field only to find that "it was, like, totally nothing. I mean, it was useless." Frustrated and angry at the creator of the incident, she looked at the field indicating authorship, only to discover it was herself. This story, as another specialist commented:

> . makes you realize that it's really going to benefit people if, you know, if even your thought process and everything can get into the incidents

The norms that emerged from specialists' use of ITSS reflected their recognition that the database was a shared resource and that value lay in making the content of incident records reusable, whether by other specialists in the group, or by themselves at a future time:

> In my incidents I try to be very specific, even though I find sometimes it's boring to do that. . I mean I'm really tired of typing [all the details] in, but I figure some poor sap in another year is going to be trying to solve this problem he's never seen before, so I still need to write all that down.
>
> You need to be a little more thoughtful about how you present information so that it's useful for other people. . You have to have the description in there in such a way that you've made sure you've used key words that other people might search on. There's a lot more thought involved rather than just kind of a scratch pad situation

These norms, once shared and practiced within the CSD for some time, became reinforced and established as important cultural norms about the representation of work process within electronic documentation. Norms also emerged about the representation of self within this electronic text.

Impression Management. Specialists were very aware that as they worked with the ITSS technology, their use reflected, very visibly and immediately, on their work practices and on themselves as support specialists. The boundary between private work and public space had shifted significantly as specialists used ITSS to produce an ongoing electronic text of their work process, which was available for future use and served as the basis on which managers had begun to evaluate them. Before their use of ITSS, specialists had tended to do much of their research work in private, making public only their questions to colleagues and their problem resolutions to customers. With ITSS, specialists now made public most aspects of their research work through their own documentation of their ongoing work in progress. They participated in making their work (and thereby, themselves) electronically visible and accountable. While specialists retained some dis-

cretion over what, how, and when to make their work visible, they had changed the nature of their work from being largely off-line (done privately in one's own space and never recorded) to being largely on-line (done privately but recorded publicly in a shared space). The transparency of the electronic text ensured that specialists' work life was now more "on display" or at least potentially so, through the medium of ITSS.

Many specialists were acutely aware of their new visibility—some of them referred to it as "big brother"—and responded by improvising some informal guidelines about what they would and would not articulate within the electronic text. In so doing, they began to appropriate the features of ITSS to manufacture a virtual or "electronic persona" of themselves by consciously engaging in impression management (Goffman 1959). Goffman's distinction of front and back regions is useful here to explain specialists' use of such impression management. The "front region" is where the performance takes place and where individuals strive to maintain and embody certain standards of politeness and decorum (1959, p. 107), while the "back region" is where the impression managed by a performance is openly constructed, rehearsed, and contradicted (1959, p. 112). The ITSS records represented the (electronic) front region of the specialists' back region work. It was here that they expressed the activities they had performed backstage in terms that were compatible with the norms of front stage behavior. In this public recounting of private work, there occurred an accounting of effort in a manner designed (whether deliberately or not) to create a particular professional representation of self:

> I am definitely more careful about how I say things now. If I want to say some guy was a real jerk to me, I might phrase that a little differently and say that he was not very nice We have to be more careful about entering information. We have to be more diplomatic
>
> There is like a general rule that you've got to be courteous and use the right language You have to use the correct and politically correct language. You don't want to use any slang. You just want to be professional about it.

In representing their work publicly, specialists were conforming to the standards of the front region by their impression management, the unanticipated result of which was self-censorship, limiting what was documented within the ITSS database. For example,

> The accessibility of the database is something that I'm always aware of and I think I'm very guarded in what I put into the database I am always concerned about being politically correct, professional, diplomatic.
>
> It's kind of like—if you don't want anyone to read this, don't write it, you know What I may do is vent by just typing something and then erasing it

What was interesting about this electronic impression management was that it was not actual electronic scrutiny within the front region that compelled "political correctness," but the possibility of such scrutiny—inherent in the notion of a front region—that focused specialists' attention on what impression of themselves was being conveyed in electronic text:

> It's not obvious if they're watching the numbers. There is an undercurrent of scrutiny, big brother is there but it's below the surface

Such self-regulation is a form of "participatory surveillance" (Poster 1990), and an interesting electronic example of Foucault's panoptic discipline (Orlikowski 1991, Zuboff 1988). As Foucault (1979, pp. 202–203) notes: "He who is subjected to a field of visibility, and who knows it, assumes responsibility for the constraints of power; . . . he becomes the principle of his own subjection."

While some specialists felt the electronic exposure provided by their and their managers' use of ITSS as vulnerability, others saw some advantages:

> I know that it's kind of like big brother watching over you, but it really doesn't bother me in that way. It's good because . you get so many calls that you forget what's going on . . and that you should have alerted these people. And by having the managers look at our database and say, "Oh, this is this client and we need to alert this, that or the other," it helps. I think it's more of a team approach
>
> It's a record of what we're doing, and . it's a number that we can point to show how we are working, and how well we are working

In particular, those specialists who felt they were "high performers" welcomed the electronic scrutiny as it made their accomplishments more visible:

> [ITSS] is a working database of what I'm doing . It's my brag record I have more calls in there than anybody else

> For awhile I had taken an incredible number of calls And [ITSS] sort of validated the fact that I am very busy, I am taking a lot of calls, I am really contributing to the group effort

Thus, for some specialists, the use of ITSS created a forum in which to showcase their efforts, occasions to manage impressions of themselves as highly productive. Indeed, the electronic text provided opportunities for individuals to "make-work" (Goffman 1959) by fabricating or embellishing work in their documentation of work in progress. Specialists continually engaging with and contributing to such a transparent electronic text changed how they represented themselves to others, engaging in the construction of professional electronic personae. Such constitution of self was facilitated by the cognitive and normative awareness of how different their work practices were when they were mediated by the technology:

> There's more of a record It's more of an online mentality It's a different mental attitude. . It's a mindset of everything being online and everything being accessible to everybody, and recording everything in the computer, as opposed to, you know, presenting a report to your boss at the end of the month. The ongoing thing. The idea that anybody can read your words if you want them to, or if they have the right access, and that some people can get in there and read your notes even if you haven't given them access.

With the expansion of support work to include process documentation and the adjustment of evaluation criteria to reinforce that change, the boundaries of public and private work space have shifted. Both managers and specialists have become much more attentive to the process of customer support. However, this change masks another more subtle shift in the texture of work within CSD—a focus less on process per se, than a focus on the process as documented in incident records within ITSS. This is a technologically-mediated process orientation, where the interest is less in the execution of work than in the symbolic artifacts that describe the execution of work and which are immediately and continually available through the technology. The text has become central. Poster (1995, p. 85), drawing on Foucault's analysis of discourse, suggests that "databases are discourse," because they "effect a constitution of the subject." Such a constitution of specialists is present in the creation, examination, and monitoring of the ITSS electronic text, where the incident records serve as symbolic surrogates for the specialists, traces of and testaments to their work. To retain some discretion in this discourse, specialists developed norms for the construction and manipulation of the text, strategies for managing impressions and expressions within it, and an awareness of some of the political and personal consequences—intended and other—of its use.

