Computer Systems and the Design of Organizational Interaction

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The goal of this paper is to relate theory to invention and application in the design of systems for organizational communication and management. We propose and illustrate a theory of design, technology, and action that we believe has been missing in the mainstream of work on office systems. At the center of our thinking is a theory of language as social action, which differs from the generally taken-for-granted understandings of what goes on in an organization. This approach has been presented elsewhere, and our aim here is to examine its practical implications and assess its effectiveness in the design of The Coordinator, a workgroup productivity system that is in widespread commercial use on personal computers.

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1. INTRODUCTION

In using the word "technology" people are generally concerned with artifacts—with things they design, build, and use. But in our interpretation, technology is not the design of physical things. It is the design of practices and possibilities to be realized through artifacts. Computer technology involves machines, but that is not what is ultimately significant. It encompasses the design of new practices (including those of word processing, electronic communication, printing, accounting, and the like), and beyond that it opens the possibility for new realms of practice.

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Computer technology can change what it means to manage and to act in an organization. In fact, such a change is happening and is going to happen regardless of what the designers think they are doing. When we accept the fact that computer technology will radically change management and the nature of office work, we can move toward designing that change as an improvement in organizational life.

At one level this is a paper about a particular system designed to provide computer support for communication in organizations. At another level, it is about the design of computer systems in general, and beyond that about the nature of the design process and its relation to theory. We argue that careful, conscious theorizing at a foundational level should precede design and can increase the likelihood of its effectiveness. We begin by expanding on what we mean by "theory."

2. THEORY AND DESIGN

The design of new technology is always an intervention into an ongoing world of activity. It alters what is already going on—the everyday practices and concerns of a community of people—and leads to a resettling into new practices, which in turn create new future design possibilities.

The designer is someone who steps back from what is already going on to create an intervention. In doing this he or she applies, implicitly or explicitly, a background orientation toward the activity in which the technology is to be employed. This orientation may rest on taken-for-granted conventional wisdom or may emerge from an explicit theoretical articulation of what it is that is going to be facilitated. For example, the design of a tool for communication and management in an organization will embody an orientation toward action and the management of action. As one possibility, the designer may assume that the relevant activity can be characterized as the generation and movement of objects (papers, reports, products, etc.) through some space (the office or a network of offices and receiving and dispatching points).

One can increase the coherence of a design by developing a theoretical "ontology," which lays out basic dimensions and distinctions. In saying that this explication is theoretical we are not attributing to it a predictive structure like that of mathematical theories of physics. What we mean is that it clarifies the preunderstanding of what kinds of things exist, what kinds of properties they can have, and what kinds of events and relationships they can enter into. The "objects," "forces," "velocities," and the like of Newtonian physics provide this kind of basis for the more quantitative aspects of the theory.

A theory, as an ontology, is a set of key distinctions for observing, participating, and designing. It is (to use a metaphor) the eyes with which we see what is going on. For example, one distinction in our common sense ontology of organizations is that of "messages" that people send to one another. As observers in this ontology we see messages going back and forth; as participants, we send and receive messages; and as designers we may design systems for facilitating message composition and transmission. But "messages" is only one possibility for constituting ourselves as observers, participants, and designers. We might, as theorizers, offer other interpretations of what is happening on the basis of other key distinctions, such as those of shared tasks and goals or of speech acts.

Every theory or every ontology of distinctions will allow us to make some observations, actions, and designs and prevent us from making others. Designers who work with "messages" can devise systems for making the preparation and passing of messages more efficient. But the possibilities are also limited by this ontology—they cannot escape designing something to do with messages. The question is what ontology of distinctions—what theory of management and organizational action—will prove effective in designing systems for organizations.

The effectiveness of a work of design, and of a theory as a basis for design, must be assessed in the context of the consequences of the intervention. Some theories will prove better as a basis for design than others. That is to say, some will be more effective for orienting us toward new possibilities that can be developed into useful artifacts. For some purposes, the understanding we already experience will be a satisfactory basis. In others, reorientation can open new and better possibilities.

Two prominent orientations underlie most of the computer systems in common use today. Each of them offers distinctions from which users and designers observe and participate in the activities of concern. The most prevalent, which underlies traditional electronic data processing, has been based on an ontology of "data" and "information." Its distinctions are those of data, formatting, and algorithms for data storage and manipulation. A computer system contains and manipulates information and is related to the "real world" through operations of "data entry" and "reporting" or "data access."

This orientation is embodied in the design of "management information systems" (MISs), which focus their intervention on the task of providing quantities of accurate, up-to-the-minute data to managers. They carry the assumption that the greater the quantity and accuracy of the information available, the more able are people to consider alternatives and make decisions. These systems have largely failed in their attempt to improve management because the problem is not one of insufficient or stale data. Management is not management of information. Information is only important to managers because they need to take actions, for which they sometimes require grounding that can take the form of statements, summaries, and reports. By focusing on an ontology defined in terms of data, MISs operate in a secondary domain and more often than not swamp the manager in distracting information.

A second orientation takes "decision making" as the central task of managers and is expressed in the design of "decision support systems" and more recently of "expert systems." Here the focus moves away from the data itself to the process of problem solving and decision making. This process can be roughly characterized as a series of steps, which include defining the problem space, listing alternatives within that space, assessing the consequences of each alternative, and finally selecting from among them. Decision, evaluation, search, and cognition are taken as the key distinctions.

