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Selection and Effects of Channels in Distributed Communication and Decision-Making Tasks

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Northwest Regional Educational Laboratory

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for

Contracting Officer's Representative
Judith Orasanu

Basic Research
Michael Kaplan, Director

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) This report describes the second year of a project that is researching the communication patterns of selected workgroups. Emphasis is on the definition and analysis of selection of channels (e.g., face-to-face meetings, phone, electronic mail, etc.) and the effects of those choices on the ensuing communication and task-oriented activities. Preliminary findings suggest implications for both the design of organizations and communication support systems.				
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SELECTION AND EFFECTS OF CHANNELS IN DISTRIBUTED COMMUNICATION AND DECISION-MAKING TASKS

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SELECTION AND EFFECTS OF CHANNELS IN DISTRIBUTED COMMUNICATION AND DECISION-MAKING TASKS

I. Project Status Overview

At the conclusion of the second project year, there is considerable progress to report. The empirical study of the first field site has been completed, and analysis of an extensive data set is underway. Significant developments in both theory and methodology are emerging as the analysis proceeds; these developments are influencing the selection of the second field site and the plan of research for that setting. A second organization is being carefully considered as a potential second site for the project. As soon as the initial explorations are completed (by the end of August), the prospective site will be discussed with the project's COR.

II. Refining the Research Agenda

The original research plan called for analyzing the relationship between communication and decision-making patterns within workgroups. For reasons discussed below (and during the May 1988 In-Process Review), we have broadened the scope to focus on the relationship between communication and the accomplishment of cooperative activities in general within workgroups.

Research in the first field site raised significant questions concerning the observability of decision-making processes within the ongoing stream of behavior. Our experience in the field aligns with that of Mintzberg, Raisinghani and Theoret (1976) and indicates that decision-making activities are most often *not* clearly separable from other work activities. While decisions affecting workgroups were occasionally reached "in public"--according to a structured, routinized process--these occasions were infrequent. The majority of decisions affecting the day-to-day activities of the workgroup seemed to emerge and evolve as part of the ongoing work flow. High level decisions were made out of the view of the workgroup members and the process whereby those decisions were made most often was unknown to members of the affected groups.

Further compounding the problem of the often invisible decision-making process is the tendency of decision makers to recall decisions as having been organized in a more purposeful, sequential and goal-directed manner than they actually were. A further difficulty lies in the inherent incompleteness of archival or transcriptual materials which might be used to elicit the structure of decision making processes (Schwenk 1985). Thus, we found it extremely difficult to trace the structure of decision-making through either direct observation, informant recall or analysis of archival or transcriptual materials. Though potential avenues for the resolution of some of these difficulties could be suggested, the invisibility issue is less easily bridged. It would appear that the majority of decisions affecting the task accomplishment of workgroups we studied are not behaviorally observable.

The most significant implication of these findings for the present research project is that the research agenda is now framed in terms of relationships between communication and on workgroup or unit performance of cooperative tasks. In general, however, the revised research agenda remains largely the same as the initial one:

- Conduct indepth field studies of the communication patterns of selected workgroups in two organizational settings
- Broaden the application of linguistic theory to encompass the situationally-patterned behavior individuals display in choosing among alternative communication channels and message features
- Test and refine a model (described in detail in the project proposal) of channel choice and behavior which analyzes observed relationships among characteristics of workgroups, communication channels, message structures, and task outcomes
- Explore the ramifications of the model for the collaborative work processes of spatially distributed groups
- Identify and consider the implications and applications of the research findings and theory for military organizations

III. Organization of Report

This report provides an overview of project status including: a review of the past year's field activities, an overview of the data collection process, a profile of the

types of data collected, an examination of findings and theory emerging from the ongoing analysis of the data, a discussion of the implications of these analyses for research being planned for the second site, an update on the selection and research plan for the second site, and a discussion of the implications for military organizations. An article has been prepared and accepted for publication regarding some preliminary aspects of the data from the initial site; a preprint is appended to this report

IV. Field Activities in Year Two

Though a detailed description of the first field site was provided in the first Interim Annual Report, a very brief overview will be provided here to provide the context for further discussion. The New Products Division (NPD), a division of Io Products Corporation (IPC), employs over 600 workers. The division is responsible for design, development, manufacture, and marketing of a range of high technology products.¹

At the end of the first year of the project, four sets of activities within NPD were targeted for detailed study: the Nova project, a Divisional effort to secure and integrate an important component in a new, strategic, top-of-the line product; the Saturn upgrade project, involving integration and upgrade of existing products with a new component; the Mars System project, involving the installation and adaptation of an industry standard system to replace the locally-developed system; and System Integration activities, an ongoing process involving the integration and evaluation of new products.