Electronic Searching. The ITSS database of calls with its documentation of process and resolutions soon contained enough prior incidents to make searching the database a useful step in researching problems. Specialists expanded their appropriation of ITSS features by beginning to use the powerful search engine available to quickly scan the ITSS database on specified keywords or text. By including such searching as part of their problem-solving activities, specialists enacted a deliberate change in their work practices intended in the original design of ITSS. Searching the ITSS database became increasingly valuable over time, as the number of incident records grew, from some 4,000 in December 1992 to 35,000 in December 1994. Searching ITSS located possibly reusable problem resolutions that often saved time and effort, and offered insight into approaches and strategies for resolving various problems. Specialists reported resolving up to 50% of their problems through electronic searching, an accomplishment that had not been possible without the mediation of support work by the ITSS technology.

As specialists depended increasingly on searching to do their problem solving, the reliability of the knowledge in ITSS became a central concern. The ITSS technology itself offered no indicators or guarantees of the reliability or relevance of the data contained within it. Such a concern led specialists to develop some social heuristics for assessing the quality of knowledge in the ITSS records. The ITSS technology was designed to automatically assign a unique number to each incident entered into the database. This number included a code which identified the particular specialist who had documented the incident. Specialists learned each other's identifying codes, and enacted an emergent change in their work practices when they began relying on this identifier to gauge the likely quality of potentially reusable incidents:

> You tend to evaluate information differently from different people. So if you see 40 items from a search you go to the in-

> cidents of those folks you've gotten good information from in the past
>
> I know certain people in the department, and I know that Arthur has a reputation for writing short novels as resolutions. I mean, he's a wonderful source of information and when he has an incident, he really spends the time to put a lot of detail in it. And it's extremely helpful. So when I get an incident from him, I'm very comfortable with that information. Whereas, some of the other people in the department . For example, Beavis has a reputation that he doesn't do much research.

Thus, specialists in the CSD improvised techniques for judging the quality of the electronic texts they chose to use in their own work.

The change in specialists' work practices to include electronic searching led, over time, to the unanticipated outcome of technological dependence, which seems almost an inevitable result of mediating work practices through technology. Technological dependence within the CSD has both a physical and a psychological referent. Dependence resulted from the ever-increasing use of the ITSS technology. Thus, when the system broke down, the specialists lost their ability to execute much of their ongoing work.

> We had a power outage last week because of the thunderstorm, and there was virtually nothing I could do. Almost everything I needed to do was on the networks. So we were pretty much paralyzed.
>
> You must have heard, we lost part of our searching capability for, like, two days Monday, Groucho died [author's note. Groucho is the name of one of the file servers used to store the ITSS database. The others are Chico, Moe, and Curley] . . I mean, we came in Monday morning and—it's dead And we didn't have it for two days . It was really actually very crippling. It was very hard to do your job, because so much depends on it. You know, you get a call and your first resource is to search in ITSS, and it was like "My resources aren't here!"

Some specialists were less dependent than others and managed to devise ways of working around technological breakdowns:

> I would say we're very dependent on ITSS as a whole. . And we sort of work around it when it's down We pull out a sheet of paper and just start writing. The other side of that is the searching tool. Certainly when it's down you become a little crippled, because the information that you could pull up in a matter of seconds now might take a little longer because you have to find the right person.

Not all specialists, however, were able to fall back on other forms of working when the technology was not available. In particular, junior specialists who had learned support work in the context of ITSS, had no cognitive and behavioral resources for working without the technology:

> We're extremely dependent on these databases Without them I feel underconfident I feel I can't do this. I would be much more stressed out without them . . because I would feel like more calls are coming in that I can't answer than I can So, psychologically, it would be difficult.

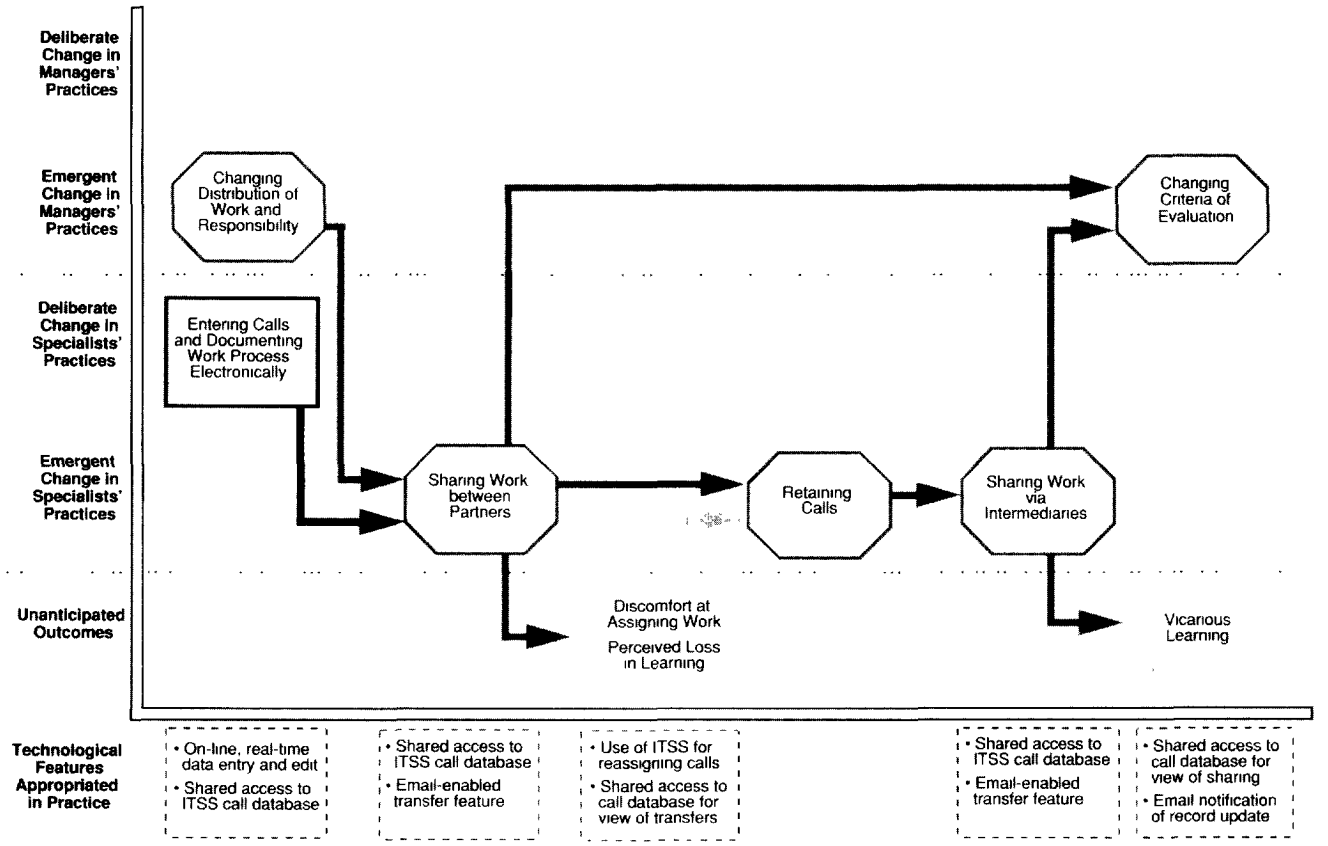
Such dependence was also reflected in junior specialists' behavior. While I was observing a junior specialist at work, he kept issuing searches within ITSS to try and find an incident that resembled a problem he was researching. His remarks while doing so reflected the expectation that "all the answers" are in the database: "Hmm–why can't I find anything here. There's got to be something in here. I'll keep trying." And he did, for quite a while, until eventually abandoning his search and moving on to another incident.