Hidden within this ontology is a focus on evaluation and search for solutions that rest on a relatively well-established and formalizable problem space. We believe that much of the work in this area is foundering because this assumption is rarely appropriate in practice. Coming to terms with the ill-defined background within which we feel there is a problem or state of irresolution is one of the fundamentally unsolved central issues in this line of research.

Both traditional data-processing and problem-solving orientations convey an attitude that there is an "objective" external world that can be neutrally observed and fully characterized in symbolic representations. This kind of approach (which we have labeled "rationalistic" in [6]) has a long and useful history, but it is not the one best suited to design in the office. The more urgent need is to understand the role of background and language in setting the dimensions of the space in which people interpret and generate their possibilities for action.

In line with this, a third theoretical orientation underlies our own work, with "action through language" as the key domain of distinctions. The design of conversational systems focuses on interventions into the recurrent patterns of communication in which language provides the coordination between actions.

3. A LANGUAGE/ACTION PERSPECTIVE

Our principal theoretical claim is that human beings are fundamentally linguistic beings: Action happens in language in a world constituted through language. What is special about human beings is that they produce, in language, common distinctions for taking action together. Language then is not a system for representing the world or for conveying thoughts and information. Language is ontology: a set of distinctions that allows us to live and act together in a common world.

The orientation within which we go about design is one that allows human beings to observe their producing and acting in a world linguistically, to design their actions together, and to recognize and respond to breakdowns. The designer's job is to identify recurring breakdowns, or interruptions in ongoing activities, and prepare interventions to resettle the activities in ways that cope with or avoid those breakdowns.

In using the term "breakdown" here, we do not intend it to have a tone of "upset" or "catastrophe." A breakdown is any interruption in the smooth unexamined flow of action. It includes events that participants might assess as negative (as when the pen you are writing with runs out of ink) or as a positive new opportunity (e.g., a stray useful thought that interrupts your flow of writing or a friend knocking at the door).

In turning our attention to this ontology, we are not designing something new for human beings to do. People already produce a world together in language and they already coordinate their actions in that world. A fundamental condition of human action is the ability to affect and anticipate the behavior of others through language. Design can improve the capacity of people to act by producing a reorganization of practices in coherence with the essential, ineliminable nature of human interaction and cooperation. The crucial distinctions—the ontology—of our design are the fundamental linguistic actions: requests, promises, assertions, and declarations. A brief summary of the dimensions of linguistic action is given by Aurämaki et al. (pp. 126–152, this issue) and is based on a taxonomy developed by Searle [3]. We do not lay out all of the distinctions here but indicate the direction of our theory with the cases of requests and promises.

When you request that someone perform an action in the future, you anticipate the fulfillment of certain conditions. The conditions explicitly stated in the

request are interpreted within an implicit background of standard practices—what is "normally" done in your community in similar situations—and within the shared understanding of speaker and hearer. Not all conditions will be or need be explicitly stated when the background itself is sufficient. For example, in requesting "Meet me tomorrow at two o'clock," you specify an action and a description of those conditions of fulfillment that are not taken for granted. In this case, the time is explicit, whereas the place and any other conditions are implicit in the preunderstanding of the speaker and listener. We speak of the "conditions of fulfillment" of a request as including not just the explicit statement, but the larger interpretation (which may differ between speaker and hearer) of the conditions under which the requester will declare that the request has been satisfactorily fulfilled.

People promise actions to one another. That is, they offer to perform some action in the future, or they agree to perform some future action that has been requested of them. This act need not involve any mention of "promise." A promise might be "Okay," or "You're the boss," a nod, or even in some contexts just a mutually recognized silence.

A request and promise (or a declining) make up an initial segment of a "conversation for action," which initiates a simple structure of possibilities for continuing to some kind of completion. The promiser may later report performance of the action, and the requester may declare the conversation and the action completed. Alternatively, the request or promise may be canceled, or a further request made (by either party) to clarify or modify the conditions of fulfillment.

Organizations are structures for the social coordination of action, generated in conversations based on requests and promises. These distinctions of linguistic action are crucial to building technology for organization and management. They are also universal with respect to time and culture. So long as people live and work together, they will coordinate their actions in requests and promises and the expectations that derive from them.

It is important to separate out these basic constitutive phenomena of social action from the particular cultural and linguistic forms in which they appear. As mentioned above, many different kinds of utterances (or nonutterances) can be interpreted as promises in a particular cultural background. The same words may lead to very different interpretations in different contexts.

In some cases the forms depend on the details of the situation. "It's cold in here" may be a request for action in some situations and not in others. In other cases there are cultural norms. In adapting The Coordinator to Italian, the programmers were told to avoid the term corresponding to "request" because "Only the government requests. Other people 'invite.'" Similarly, a popular observation about Japanese culture concerns a reluctance to appear to offend the listener. It is said that the Japanese will "never decline a request." In the immediate visible sense, this may be true: A direct expression of a request is never (in polite discourse) answered with "No." But in the deeper interpretation there must be recognizable means for conveying all of the basic possibilities of promising, declining, and negotiating. If I enter into a conversation with you about meeting at two o'clock tomorrow, I need to go away from that conversation knowing whether it is worth my effort to show up at the appointed time on the

expectation that you will be there. Without the fundamental distinctions of social coordination, we cannot carry out activity that involves other people in anything but the immediate present or in predictable recurrent patterns.

These distinctions will be implemented with different tools and regularized practices, depending on context and culture and on what technology is available. Much of our own work has concerned computer-based tools for conversation. We have also implemented our theory of language as action in other areas, such as the design and presentation of courses in management and effective communication, and for generally allowing people to learn and embody new distinctions for observing, assessing, and designing social actions.