As the start of formal data collection approached, however, two of the four sets of activities proved to be inviable candidates for study. The Saturn upgrade project was delayed and ultimately radically reworked, and managerial and technical staff were reassigned to another project which was to grow out of the Nova work. By the start of formal data collection, the staff involved in this project had yet to coalesce. The System Integration study proved unworkable for other reasons. Though the system integration

¹These and all other names of units and persons are pseudonyms.

required the cooperation of several individuals, this collection of individuals was neither structurally stable nor enduring. Different individuals were involved in different integration activities at different times and involvement was often sporadic rather than ongoing. Thus the study of these activities was logistically difficult. In addition, the major system integration activity we had targeted for study was delayed for several months and as of this date has yet to be completed. Because the other two projects proved inviable for study, it was possible to focus more intently on the Nova and Mars workgroups.

The Nova and Mars target groups were made up of operationally defined core groups of 13 and 7 individuals, respectively, though additional workers were involved with the projects over time. The core groups were composed of individuals who spent 50% or more of their time on that project. While there was some fluctuation in group membership over time, the core groups remained stable throughout the whole of the study period. Participation levels were very high, though one individual flatly refused to participate in the study citing a "probably unfounded over-concern with issues of privacy", and a second declined in light of his position as a part-time consultant and his concern that he could not justify even the minimal amount of time the research project would require of him given his status as a non-IPC employee being paid on an hourly rate. A third individual claimed willingness to participate but failed on all occasions to complete the data collection tasks we required. All three of these individuals were involved with the Nova project. Thus, of the potential 16 participants involved in the Nova project, 13 were active participants in the study.

Both groups included a project leader with other individuals responsible for distinct segments of the overall projects, and because NPD practices matrix management, workers often found themselves working for someone other than their actual manager. This was in fact the case for both the Nova and Mars projects where the workgroups were made up of individuals drawn from a variety of different departments. Both

groups held weekly status meetings but interacted on an ongoing basis as required.

Electronic mail was widely used and workers had at their disposal telephones, computers (including word processing software) and printing equipment, photocopiers, and access to internal and external mail systems.

V. Data Collection

Fieldwork during the second year of the project was conducted in two phases. The first involved a period of several months of informal research wherein the researchers employed traditional ethnographic methodology and collected data to provide a general overview of the structure and organization of the targeted workgroups within NPD and IPC. Instruments were developed for recording details of observed and self-reported communication and work activities. Software was developed to enable automatic collection of electronic messages. Next, final decisions were reached as to which of the targeted groups would best meet the requirements of the study. Once the final target workgroups were determined, the researchers sought clearance from NPD and target group management to begin the second phase of data collection. To gain the necessary cooperation, presentations of the goals and methodology of the study were then made to the Nova and Mars teams and individual discussions held with the members of each group.

The second phase of fieldwork spanned a period of approximately 11 weeks and involved systematic collection of a variety of data. The data collected are of four general types: ethnographic data, shadowing data, electronic communication materials, and self-logged communication records.

Ethnographic Data. Both during the initial stage of fieldwork when potential target groups had not yet been identified, and then later when particular groups were identified and being studied, the research team collected ethnographic data. These data were derived from observations of the features of the work environment, workgroup dynamics, variations in individual work and communication styles, typical tasks, and

typical patterns of communication and decision making-processes. Ethnographic methods were used to collect a wide range of background and contextual information pertaining to the specific daily activities of members of the targeted workgroups. Field observations were documented and provide a record of the progress of projects and external factors which impinged on workgroup activities. The collection of these data provide the fine grained descriptive context within which the other types of data will be placed.

Surveys, formal and informal interviews, and participant observation fleshed out the ethnographic portrait of the field site. Though surveys and formal interviews were common in the first phase of research, during the 11 weeks of formal data collection, the researchers emphasized the less obtrusive method of participant observation. By the time the formal data collection had begun, the presence of the researchers was taken for granted by members of the target groups and data was easily collected with minimal or no disturbance to the patterns of work and communication within the groups. As much as possible, the researchers attempted to become part of the work environment and attempted to be present on site every work day. The researchers maintained a work area at the field site and, sent and received electronic mail messages through the in-house system, and attended workgroup meetings and events.