Metamorphosis II

The second set of metamorphic changes enacted with ITSS in the CSD is displayed in Figure 6, which shows the emergent changes in work practices that evolved from the previous deliberate changes in electronic entry of calls and process documentation. These changes comprised a redistribution of work and responsibility within the CSD from being primarily individual and undifferentiated to being more collective and involving new roles and hierarchical levels.

Sharing Work via Partners. After about a year of using ITSS, the managers and senior specialists initiated an emergent change in how work was distributed within the CSD. This change had not been planned prior to the implementation of ITSS, but the growing reliance on ITSS and the communication capabilities of the Notes technology, created an opportunity for the CSD to redistribute call loads. In particular, the informal distinction between "junior" and "senior" specialists, was formalized in the structural division of "front line" and "back line" support levels. Junior specialists were designated as on the front line, where they were expected to take all calls, resolve as many as they could by searching the ITSS database, and then electronically transfer those calls they felt they could not manage to the senior specialists assigned to the back line. A manager noted:

Figure 6 Metamorphosis II—Changes in Distribution of Work Enacted with Use of ITSS Over Time



> We call it "Partners," and the way it works is that newer members of the group spend an average of 40 to 50 percent of their time taking incoming calls. And they're partnered with a more senior member of the group during their shift . . . The partner gets assigned problems that the junior member doesn't need to worry about.

The new distribution of work shifted responsibility for a call from being the sole purview of the individual who initially took it to being the shared responsibility of the individual and his/her partner. When enacted by the specialists, this shift changed the organizing structure and work practices of the CSD. A new role, the partner, had been introduced and the department had become hierarchically differentiated by expertise, experience, and status. The change in organizing structure had not been intended prior to the implementation of ITSS, but ongoing experience with ITSS created an awareness among managers and specialists of its feasibility and advantages. The key features of the technology that enabled the structural change were the capability for all specialists to share access to the ITSS database, the capability within ITSS for calls to be reassigned to other specialists (via a simple "Assign To" button on the ITSS Edit screen), and the capability for the system to automatically issue electronic mail messages to specialists notifying them that they have been assigned calls. Use of the ITSS technology over time and increased knowledge of its capabilities had thus enabled the CSD to institute a new division of labor.

As specialists began to enact their new organizing structure by changing their work practices, realization of the new division of labor ran into difficulties. Many specialists refrained from assigning calls to their designated partners as instructed, retaining their old practice of handling all the calls they took themselves. Two reasons cited by specialists seem to account for such

action. One, they were uncomfortable assigning work to senior colleagues:

> You can just assign a call to a partner, but I don't I only assign the call if he offers to take it. That way you're not really dumping on the other person
>
> My rule of thumb is if I really don't know anything about the product or the issue and I know it's definitely not my area of expertise, then I would send email and ask [my partner], "What do I do? Do you have any suggestions?" But I keep ownership of the incident, because it takes the pressure off of that person.

Two, some junior specialists preferred to solve their own problems, seeing such action as both a sign of competence and as a learning opportunity. For example:

> I don't like passing off calls, . . . it's kind of like a cop-out for me because I want to learn more about things and it would be kind of a way of not learning It wouldn't be a learning process.

Sharing Work via Intermediaries. Managers reacted to this unanticipated reluctance to transfer calls by creating a new role—that of an intermediary—to facilitate the distribution and transfer of work between the front and back lines. Two senior specialists were designated as intermediaries and their work practices changed significantly. From taking calls and solving problems, they now electronically monitored the incidents entered into ITSS by junior specialists and ensured that assignments to senior specialists, where they felt appropriate, took place. One intermediary described her role:

> I monitor the incoming calls to make sure that the people that are taking incoming calls can either handle the call or else refer the call to someone else. Because we have support set up with front and back lines, we have people that take incoming calls, and if they can't answer them in an amount of time then we transfer the call to someone who is more experienced, maybe more expert in that type of problem.

While junior specialists did lose direct experience with solving certain problems, they did not give up all opportunities for learning. The technology included a feature that enabled them to be notified whenever any action was taken on a record. Thus, a junior specialist, having assigned a call to a partner, could request that the system send electronic mail each time the partner updated the record. This way, junior specialists could follow the progress of calls and learn vicariously, at least.

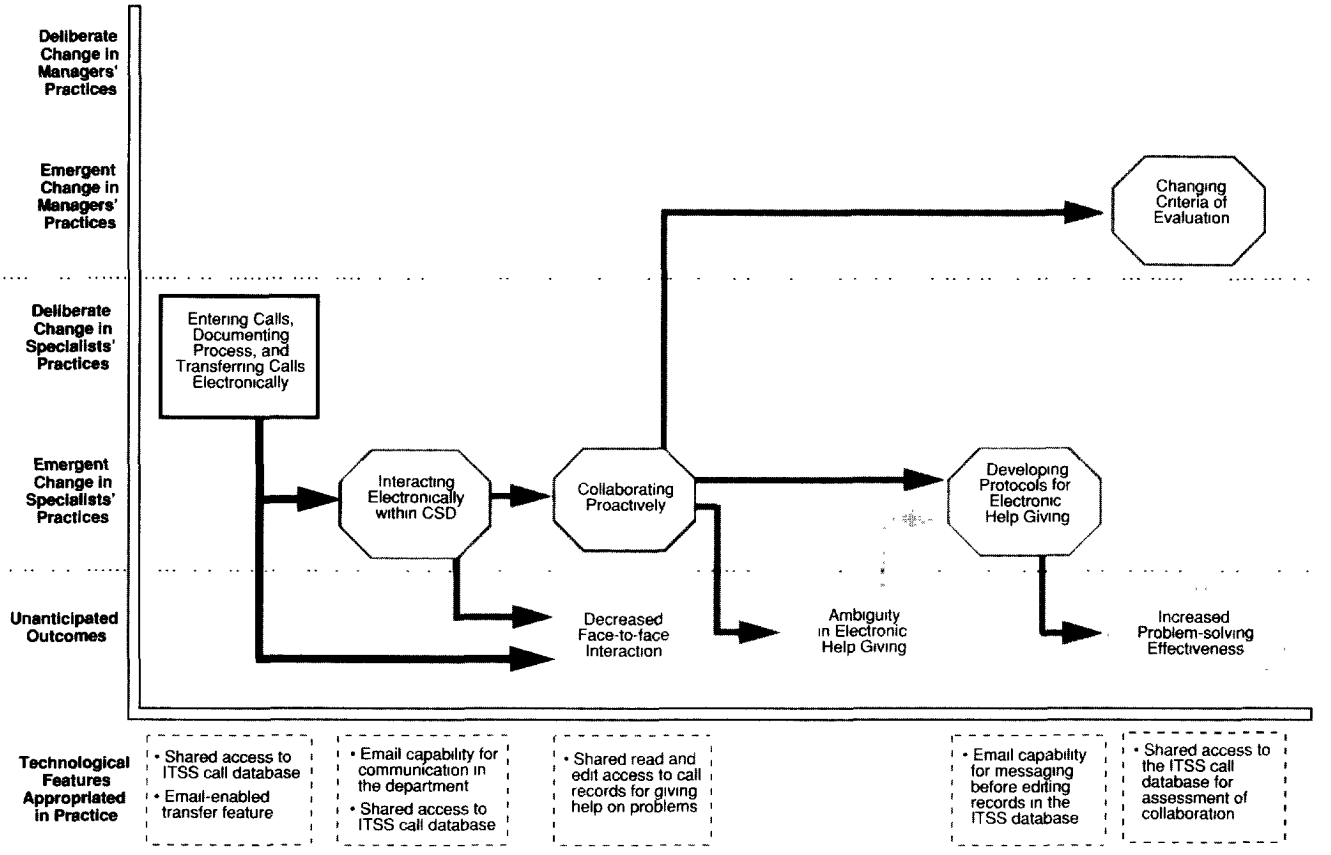
The sample ITSS record shown in Figure 5 illustrates some of the shared responsibility for work that the specialists had enacted with ITSS and the creation of partner and intermediary roles. The call was originally taken by Gillian Smith, a front-line specialist, who entered the call into the ITSS database on 11/28/94. The next day, she updated the incident's history (see bottom entry of history field), indicating that she had talked to Arthur, a senior specialist and the local expert on the DSX product, and was waiting for his recommendation. No further documented work took place on this call until 12/2/94, when an intermediary, Martha Robinson, stepped in and reassigned the call to Tom Brown, a senior specialist and Gillian's designated partner. This reassignment was indicated under the Incident Management section of the record and was prompted by the fact that a number of days had passed without activity and that the customer had called back requesting a response. The e-mail-enabled feature of the technology is visible under the entry on 12/2/94, where both Tom Brown and Gillian Smith are designated as "MailTo" which means they were sent electronic mail notifying them of any subsequent update to this record. Tom responded to the newly assigned call within the hour, indicated that he had unsuccessfully searched the ITSS database for clues, and that he would consult with Jenny, another senior specialist knowledgeable about DSX. On 12/6/94, Jenny Jones, the senior specialist consulted by Tom, updated the record with a possible solution.