By teaching people an ontology of linguistic action, grounded in simple, universal distinctions such as those of requesting and promising, we find that they become more aware of these distinctions in their everyday work and life situations. They can simplify their dealings with others, reduce time and effort spent in conversations that do not result in action, and generally manage actions in a less panicked, confused atmosphere.

4. COMPUTER TOOLS FOR ACTING IN LANGUAGE

As computer networks become more widely available and easier to use, they are generating new phenomena relevant to management. They introduce more than just the connectivity of being able to send, store, and receive information. Via networking, one can extend the effective reach of actions, record them, and structure them. Although this new potential rests on the technology of computer networks, that is not where the relevant understanding lies. The potential for designing new and more effective tools and practices lies in the domain of networks of people engaged in conversation and in the networks of actions that connect them. This is where the fundamental distinctions are made and where the salient breakdowns occur.

As we described above, the rationalistic tradition leads people to think that as they become more electronically connected, the ensuing availability of information will greatly improve the effectiveness of organizations and the execution of management. It is tacitly assumed that information quantity can somehow be correlated with enhancement of alternatives and hence more effective decision making. But productivity in the office is not quantity of information—it concerns the effectiveness of people getting things done. As more and more databases, electronic bulletin boards, online query systems, and the like become routinely available, people often become less rather than more certain of what actions are appropriate. The breakdown that arises is one of overload. It becomes more difficult to assess the available information in a meaningful way: to determine what is relevant to actual and potential concerns, what legitimacy to grant to the information and its speaker, and what structure to impute or assign to it.

Electronic mail, for example, has led to new possibilities for communication that cuts across many of the older structures in organizations [4]. At the same time, it has created a new source of breakdown for many people, who find themselves swamped by messages that demand their attention. As Kiesler observes, "If you just add technology to the office, you may wind up having more communications to monitor, more things to type, and more projects initiated

that don't get completed; you may not improve performance" [2, p. 48). In the authors' personal experiences working within a community of researchers dedicated to the design and use of computer systems, we are continually jolted back to reality by statements like "Oh, sorry I didn't get to that—I'm two weeks behind in getting through my e-mail."

For older media, specialized roles and institutions have evolved to deal with this breakdown. Libraries, universities, publishers, editors, commentators, and the media marketplace help to digest information for us. Receptionists, secretaries, and assistants manage the flow in a variety of organizational situations. The range and quantity of information readily accessible via the computer appears to have temporarily outpaced the growth of new roles and institutions for handling information. And so, to view networks as simply a mechanism for information connectivity leads to a fundamental breakdown. The management of information becomes an additional task—a burden, not a support.

Tools continually emerge to handle this flow as people attempt to cope with the breakdowns they experience. A survey of the software available for use in offices reveals a great potential for innovative practices. Calendar programs, project management tools, spreadsheets, and the like can be used effectively to associate information with the human environment that makes the information meaningful. Users adapt generic technologies such as spreadsheets to the immediate tasks at hand in a pragmatically effective way (often in ways other than those anticipated by their designers) without a theoretical foundation.

If design is based on a theoretical framework, a unified and coherent approach can be developed. The vast number of specialized and idiosyncratic tools and practices can be incorporated into a coherent theory that leads to an effective redesign of already existing tools and to fruitful new possibilities. Database systems offer an example of this process in a different domain. The jumble of practices for storing structured data in computer-accessible files has gradually evolved into a relatively small and coherent theory on which powerful generic tools such as relational databases and query languages can be built and standardized, thereby not only providing a way to clean up existing systems, but, as these database tools become standard in operating systems, offering new possibilities for their use.

We propose that the language/action theory offers such a unified foundation for designing the support of interactive work in organizations. We illustrate the relevance of this analysis to computer systems by describing The Coordinator,[1] a workgroup productivity system currently used on IBM PC-compatible machines for everyday operations in sales, finance, general management, and planning in organizations of a variety of sizes and types. The Coordinator provides facilities for generating, transmitting, storing, retrieving, and displaying records of moves in conversations. However, unlike electronic mail systems that take messages and information as their starting points, it is based on the language/action theory outlined above. The description here focuses on the "conversation manager," which is one part of an integrated system that also includes word processing, formatting, calendar maintenance, and connectivity over phone lines and local-area and wide-area networks.

[1] "The Coordinator" is a registered trademark of Action Technologies.

4. THE COORDINATOR

The Coordinator is a system for managing action in time, grounded in a theory of linguistic commitment and completion of conversations. Conversations are essentially temporal, both as a sequence of acts and in the wider context of conversations and actions in a community or organization.

In making a request or promise, the speaker brings into a shared domain of interpretation a set of conditions to be fulfilled through action in the future. A conversation that develops from this opening can be viewed as a kind of "dance" in which particular linguistic steps move toward completion: If an action has been requested of you, you promise or decline; if you have promised to complete the action, you report completion or revoke your promise; if you have requested an action, you cancel your request, ask for a progress report, or declare that your conditions have been fulfilled and the action completed. What drives the design here is our theoretical claim that social action happens through language. The conversational dance is a social dance of bringing forth conditions of fulfillment, commitment to fulfill them, and completion.

The user interface of The Coordinator is based on menus that reflect the underlying theory. The primary menu for conversing is shown in Figure 1. Some of the menu items initiate new conversations. Others bring up records of existing conversations.

Instead of providing a uniform command to initiate a new message, The Coordinator provides options that identify different linguistic actions. When "Request" is selected, the user is prompted to specify an addressee, recipients of copies, a domain (a keyword that groups related conversations under a common concern), and a brief action heading (corresponding to the subject header in traditional mail systems). The body of the message is prompted with the phrase "What is your request?" to which the user enters any text whatsoever. The system makes no attempt to interpret this text but relies on the user's understanding and cooperation that the message is properly identified as a request. This is a key design issue: Let people interpret the natural language, and let the program deal with explicit declarations of structure (such as the user's declaration that this is a request). The conditions of fulfillment rest in the interpretations of speaker and hearer, not in the structure of the text. A perfectly understandable request (one with mutually understood conditions of fulfillment) might contain the single word "Noon?" if the participants have a shared understanding (e.g., they often go to lunch together).

When the user signals that the text is complete, the system prompts for three dates associated with the completion of the action: a "respond-by" date, a "complete-by" date, and an "alert" date. Date entries are optional, but experienced users almost always include one or more of them. Not only do they provide the primary structure for retrieval and for monitoring completion, but the identification of completions with specific dates plays a surprisingly large role in producing effective conversations. A requester will specify a completion time for the action based on assessing when this action is crucial in dealing with wider concerns, preparations for other actions, and so on. The response time will reflect an assessment of how soon other actions need to be taken if the request is declined. For example, suppose that someone requests preparation of a financial

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                    C O N V E R S E

OPEN CONVERSATION FOR ACTION          REVIEW / HANDLE
   Request                              Read new mail
   Offer                                Missing my response
                                        Missing other's response
OPEN CONVERSATION FOR POSSIBILITIES
   Declare an opening                   My promises/offers
                                        My requests
ANSWER                                  Commitments due: 24-May-88

NOTES                                   Conversation records
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Fig. 1. Converse menu from The Coordinator. (Reprinted by permission from F. Flores, C. Bell, M. Graves, and J. Ludlow. *The Coordinator Workgroup Productivity System I. Version 1.5 P.* Action Technologies, Emeryville, Calif., 1987.)

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SPEAKING IN A CONVERSATION FOR ACTION

 Acknowledge        Promise
 Free-Form          Counter-offer
 Commit-to-commit   Decline
 Interim-report     Report-completion
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Fig. 2. Menu for responding to a request. (Reprinted by permission from F. Flores, C. Bell, M. Graves, and J. Ludlow. *The Coordinator Workshop Productivity System I. Version 1.5 P.* Action Technologies, Emeryville, Calif., 1987.)

report that is crucial to a meeting on Thursday. The request includes, as a condition of its fulfillment, that it be satisfied by the meeting time, and the response must be soon enough to find another way to get the report or alternative information for the meeting.

When a request is received, the recipient responds by selecting "Answer" from a menu of mail-reading operations, which calls forth a subsidiary menu as shown in Figure 2. This menu is automatically generated by a conversational state interpreter that keeps track of the current state of the conversation (as determined by the preceding acts). For a detailed description of conversation structure and its embodiment in The Coordinator see [5] and [6].

The first three items in the right-hand column (Promise, Counter-offer, and Decline) represent the standard actions available in response to an initial request. The fourth choice (Report-completion) is also possible, since in some cases, it will turn out that the recipient of a request has already done what was requested.

The left-hand column introduces conversation acts concerned with the conduct of the conversation itself, which do not advance its state. "Acknowledge" sends

a standard reply informing the requester that the request was received. "Free-form" allows any kind of communication relevant to the conversation—most frequently, notes, comments, and questions—that does not fit into the formal structure. "Commit-to-commit" would be conveyed in natural language with sentences like "I'll let you know by Thursday if I can do it." That is, the speaker is committing to take the next conversational step (promising or declining) by a specific time.

When any answering action is selected, a new message is automatically generated with markers corresponding to the choice of act and with a generic text. For example, if the response is "Promise," the initial message is "I promise to do as you request," whereas for "Counter-offer" it is "No; I counteroffer: . . ." The user can augment or replace this text using embedded word processing facilities. Experience has shown that a surprising number of messages need only the initial pro forma composition. The message initiating a request or offer needs to contain text that sets forth the action such as "This is a reminder to send me that report we were talking about at lunch." But often the subsequent steps are made by simply selecting the appropriate menu item and hitting the button that sends a message.

Whenever "Answer" is selected, the menu displays only those actions that could sensibly be taken next by the current speaker, given the direction of the conversation toward completion of action. For example, after making a commitment, the next time the promiser answers in that conversation (assuming no intervening action by the requester), the menu offered will be as shown in Figure 3. At this point, there is no longer an option to decline, but the promiser can "Report-completion" or "Cancel" with or without initiating a new promise.

The Coordinator has no magic for coercing people to come through with their promises, but it provides a straightforward structure in which they can review the status of their commitments, alter commitments they are no longer in condition to fulfill, anticipate coming breakdowns, make new commitments to take care of breakdowns and opportunities appearing in their conversations, and generally be clear (with themselves and others) about the state of their work. The structure and status of conversations is the primary basis for organizing retrieval and review in the system. To put it simply, the structure is organized to provide straightforward and relevant answers to the implicit question "What do I have to do now?"

Several things are of note:

—The basic unit of work in the system is a conversation, not a message. In conventional electronic mail systems, messages are often linked by conventions such as the use of "Re: . . ." in headers. For The Coordinator, each message (including a Free form) belongs to a particular conversation. The retrieval structure is a two-level one with the user first identifying a conversation, then selecting particular messages within it to be displayed.