In response to the new distribution of work, managers adjusted their evaluation criteria to reflect the changed responsibilities and roles within the CSD. This involved browsing the ITSS database to determine how senior specialists helped their junior partners resolve their calls, and the extent to which the intermediaries stepped in to reassign calls when necessary. This emergent change in managers' practices further reinforced the structural change by distinguishing the roles of partner and intermediary, and differentiating the evaluation of front and back line specialists.

Metamorphosis III

The third set of metamorphic changes enacted with ITSS in the CSD is presented in Figure 7. Again, the changes were mainly emergent, being occasioned by specialists'

Figure 7 Metamorphosis III—Changes in Interaction and Collaboration Enacted with Use of ITSS Over Time



responses to the first two metamorphic changes: the deliberate changes in electronic entry, process documentation, and on-line searching, as well as the emergent changes in work sharing and call reassignment. Here, the situated changes involved a shift towards more electronic interaction among the specialists, and the development of a new, technology-enabled form of collaboration which was proactive rather than reactive, and which offered unexpected benefits in problem-solving activities.

Electronic Interaction. The increased use of ITSS to accomplish much of support work led specialists to spend considerably more time interacting electronically, an emergent change in their work practices. Specialists began to use the ITSS technology not only to enter, document, research, and reassign calls, but also to communicate with each other via the electronic mail facility available in the underlying Notes system. They sent messages seeking technical advice, distributing departmental announcements, and sharing humor. This increased use of ITSS as a medium of interaction had the unanticipated consequence of decreasing specialists' face-to-face interaction, shifting the CSD's strongly oral culture towards one that was more written and electronic.

> I've noticed stretches of two to three days where I'm at my desk trying to resolve my calls as quickly as possible, and I haven't talked to anyone . . . It's like, if Lotus Notes has the answers why should I go talk to anyone?

Some specialists compensated for this shift in interaction medium by creating occasions for getting together with colleagues, either at lunch or informal meetings:

> If I thought something important enough came up that everybody in the XSS group—and there's only four of us—I would

> say, all right, let's get together and discuss this, even if it was for a half an hour We'd just kind of sit down and go back and forth

The increased use of electronic interaction also set the stage for an interesting emergent change in specialists' collaboration.

Proactive Collaboration. With specialists interacting more through ITSS, and sharing access to all calls in the ITSS database, an electronic form of collaboration emerged in their work practices. Shared commitment to customer service had been a strong norm in the department since its inception, and it had recently been reinforced by the structural shift to partners and intermediaries. Nevertheless, before ITSS, collaboration was essentially reactive. Because all calls were held individually, specialists could only provide help on each others' problems when asked to do so. The technology of ITSS provided all specialists with access to everybody's problems, essentially a window on the problems currently being worked on within the department. Specialists discovered that with this virtual window into the work load of their peers they could browse through each others' calls to locate those they could provide help on. Then, using the technology to send electronic mail or enter comments in a record's Incident History, specialists could provide suggestions or solutions to each other. In this way, they improvised a form of proactive help giving where they actively sought problems in the electronic database that they had solutions for, rather than waiting to be asked if they had a solution to a particular problem. This emergent change in collaboration implicitly acknowledged specialists' awareness of their shared responsibility for calls received by the CSD.

Specialists—both junior and senior—changed their work practices so that they routinely engaged in electronic help giving, whether solicited or not:

> We all help each other out, you know. Like if I see Martha's gotten 15 calls and I've only gotten 3, I'm going to go in and I'm going to help her, whether she feels she needs it or not. I'm going to do some research for her. She does the same for me And it's because, you know that one day you'll get killed, the next day you don't get killed So, you're going to help whoever's getting hit the hardest that day
>
> Sometimes, if I see something that's open on somebody's calls which I've seen before, I may put a note in the incident and say "Hey, I think I've seen this before, this might be this and this "
>
> I find a couple of times that's really been helpful for me

Proactive electronic help giving, however, was not simply a straightforward matter of providing knowledge or suggestions. It also involved a social interaction with particular issues of "courtesy." The appropriate etiquette for giving or receiving unsolicited help was, at least initially, quite ambiguous. Specialists were concerned about being rude or intrusive, and so they evolved a set of social protocols over time:

> Sometimes if I don't have a lot open, I may check around and see if anybody else has something that they need done, to, you know, help around I would go in and see who looked overwhelmed, and I'd say, "Boy, you looked like you had quite a day yesterday, do you need some help?" I would do that in person. It would be very rude to go in and resolve their call
>
> A lot of times I'll see something that's similar to what I may have already worked on. And I might be able to save them some time from even having to search by telling them what call I resolved this in I'll send them Notes mail with my resolution I won't close the call for them, but I'll give them what resolution I've used

They also qualified their comments and descriptions so as not to mislead colleagues:

> [When] I put a note in Duane's call, I said "I'm not sure, but it looks like it might be this and this " And I was very careful to say, you know, "I don't want to lead you astray here, but "

Specialists also had norms for acknowledging the help received from colleagues, for example,

> We all welcome whatever help we can get . . [and] we always send back a note, "Thanks, you just saved me some time I appreciate your help."

I observed one specialist writing in the incident history of her own call: "This could be a nightmare," which, she explained, was intended "to warn anyone who might be interested in helping out," so that they knew what they were getting into before they began working on it.