—The explicit use of conversation theory in the generation of messages makes it possible for retrieval to be based on status. There is a way to display answers to questions such as "In which conversations is someone waiting for me to do something?" or "In which conversations have I promised to do things?" Note

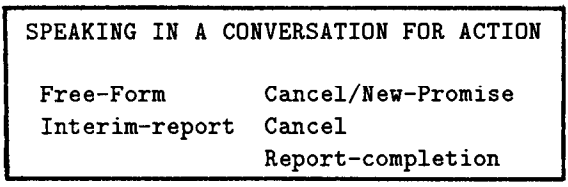

Fig. 3. Answer menu generated in continuing a promise. (Reprinted by permission from F. Flores, C. Bell, M. Graves, and J. Ludlow. *The Coordinator Workshop Productivity System I. Version 1.5 P.* Action Technologies, Emeryville, Calif., 1987.)

that these two queries are different. For example, if you make an offer to me, then our conversation is in a state in which the next move characteristically belongs to me, but I have made no promise to you.

—The distinction of "completion" is central to monitoring the progress of conversations. An "open" conversation is one in which additional steps are required to reach a state of closure. Note that completion is not the same as satisfaction. If I withdraw a request, the conversation is complete even though the request was never satisfied. The distinction between open and closed conversations is one of the primary ones used to filter out those to be retrieved. Unless the user designates otherwise, The Coordinator will display only those conversations that are still open to further action.

—Explicit response, completion, and alert dates identify potential breakdowns in the progress toward completion and are used for time-oriented retrieval. The calendar subsystem is integrated, so that all of these items can optionally appear at the appropriate places in a personal calendar, along with more conventional entries such as meetings and appointments.

—The Coordinator applies theories of language without attempting to automate language understanding. All of the interpretations (e.g., that a particular message is a request, or that it should be done by a certain time) are made by the people who use the system, guided by appropriate menus and prompts. This is not experienced by users as an extra job of annotating but in fact replaces typing parts of the contents.

—It is a generic tool in the same sense as a word processor or a spreadsheet, but in a different domain of elements, that is, a different ontology. A word processor is not equally well suited to generating all kinds of character sequences but is specially designed for the words, sentences, and paragraphs of ordinary written text. Similarly, The Coordinator is not built for arbitrary sequences of messages, but for the requests, promises, and completions that are at the heart of coordinated work.

We want to reiterate our point that, although The Coordinator exemplifies a new design and a new theory of action and management as a basis for design, the distinctions of linguistic acts and completion of action are not those of new entities or new proposals for doing something. What we are doing in our theory

is reconstructing constitutive distinctions of human social action. These are distinctions for generating any socially coordinated actions: bringing, in a request, a future action and its conditions of fulfillment into a publicly shared world and producing, in a promise, a commitment to complete the action. These distinctions are simple, universal, and generative of the complex organizational and management phenomena with which we need to deal.

Managers are often faced with apparently overwhelmingly complex projects and sets of actions to manage, recurrent miscoordinations of action (misunderstandings of requests, conditions of fulfillment, and promises), and information overload. By interpreting the situation as a network of requests and promises with certain regular logical and temporal structures, we can help bring order. Information is information that appears within a conversation with relevance to action: It is not piled up as contextless facts. The activity of management is the creation and development of conversations for completing action. These constitutive distinctions give managers an improved awareness of what they are managing and an increased capacity to observe, monitor, and intervene in the flow of activity.

Everyone makes requests and promises, but we are not typically aware of them in a fashion that helps to identify breakdowns or intervene in the constitutive dimension of our actions. The Coordinator expands the individual's capacity to observe and assess a situation and intervene into what is already going on. When you make a request with The Coordinator, you are presented with the fact that you are making a request—you choose "request" from its menu for conversations. When you make a promise, it is the same. And, more important than the names on the screen, the request or promise you make in the conversation sets in motion a conversational structure and a structure for observing your conversation that is defined by the linguistic move you have made. You have tools, in other words, for anticipating and identifying breakdowns on the way to the completion of action, for intervening consistently with breakdowns that have occurred, and generally for making the next appropriate moves in the conversation.

What is crucial, we are saying, to the effectiveness of The Coordinator is that it produces in its user a capacity to observe action in its constitutive dimension. The system will "coach" its user to operate in a system of distinctions that constitute and promote effective coordination of action. The effectiveness of the tool is not limited to its actual occasions of use. The Coordinator also has an educational dimension. By operating consistently within the distinctions embodied in it, people begin to acquire a "new common sense" about social action. Even away from The Coordinator itself, they will begin to observe and act in ways that are consistent with the theory. Their taken-for-granted understanding or way of observing will embody those distinctions on which The Coordinator is designed, and they learn to observe, assess, identify, and intervene in accordance with them.

5. THE SOCIAL ENVIRONMENT

Since The Coordinator embodies an orientation toward language as social action, its effects must be examined beyond the context of a single user—in the social interaction of an organization as a whole. The key observation about a tool like

The Coordinator is that it intervenes and creates change by making explicit a structure of conversation that was already there.

The most visible impact is to facilitate the shared clarity of communication. Participants who share a grounding in observing, assessing, and intervening in conversations for action will have the basis for a more effective mutual understanding of actions to be taken. A request is a request, with a well-understood structure of consequences, in the understanding of all participants. They share a language of distinctions for attacking ambiguity and ensuring that they share an understanding of what they are doing together.

In a sense, this clarity is something that needs to be recovered as we move from older social forms to the complex computer-mediated modern organization. In a simple closely knit society, there is a tremendous degree of overlap in people's backgrounds. They share a common set of social mores and understandings and can anticipate close similarity in their interpretations. In a small group, furthermore, each individual is familiar and everyone's behavior can be frequently anticipated on the basis of prior personal experience. In such a context, there is a relative clarity of knowing what people really mean by what they say.

In today's modern society, there is much less cultural commonality, and organizations tend toward being collections of nameless and faceless "functional roles." Communication structures are mechanized and regularized in order to regain some degree of predictability. Kiesler describes how "computer-mediated communication can break down hierarchical and departmental barriers, standard operating procedures, and organizational norms" [2, p. 48]. She documents a number of ways in which the use of electronic messages can lead to breakdowns in the face of the relative absence of what she terms "static and dynamic personal information" and argues that "the real challenge is to build electronic communication facilities so that it is easy for people to negotiate and to implement procedures and norms—in other words, to design systems that somehow give back the social context that computer mediation wipes out" [2, p. 54].

In a way, the drive toward "computerization" is an overreaction in this direction. A rigidly specified set of procedures can help ensure context-independent predictability at the cost of a mindless lock-step pattern in which the individual cannot vary from the prescribed routines. In contrast, by making the network of requests and promises explicit in its structure and temporality, systems such as The Coordinator can provide a means of improving the degree to which people have adequately shared interpretations of their commitments and actions, while leaving them the individual choice and responsibility for dealing with them.

The success of systems based on the language/action ontology depends on the development of a new shared culture or "tradition" in which the commitment dimension of language is taken seriously within a shared interpretation of explicitly marked language acts. Although the dance of request and promise is universal, doing it and being explicit about it are two very different things. In all areas of social interaction, the experienced phenomenon of acting is very different from what happens when we make an interpretation of our acts explicit by describing or characterizing them. If I discreetly behave in a way that I hope will make you want to leave (e.g., looking at my watch and stacking up things on my

desk while we talk), my act is socially different from directly saying "I request that you leave." These kinds of subtleties are extremely important in maintaining the network of relationships and assessments of other people.

In some contexts, standard practices lead us to associate indirectness with politeness. A request to have the window closed can be "Close the window!" or "My, but it's chilly in here." The explicit prefacing of a request with a marker ("I request that you close the window") is an additional act, which in the background of everyday interaction has a stiff and rather formal sound. The same explicitness as signaled by the message type in a Coordinator request can be heard (especially by new users) as having a less-than-friendly tone. But as practices evolve in a group, the listening evolves to suit the medium.

By explicitly marking the action structure, The Coordinator changes the space of possibilities for communication—the form of the dance. It is not possible, for example, to be ambiguous as to whether or not a message is intended to convey a request. It is hard to "suggest" an action to test whether it is taken as something you want the hearer to do. Each message carries a label that distinguishes it as a request or as not-a-request (e.g., a conversation for possibilities). The labeling itself constitutes part of the meaning. Even the need for the sender to consider "Am I making a request here?" changes the situation.

New users who interpret The Coordinator as a "message system" are sometimes frustrated by what they perceive as undue restrictiveness or regimentation; they see it as restricting the range of possibilities for communication by imposing categories such as "offer" and "request." At a superficial level, it is easy to refute this by noting that these categories are not forced on all messages: It is always possible to send a "free-form" which has no status in the conversation structure, and there are "conversations for possibilities" in which no pattern of request and promise is expected or made possible. But it should be clear that this is not the whole story. The fact that there is a conversation initiated with "request" means that when a sender chooses to label something as "free-form" or "possibilities" it can be interpreted as *not* making a request. The overall space of possible choices conditions the interpretation of everything made within it.

Relative to a seemingly unstructured language such as that associated with standard electronic mail systems, conversation systems such as The Coordinator present constraints. This is not surprising; all language always does that by creating a space of distinctions in which to interpret the world and our actions. The questions are then, "Relative to what is it constraining?" and "What is gained by these constraints?"

There is a spectrum having at one end unstructured message systems and at the other traditional information systems, that are limited to a particular conversation that they help to administer effectively (e.g., customer service requests). Information systems impose significant constraints and provide efficient tools for dealing with the specified conversations. There is little confusion about which set of conversations can best be mediated by the particular system and which are best dealt with in some other way.

Electronic messaging systems seem quite unstructured, but in fact they do impose some structure, such as forcing explicit declaration of recipients and, sometimes, of the subject. They do not provide, for example, the potential found

in ordinary conversation for making a remark without making it clear whether a particular person was supposed to hear it. Even though this could be seen as a limitation in the design of mail systems, it is a limitation that people are accustomed to and which for the purpose of most conversations is not serious. The Coordinator comes in the middle. It offers more structure than conventional mail systems in order to better organize and more rapidly assess the conversations one is engaged in, that is, to deal with the barrage of messages that can be quickly produced and transmitted with computer networks. On the other hand, it is less confining than the customer-order system.

The underlying claim of The Coordinator is that such explicitness is beneficial, overall, for the kinds of conversations that go on among managers and other workers in settings like offices. This claim can be refined in several dimensions as outlined in the following sections.

5.1 Conversation Types

With The Coordinator, we are only dealing with some of the conversations in an office setting. It is misleading to see the future "electronic office" as one in which all communication is mediated by computers. There is a vital place for everything from highly structured messages to the open-ended discourse that thrives around the coffeepot or in chance encounters in the corridor. In fact, an important question is what aspects of language in the office should be incorporated into computer systems at all. The medium is well suited to some types of conversation (especially those in which structured records and recall are important) and ill suited to many types that have traditionally been carried on face-to-face or by voice.