Specialists also attempted to maintain a sense of collegiality in their electronic collaboration. See for example, some of the comments entered in the ITSS record displayed in Figure 5. During my observation I noticed one senior specialist entering comments in junior specialists' call records by addressing them by name and signing her own name. She explained:

> I'm mucking around in their calls, so I do [use first names], otherwise it's so impersonal It takes the formality out of it It

> takes the edge out of it So if I'm being somewhat critical it doesn't come across negatively

An unanticipated consequence of the emergence of proactive collaboration was an increase in the effectiveness with which problems were solved. Managers responded by changing their evaluation criteria of specialists to take such unsolicited and courteous help giving into account:

> When I'm looking at incidents, I'll see what help other people have offered, and that does give me another indication of how well they're working as a team.

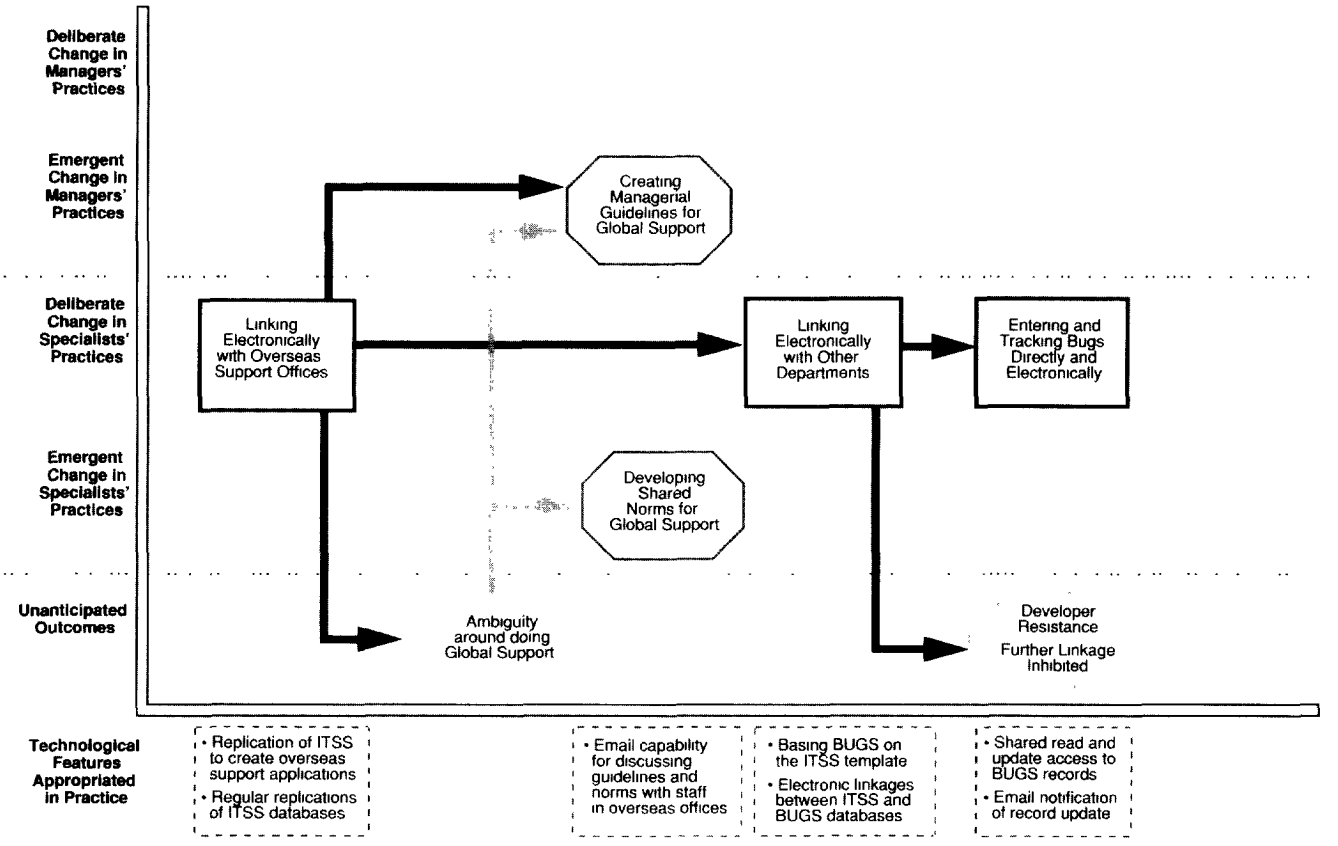
The use of ITSS facilitated proactive help giving by specialists which included but also transcended the formal division of labor into front and back lines. This unexpected innovation in work practices and the emergence of norms around the courteous and diplomatic giving of unsolicited help both reflected the cooperative culture of the CSD and its shared focus on solving customer problems.

Metamorphosis IV

Figure 8 shows the fourth set of metamorphic changes enacted with ITSS in the CSD. Here, both emergent and deliberate changes were enacted by specialists and managers to facilitate a global support practice and an interdepartmental coordination mechanism.

Electronic Linkages with Overseas Support Offices. During 1993 and early 1994, the senior vice-president of the Technical Services Division authorized the implementation of the ITSS technology in the three main overseas offices that had customer support departments—U.K., Europe, and Australia. In addition, the technology was configured so that the four support departments shared copies of each other's ITSS databases, which were replicated every two to three hours. This meant

Figure 8 Metamorphosis IV—Changes in Interdepartmental Coordination Enacted with Use of ITSS Over Time



that all four of the support offices had access to each other's databases, increasing the sources of knowledge that specialists could draw on in their research. This linkage of the four ITSS databases facilitated a global distribution of work, with overseas support specialists using the ITSS technology to transfer calls they could not solve to the U.S. support office, which was larger and had more expertise. Previously, overseas support staff would have transferred incidents to the U.S. via faxes and phone calls, but such exchanges were often ambiguous, necessitating lengthy clarification dialogues, and complicated by time zone differences, which made synchronous telephone conversations difficult to schedule. Use of ITSS as a transfer medium overcame the synchronicity constraint and ensured that more information about each incident was included.

Integrating the various support offices into a global support practice, however, did not just require a technological linkage. Social norms and expectations about call responsibility and work load were also necessary to facilitate cooperation across the remote offices. Initially, different customs and expectations generated ambiguity and created breakdowns in communication among the support staff across the various offices. The U.S. specialists, for example, resented what they saw as the tendency by overseas specialists to "just throw things over the wall," a sense exacerbated by the asynchronicity and impersonality of the ITSS-based electronic transfers. Such apparently noncollaborative behavior violated the CSD specialists' norms about support, which they had come to regard as a collective and shared activity:

> A lot of times, it's almost as though we're getting the problem without any analysis or testing on the part of the other office . . . If we ask for details on a certain piece of it or ask them to clarify a certain point, it may be days, sometimes it's weeks before a response will come through, . and then they say we talk down to them.
>
> I would say there is a fair amount of [calls] that if they bothered to search in the database they would have found the answer and it wouldn't have generated the transfer to us It's just very frustrating because here you are, working with somebody, you work for the same company, you're on the same team, and you get attitudes back and forth

Research has pointed to the importance of developing shared assumptions and expectations about use of a new technology (Orlikowski and Gash, 1994), and the U.S. specialists' frustrations suggest that the overseas specialists have a different understanding of the division of responsibility among support offices. Used to the collaborative problem-solving norms that have developed within the CSD, the U.S. specialists expected a similar relationship with their overseas colleagues. Overseas specialists, in contrast, had just started using the ITSS technology and had not had time to develop norms of collaborative problem-solving around incidents. They may have understood the relationship with the U.S. office as one of assigning responsibility for incidents. Responding to these breakdowns, the CSD managers contacted their overseas counterparts by phone and electronic mail, and together they generated a set of guidelines that explicitly articulated the procedures and expectations associated with a global support practice. Similarly, specialists began to send electronic mail to their overseas counterparts to clarify their expectations around joint responsibility for calls, and offered specific suggestions for how their collaboration could be facilitated.

Electronic Linkages with Other Departments. Based on the success of the ITSS expansion into overseas offices, the senior vice-president of the Technical Services Division authorized the development of a number of Notes-based bug tracking systems (one for each Zeta product) for installation within Zeta's product development, product management, and quality assurance departments. These bug systems (BUGS), modeled on the ITSS system and linked directly to it, were motivated by CSD's interest in being able to report and track bugs more efficiently, and hence were initiated, developed, and paid for by the Technical Services Division.

The bug tracking systems were built to allow a direct linkage from the ITSS database to the BUGS database. For example, if a specialist working on an incident discovered that the problem was due to a bug she could directly access the appropriate BUGS database to report the bug. The reference number assigned to that bug would appear in the original incident record (see the field "Bug Number" under Incident Management in Figure 5). Later, if she were curious about the status of that bug, she could open the original incident in ITSS, click on the bug field, and be directly connected to the appropriate BUGS record for determining the progress to date on that bug. Thus, specialists changed their work

practices of reporting and querying bugs. They now electronically transferred bugs that they had found directly into the appropriate bug tracking system, and they electronically queried the status of various bugs simply by calling up those records directly. This eased the task of reporting bugs to product development (previously a manual process) and gave specialists up-to-date information on the status of bugs when they needed it. By using the e-mail-enabled notification feature they could have the system notify them whenever someone updated a particular record in one of the bug databases. Specialists found these interdepartmental electronic linkages useful:

> The bug system provides a way to keep track of the work between the QA department finding the bug, the development fixing the bugs, and the status of the fix. But what's great is that we've actually hooked it into our incident system so that when a call comes into support and it turns out that it's a bug, we just click on a field and boom, it merges into the bug system, and so now we can keep track of it. Before that was really frustrating, we really went into a black hole
>
> Whenever someone goes in and makes a modification to that bug from development, we're notified immediately So, we're not hanging around, you know, having to go in and check every couple of days or every couple of months to see when our bugs get fixed. . . . We're notified every time they do something.

An unanticipated consequence of this interdepartmental expansion of ITSS use was the resistance it evoked from the Zeta product developers. They were reluctant to change their work practices to use BUGS, in part because they saw use of these systems as unimportant given that bug fixing represented only a small aspect of their work responsibilities:

> It's probably a sense that [bug tracking] isn't the real work. This is a little bit outside. We're trying to produce a product. [BUGS] is only a tool that helps us maintain a product, but it's not really part of the product itself

In contrast, use of ITSS by the CSD specialists was central to most of their work practices. Developers also worked under significant time constraints to get the next release of their product out, and hence were reluctant to take the time to learn to use a new system to facilitate their fixing of the old product. Their attention and interest were clearly focused elsewhere. The unanticipated outcome of developer resistance to use the Notes technology in their work or to change their work practices consequently inhibited future attempts by the CSD to more closely integrate the activities of the support and development departments.

Metamorphosis V

Figure 9 depicts the fifth set of metamorphic changes realized in the CSD with use of ITSS. It shows the deliberate and emergent changes that specialists and managers enacted in response to an increasing demand for access to the knowledge generated and archived within ITSS.

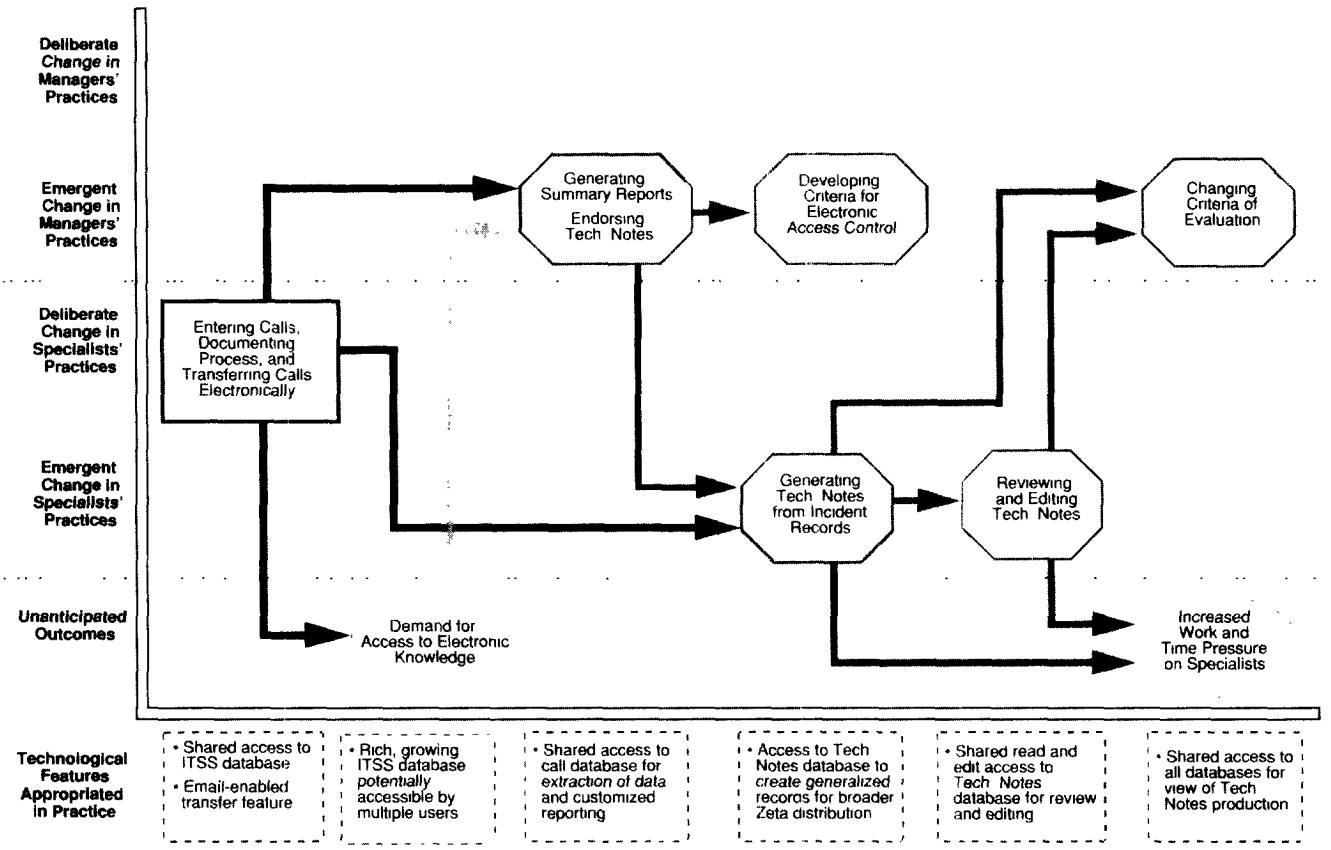
Electronic Access Control. With the ITSS database emerging as an increasingly valuable knowledge archive through the work practices of the specialists, others in Zeta began to demand access to this database, either to assess trends in customer problems, or to directly obtain resolutions to specific problems. Because of the level of detail in the ITSS database, CSD managers and specialists were concerned about who had access to the ITSS database, and how the accessed information would be used. For example, they feared information would be used against the department or individual specialists:

> There are people in the company who say, "Well, I just want a copy of this entire database so that I can use it to research problems for my customers and I won't have to call you " But sure as shooting, they'll look at it and say, "Well, I don't agree with that answer, and why did it take two days to get that answer?
>
> [Our] fear is that finger-pointing is an outcropping of access It's not everybody's motivation going in, but it happens
>
> Since we use this database all day long and pretty much everything we do is in here, you're under the microscope. And there's a lot of people in the company who could essentially look at this database and start criticizing.