As we move from face-to-face encounter, to telephone, to written text, to online data, we progressively narrow the basis for interpretations. A shrug and a smile may be a perfectly adequate response to a request in face-to-face conversation because the listener (who listens with eyes as well as ears) has a wealth of observations on which to ground assessments of what to expect. On the other hand, not everything can be done face-to-face. The airplane, postal system, telephone and telegraph coexist. We select the medium on the basis of its suitability, cost, and convenience.

The Coordinator is a machine for conducting conversations for action and also provides facilities (equivalent to conventional electronic mail) for other types of conversation. For a broad range of work-related interactions we believe much can be gained from the introduction of commitment management in conversations for action. There are also interesting new possibilities for different kinds of machines that would provide support for conversations with different structures. But computer-based communication cannot take over the wide range of spoken communications, including those in which vagueness serves an important social purpose and in which the (often unconscious) interpretation of "tone of voice" and "body language" are essential to understanding. It may well be that as office communication systems evolve, there will be a mix in which computer-based text is used for the more explicit forms, while recorded and transmitted voice and video images become the preferred mode for less structured types of conversation that must occur at a distance.

5.2 Stability of Role Structure

We are primarily designing for settings in which the basic parameters of authority, obligation, and cooperation are stable. The typical office presents a structure of recurrent patterns of conversation in mutually understood domains of possibilities associated with formally declared roles such as "group manager," "assistant," and "programmer." The issue here is not whether the role structure is hierarchical, democratic, or whatever, but whether it is basically agreed upon and is not itself a matter of ongoing active negotiation. In an unstable organization, for example, it might be very useful to be able to "suggest" an action without explicitly requesting that anyone do it in order to gauge people's responsiveness.

This is not to imply the absence of such negotiations within the structure of The Coordinator, since they always occur in every social setting. For example, authority roles are negotiated as people judge whether it is acceptable for them to decline (or even counter) a request of a given kind from a particular party, upon considering the consequences of doing so. But successful functioning depends on this not being the primary concern in the bulk of interactions.

An observation that goes along with this is that The Coordinator has been most successful in organizations in which the users are relatively confident about their own position and the power they have within it. This does not mean that the organization is democratic or that power relations are equal. It means that there is clarity about what is expected of people and what authority they have (e.g., what requests can be clearly declined without fear of negative impact). In such an environment, people can be comfortable with making (and then possibly changing) commitments and accepting commitments from others in the same spirit.

5.3 Cooperation and Competition

We are primarily concerned with work settings in which the cooperative aspects of achieving mutually declared results dominate over the competitive aspects of interpersonal or intergroup conflict. Of course, no setting, no matter how visibly "cooperative," can be understood without recognizing the internal conflicts of interest and the ways in which they generate the space of actions. The Coordinator's successful use does not depend on an idealized cooperative spirit in which everyone is working for the good of all. But it does depend on basic assumptions that the overall interests are shared and that the parties recognize that honest dealings with one another will be the best for their shared benefit. This is true, for example, in successful market structures in which each party competes with the others, but recognizes the joint advantage in maintaining (through legal systems and the like) a communication mechanism based on mutual trust.

Our philosophy of communication rests on an interpretation of individual responsibility and autonomy in which people take responsibility for their language acts and behave in accordance with shared standards. This does not mean a utopia in which people always tell the truth or always come through with what they promise. We can design to facilitate the positive aspects of social interaction but we cannot magically change human nature. People can use any communication device whatsoever to lie, deceive, and manipulate. They will always promise

things they cannot or will not do and will generate further conversations to deal with the consequences.

With The Coordinator, we are not proposing a change in the nature of action and cooperation in the office. What we are doing is laying bare the constitution of action and cooperation in order to open the way to diagnosing breakdowns, increasing effectiveness, and in general designing the workplace as an effective, healthy environment. To do so requires building and implementing practical tools on the basis of a theory of organizational life. We believe it is imperative that constitutive theories of organization and cooperation be embodied in tools and practices. Only in that way can our understandings shape the reality of work. Work, and the organization of work, can be designed only when practices are designed and implemented on the basis of sound theory.

6. TECHNOLOGY, CHANGE, AND LEARNING

Our view of design is consciously oriented toward improving the quality and effectiveness of organizational life, not just providing computer support for current practices. As we emphasized in the first section, all innovative technology leads to new practices, which cause social and organizational changes whether anticipated or not. Some of these will be effective and others may be counterproductive. Our firm belief is that this process can be done with awareness. Although we can never fully anticipate the changes a technology will trigger, we can make conscious choices in the directions of change we facilitate.

This attempt to do conscious design in this domain is both worthwhile and difficult. A system that is intended to have certain positive impacts (as assessed by the designer and/or the users) may turn out to do quite the opposite when it is put into practice. Although all aspects of design gain from being done in collaboration with the users (see [1]), it is especially essential that the explicit interpretation and implementation of social changes be generated jointly with the people who participate in them.

There needs to be a shared understanding within the organization that there is an ongoing breakdown in the domain of conversation and commitment that is relevant to productivity. There is wisdom in the aphorism "If it ain't broke, don't fix it"; people only seek change when they experience breakdown. The problem is that it is relatively easy for people to identify small-scale breakdowns ("I can't get invoices to the branch offices fast enough") and difficult to recognize the large-scale breakdowns of organization and communication that pervade their work. Most people (including most managers) do not experience "lack of coordination" as a breakdown even though they face the consequences of it every day under a variety of names.