They also feared that the ITSS information would be taken out of context and used inappropriately:

> [ITSS] isn't really a knowledge base, it's a history of all the problems we take in. And just because one incident might tell you to do something one way, doesn't necessarily mean that it's going to solve [every] problem . . Somebody in the sales group is not going to understand that . they will read it and take it as gospel, and it's not.
>
> All we attempt to do in support is answer the question to the best of our abilities There's no guarantees that it's right I don't think we want a situation where somebody passes something onto a client, and it ends up being a big problem for the client, and then everybody turns around to us and says, "Well, we got it from your database, so what's going on?"

Figure 9 Metamorphosis V—Changes in Knowledge Distribution Enacted with Use of ITSS Over Time



Over time, the CSD managers developed various mechanisms for dealing with this unanticipated demand; at the same time, norms around electronic access control gradually emerged, being improvised through a process of learning and experience in use. As a manager observed:

> Initially, I knew why I didn't want them to have it, and that was that it could be used against me. But at that point, I wasn't secure in being able to articulate that, maybe because I didn't have enough knowledge I couldn't have looked the [President of Zeta] in the face and told him that that data could be used against me, and felt strongly enough about it. I guess I had to experience—I had to go through a couple of years with that system knowing, experiencing different situations, and say to myself, "Gee, if they had access to my data I'd be dead right now." And now, I just have a much better perspective, and I'll go up against anybody when it comes to access of this data

At first, managers established a strong position of refusing ITSS access to anyone outside of the CSD. For individuals seeking information on customer trends, they offered as an alternative, customized, summary reports. A manager described a specific example:

> The western region heard about this great database that we had And they were particularly interested in finding out what their clients call us about. . . . So, as a way to pacify them I got a copy of a client list from them, and I would on a weekly basis go in and just highlight the week's activity in a view of those clients, and fax it to them.

For individuals seeking technical information, managers referred them to a mechanism improvised by the specialists and known as "Tech. Notes," which disseminated sanitized extracts of ITSS data throughout Zeta (see next section). Only after some time, did managers relax their strong position on "no access to ITSS," although still only allowing access to selected individuals:

> We have given access to a few product management type people, on the basis of whether we felt we could trust them with

> the information. If other people were to move into [those positions] we'd take the access away.

The CSD also communicated its position on ITSS access in the on-line ITSS users' guide:

> ITSS is, for the most part, the backbone of Technical Support It has become so valuable that other groups are requesting access to it for everything from account management to Client addresses Reasonable requests for access to ITSS information will be considered, but let the users beware!!! ITSS is intended as a call tracking application, not a technical notes database or a Client tracking database. The information in ITSS is provided "as is," with no guarantees It represents the best efforts of Technical Support Specialists working in a very complex support environment under serious time constraints. [highlighted in red] **Any use of ITSS that negatively impacts Support will not be allowed, and all offenders will have their access revoked immediately.**

Electronic Knowledge Dissemination. After many months of using ITSS and realizing the benefit of the ITSS knowledge base, the specialists began to generate sanitized summaries of information about particularly common or difficult problems. They shared these summaries among themselves and disseminated them to other Zeta departments. This practice, which had started informally among the specialists, received a big boost when the CSD managers used it to justify denying requests for direct access to ITSS. Zeta had in place a number of company-wide electronic bulletin boards known as Source Zeta (implemented in the cc:Mail software package). Different departments (e.g., customer support, product management) used these bulletin boards to announce information or distribute knowledge about various products. Specialists proposed the idea of taking common or important customer problems from ITSS, documenting them with clear descriptions and appropriate solutions, and then disseminating them via Source Zeta to the rest of Zeta (including the many field service representatives who represented up to 30% of the CSD's callers).

The transfer of knowledge from the ITSS database to Source Zeta took a few steps. First, individual specialists voluntarily wrote up sanitized and generalized "position papers" as Tech. Notes on specific technical issues. These Tech. Notes were entered into the Tech. Notes Review database (within the Notes technology) where they were reviewed by a (volunteer) committee of specialists whose comments triggered corrections and elaborations by the original author. This review cycle was facilitated by the shared access to databases provided by the technology. After iterating a few times through the review cycle, a Tech. Note would be published on the Source Zeta bulletin board, and thus disseminated throughout the firm. The initiative for producing Tech. Notes lay with the specialists. While not a mandatory part of their job, many specialists included this activity in their work practices, motivated by an interest in reducing calls from field service representatives, and a desire to increase their personal visibility within Zeta:

> The incentive is more or less trying to save somebody else time. You document something that you spent a lot of time on so that somebody else doesn't have to spend the time later on.
>
> It is a very visible note of productivity. . . . The primary author's name is associated with it, and it's distributed in a way that indicates it came from support. So I suppose it has both personal and group recognition.

The practice of generating and reviewing Tech. Notes was applauded by the managers, who modified their evaluation criteria to include such activity in their assessment of individuals' performance. An unanticipated outcome, however, of the use of Tech. Notes as access control was that it increased specialists' work load. Converting the electronic knowledge in ITSS from its situated, specific form to a more generic, abstract, and accurate form more suitable for broader dissemination was time-consuming, and at the time of my final interviews, specialists were finding that this voluntary activity had begun to add to their sense of time pressure. Presumably, further metamorphoses will occur as responses to these pressures.

Implications

Almost 15 years ago now, March called for theoretical developments that explain "how substantial changes occur as the routine consequence of standard procedures or as the unintended consequence of ordinary adaptation" (1981, p. 575). The practice-based perspective outlined in this paper attempts to take this call seriously. By focusing on change as situated, it provides a way of seeing that change may not always be as planned, inevitable, or discontinuous as we imagine. Rather, it is often realized through the ongoing varia-

tions which emerge frequently, even imperceptibly, in the slippages and improvisations of everyday activity. Those variations that are repeated, shared, amplified, and sustained can, over time, produce perceptible and striking organizational changes.

Such situated changes were associated with the implementation and use of new technology in the customer support department of Zeta Corporation. The appropriation of this technology by members of the CSD, and the adaptations and adjustments they enacted over time facilitated the slow, sometimes subtle, but surprisingly significant transformation of the organizing practices and structures of the CSD. In particular, we saw changes in the following areas: the nature and texture of work (from tacit, private, and unstructured to articulated, public, and more structured); patterns of interaction (from face-to-face and reactive to electronic and proactive); distribution of work (from call-based to expertise-based); evaluation of performance (from output-focused to a focus on process and output as documented); forms of accountability (from manual and imprecise to electronic and detailed); nature of knowledge (from tacit, experiential, and local to formulated, procedural, and distributed); and mechanisms of coordination (from manual, functional, local, and sporadic to electronic, cross-functional, global, and continuous).

Figure 2 depicts these transformational changes in the CSD as emerging out of the ongoing practices of organizational actors. The theoretical premise is that these practices are generated through a structuring process, where the everyday actions of organizational members produce, reproduce, and change their organizing structures. Changes in the CSD's organizing practices (and hence its structures) were initially triggered by the design and installation of a new information technology to mediate support work. In contrast to the technological imperative perspective however, this new technology did not cause particular predetermined organizational changes. Rather it was designed and constructed by the CSD implementation team to provide a set of features which both constrained and enabled the ITSS users in ways anticipated and unanticipated by the implementation team. The ITSS technology enabled specialists and managers of the CSD to allow the representation and storage of structured and free-form data about each call entered into the database, provide shared access to networked users, support fast searching of records in the database, facilitate communication and call transfers, allow replication of distributed databases, and afford direct links to related databases. But the ITSS technology also constrained the practice of support work by formalizing and encoding particular procedures for conducting support work, providing only particular structured views of the data in the form of fixed entry and edit screens (manipulation of which required careful attention), restricting structured fields to only certain values, thus legitimating only certain meanings, presenting a strictly chronological trace of work in progress that endorses documentation not action, preventing the alteration of incident histories, making work process visible and measurable, providing few cues or clues about communication and collaboration norms, offering little statistical capability, and mediating work so that when the technology breaks down or exhibits errors, breakdowns arise in user routines.

As members of the CSD attempted to make sense of and appropriate the new technology and its embedded constraints and enablements, they enacted—through the structuring process—a series of metamorphic changes in their organizing practices and structures. These changes were grounded in members' daily actions and interactions as they responded to the expected and unexpected outcomes, breakdowns, and opportunities that their technological sensemaking and appropriation afforded. While some of the changes were deliberate and intended, others were emergent and unanticipated. In contrast to the planned change perspective, thus, many of the changes realized by the CSD were not planned a priori, and neither were they discrete events. Rather, they revealed a pattern of contextualized innovations in practice enacted by all members of the CSD and proceeding over time with no predetermined endpoint. A comparison of CSD practices and structures in June 1992 and December 1994 (see Figure 2) reveals significant changes in work, norms, structure, coordination mechanisms, evaluation criteria, and technology use. These changes were not all implemented with the initial deployment of the technology (Metamorphosis I), but emerged and evolved through moments of situated practice over time. These findings suggest—contrary to the punctuated equilibrium pre-

diction that organizations do not experience transformations gradually—that local variations in practice can, over time, shade into a set of substantial organizational metamorphoses.

The five metamorphoses in Zeta's CSD provide one instance of situated organizational change. Considerable further empirical research is necessary. As indicated earlier, the current research is limited by the retrospective nature of much of the data. Studies that allow long-term observation of ongoing practices would clearly deepen and extend the analysis, begun here, of organizational change as situated in moments of practice. Further empirical research is also needed to determine the extent to which a practice-based perspective on transformative change is useful in other contexts, and how different organizational and technological conditions influence the improvisations attempted and implemented. While the changes in the CSD were relatively effective, one may imagine, for example, that in a more hierarchically organized or more rigidly controlled workplace, the sorts of workarounds, adjustments, and innovations enacted by Zeta actors may not have been tolerated or successful. Organizational inertia and resistance to change—often seen in organizations and predicted by a number of change theories—were not apparent within the CSD. Members of the CSD appeared to be open to exploring alternative ways of working, of learning from and changing with the new technology. The CSD managers initiated and encouraged such experimentation and learning, thus providing a legitimating context for ongoing improvisation. Indeed, these ongoing changes continue within the CSD, and as the research study ended, there was no sense of a transformation completed. Metamorphosis continues, as one manager observed:

> We've had ITSS for two years. I'm surprised that the enthusiasm hasn't gone away. . . I think it's because it's been changed on a regular basis. And there's always some new feature, or we think about . . other things that we can do with it. Knowing that they're going to get implemented keeps you wanting to think about it, and keep going

Similarly, more research is needed to investigate how the nature of the technology used influences the change process and shapes the possibilities for ongoing organizational change. Had a more rigid, more fixed-function technology been used, the pattern of use and change realized within the CSD would have been different. The specific ITSS technology was built within a general technological platform (the Notes groupware system) which is more open-ended, generic, and user-customizable than traditional transaction processing or single-user computer systems. Such technological capabilities represent a new class of organizational computing, which Malone et al. (1992) aptly refer to as *radically-tailorable tools*. The distinguishing capability of such tools is that they enable users to construct or customize specific versions and local adaptations of the underlying technological features. This capability has two important implications for practice. One, it allows for easy ongoing changes to the technology in use, in contrast to more rigid, fixed-function technologies which are difficult and costly, if not impossible, to change during use. Two, because customization is required for effective use, ongoing learning in use and consequent technological and organizational changes are encouraged. As Orlikowski et al. (1995) suggest, because new customizable technologies are so general, local adaptations and ongoing accommodations of such technologies and their use are necessary to make them relevant (and keep them relevant) to particular contexts and situated work practices. Such adaptations and accommodations cannot be known upfront and typically have to be enacted in situ. The practice-based logic of change followed by the CSD would appear to be a particularly useful process for implementing and using such new technologies.

The particular kinds of metamorphoses identified in Zeta's CSD—increased documentation, accountability, visibility, and differentiation, shared responsibility, proactive collaboration, distributed and cross-functional coordination, and knowledge dissemination—are clearly specific to one unit (CSD) within one organization (Zeta). This is appropriate in a perspective of situated change, which by definition, assumes context specificity. However, the *process* of change outlined here—ongoing local improvisations in response to deliberate and emergent variations in practice—is potentially generalizable and is offered as a stimulus for further research. Of particular interest is the general usefulness of this perspective in those organizations embracing calls for flexibility, experimenting with ongoing learning, or investing in open-ended, tailorable technologies.

The dominant models of technology-based organizational transformation—planned change, technological imperative, and punctuated equilibrium—each make a number of assumptions about the nature of agency, context, technology, and change which are appropriate to an organizing practice premised on stability. Contemporary demands for organizations to be flexible, responsive, and capable of learning require organizing practices to deal with ongoing change. I have proposed an additional perspective on organizational transformation that avoids the strong assumptions that have characterized prior change perspectives because it focuses on the situated micro-level changes that actors enact over time as they make sense of and act in the world. In its presumption of ongoing action, a practice lens allows for the possibility of ongoing change. It conceives of change as situated and endemic to the practice of organizing. It affords an analysis of technology-based organizational transformations that is ongoing, improvisational, and grounded in everyday, knowledgeable agency. As such, it may offer a unique and especially appropriate strategy of interpretation for the new organizing discourse becoming increasingly common today.[1]

[1] I would like to thank the members of Zeta Corporation who participated in this research, as well as Michael Gallivan, Cheng Goh, Lorin Hitt, and George Wyner who collected data during the first research phase. Comments of the issue editors and anonymous reviewers on an earlier draft of this paper were very helpful. This research was supported by the Center for Coordination Science at the Massachusetts Institute of Technology.

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Accepted by JoAnne Yates and John Van Maanen, acting as Special Editors