In addition to recognizing the problem, people must understand the intervention well enough to identify and anticipate the new breakdowns it will create when integrating with preexisting structures, practices, and tools. The use of an explicit conversation manager will lead to changes in the social practices with potentially complex ramifications. In every organization a background of practices has evolved in conjunction with the mixture of previous technologies and circumstances. Any change to this background, planned or not, will affect power

relations, stability of roles, and individual satisfaction. With the introduction of any new technology (hardware, software, or practices), some people will see themselves as gaining and others will anticipate (often appropriately) being put at a relative disadvantage. Education cannot eliminate the underlying power struggles but can be the basis for dealing with them explicitly in the context of potential changes.

It must be understood that a system can be used as the basis for an ongoing process of mutual education in which the people who use the system envision possibilities for new ways of working, interpret those possibilities in light of their own experience, and choose what will be implemented. The technology in turn can play a role in "coaching" the users. We are all aware of cases in which our verbal understanding of what we should do is not effective in generating the acts we want. For example, understanding the advantages of getting things done on time is rarely sufficient to prevent procrastination. An effective reminder system cannot prevent it either, but it can help by offering opportunities for self-examination, that is, by getting us to ask the question "When am I really going to work on this?"

In the domain of commitment and conversation, this kind of coaching is offered by the structure of The Coordinator. The simple need to characterize a message as an "offer," "request," or "opening for possibilities" leads the user to ask "What am I trying to do here?" At a later stage in a conversation, the need to explicitly declare it "complete" or to choose a speech act that leaves it "open" leads the user to ask questions about what is still missing and who is responsible for resolving it. Our experience in introducing The Coordinator has convinced us that this kind of coaching can be valuable and that it leads to a kind of continuing education that goes well beyond training for technical facility in using software. As people use the system they develop their understanding of the acts that go with it.

Programs like The Coordinator, which are based on an explicit theory of organizations and of directions for change, have at times been referred to pejoratively as "missionary software." The implication is that organizational or social change is being imposed on an unwilling populace by outsiders with a dogmatic theology. Although this kind of manipulation is possible in principle, the technology is likely to be rejected, ignored, or subverted in practice. But from a different perspective, The Coordinator is a new kind of "educational software" in which the everyday use of its communication tools serves to educate users in the principles of conversation and action. Learning is integrated into the practice of working so that the skills for understanding the organization as a network of negotiated commitments for operating within it can be developed.

7. CONCLUSION

In this paper, we have been talking primarily about The Coordinator. Here we want to reemphasize that The Coordinator design, with its particular screens, buttons, and so forth, is an initial example of a large family of potential tools, based on some fundamental theoretical claims about design and

organizational action:

—Design is for transparency of action and expansion of possibilities. It is always an intervention into the practices, breakdowns, and possibilities already present in a community: an intervention that will shift and resettle practices, breakdowns, and possibilities. All design embodies an ontology, a set of constitutive distinctions, of the domain in which the design is an intervention. Good design is an ontologically grounded intervention that allows work to flow smoothly with a minimum of breakdowns in completing an action and that expands positive possibilities for participants and production in the domain.

—The ontology in which we are designing is one of action happening through language. The constitutive dimension of social and organizational interaction can be laid out as a structure of linguistic actions in a temporal dance. The key distinctions in this structure, as we have interpreted it, are requests, promises, assertions, and declarations as moves in conversations for the completion of action.

The Coordinator is a generic tool for conversations for action. Many customizations and extensions of the design are possible. For example, in The Coordinator people make requests and promises by typing in English text. But this is not the only possibility; the interpretation of linguistic acts can be based on embodiments that include figures, drawings, oral content, symbols, and formalized data relations. In another direction, tools can be developed to fit particular organizational situations, standard practices, and domains of work. The actions can be tailored to particular recurrent conversations that include the ones handled in traditional data processing such as order entry, inventory, and accounting.

By taking language/action theory as a basis, we are asking people to go about their business with a different awareness. We design in a fundamental domain of social interaction, which calls for the explicit recognition of the autonomy and responsibility of communicating individuals within a social network that is defined and maintained through the action of language. The evolving nature of computers and of work in organizations will inevitably lead to the widespread development and use of computer tools grounded in this domain of design.

REFERENCES

1. BJERKNES, G., EHN, P., AND KYNG, M. *Computers and Democracy.* Avebury, Aldershot, England 1987.
2. KIESLER, S. Thinking ahead: The hidden messages in computer networks. *Harvard Bus. Rev.* (Jan.–Feb. 1986), 46–60.
3. SEARLE, J. R. A taxonomy of illocutionary acts. In *Language, Mind and Knowledge*, Minnesota Studies in the Philosophy of Science, vol. 11, K. Gunderson, Ed. University of Minnesota Press, Minneapolis, 1975.
4. STASZ, C. AND BIKSON, T. K. Computer supported cooperative work: Examples and issues in one federal agency. In *Proceedings of the Conference on Computer Supported Cooperative Work* (Austin, Tex., Dec. 3–5).
5. WINOGRAD, T. A language/action perspective on the design of cooperative work. *Human-Computer Interaction 3*, 1 (1987–88), 3–30.
6. WINOGRAD, T., AND FLORES, F. *Understanding Computers and Cognition: A New Foundation for Design.* Ablex, Norwood, N.J., 1986 and Addison-Wesley, Reading, Mass., 1987.

BIBLIOGRAPHY

FLORES, F. C. Management and communication in the office of the future. Unpublished Ph.d. dissertation, Univ. of California at Berkeley, 1981.

FLORES, F. C., AND LUDLOW, J. J. Doing and speaking in the office. In *DSS: Issues and Challenges*, G. Fick and R. Sprague, Eds. Pergamon Press, London, 1981.

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