Shadowing Data. Shadowing members of the target groups provided the key research method during the formal phase of data collection. During this phase of data collection, individuals were followed (or "shadowed") by one of the researchers for an entire workday. Details of work activities and communications were observed and recorded and copies of the subject's incoming and outgoing oral, written and electronic communications were collected. For example, if the subject received a memo during the day, a photocopy was made and annotated for later analysis. If a phone call was received, or a visitor arrived at the subject's work area, a tape recording was made of the interaction (of only one side of the conversation in the case of telephone calls). If

the subject attended a meeting, the observer also attended and made a tape recording. In all cases, researchers recorded specific features of the communicative interactions on structured observation forms. The observer coded details of the subject and content of messages, and whether or not individual messages were linked to earlier or would result in later communications. In this way, the researchers were able to track the sequence of communications and activities over the course of the day.

Given the relative sizes of the two target groups (approximately 7 and 13) it was not possible to shadow all members of these groups. Consequently, 4 individuals from the first group and 7 from the second were selected for shadowing. Each of these subjects was shadowed on four days according to a quasi-random, rotating schedule, resulting in detailed observational records of communication events and work activities, and collected communication materials.

Electronic Message Collection. Because the frequent computer mediated communication among workgroup members could be automatically collected by the system, a series of programs were written to copy the incoming and outgoing electronic mail of individual participants. These programs provided a means of recording both incoming and outgoing messages and records of mail system manipulations. Though the subjects were occasionally required to transfer files of system-captured email messages to the researchers, the participation of the subjects in the collection of these data was otherwise completely passive. Electronic message collection was carried out (with permission, of course) for all of the participants in the study for a period of approximately 11 weeks.

Self-Logged Communications. Each of the 20 subjects was asked to log communicative activities during the workday on four separate occasions during the 11 week period of intensive data collection. Logging was scheduled on a quasi-random, rotating basis and required the recording of specific information pertaining to communicative activities occurring at the participant's work area over the length of the

workday. The logs required the participants to document specific details of communications with others from whom they received or to whom they placed telephone calls, sent or received hard copy, and individuals from whom they received visits at their work areas. Electronic communications sent and received during the day were automatically collected and required no effort on the part of the participant. Logging data in this way provided a partial though detailed portrait of the communicative activities of these individuals through the channels of telephone, hardcopy and face-to-face communication. The self-logged communication records were designed to be comparable with parts of the shadow observation records, so that controlled comparisons could be made to (1) test the generality of shadowed behavior to other individuals and workdays, and (2) examine the impact of the observer on the behavior being examined.

VI. Data Profile

On completion of formal data collection the research team had amassed a great deal of data. The collection of electronic mail messages ran without interruption for the 11 week length of the formal phase of the study. With two exceptions, copies of all incoming, and outgoing messages received and sent by all twenty of the target group members were collected. In one case the individual concerned disabled the collection software in order to accomplish housekeeping tasks on her workstation. Her software reinstallation was incomplete and only outgoing messages were collected for a period of approximately one month. Similarly, in the second case, one of the subjects disabled the software and only reinstalled it after sending several messages. With these two exceptions, the data are complete. In addition, logs of mail usage were automatically collected, recording the times and dates and sequences of viewing, reviewing, filing, and removing of messages during the whole of the 11 week period for each of the 20 participants.

The shadow observation records provide portraits of the communicative and task-related activities of each of the 11 subjects on 4 quasi-randomly chosen workdays. The

shadow log records are complemented by parallel field notes kept by the researchers during the workday. The self-logged data were collected for all 20 participants (including the 11 shadowing subjects), on 4 quasi-randomly selected days. The self-logged data for each of the shadow subjects provide a cross-check on communicative activities for days on which they were not shadowed. The self-logged data from the remaining 9 subjects also provides additional context within which to understand the activities and communications of the targeted workgroup members.

Tape recordings provide a range of data on workgroup communication. In the 11 weeks of formal data collection, approximately 85 hours of tape was used. These recordings are made up of conversations within the work area of the subject being shadowed, including both face-to-face and telephone conversations (only one side of the telephone conversation was recorded), as well as formal project meetings.

During the shadowing sessions, copies of hard copy received by the subjects were collected. These data include not only messages between individuals but also Inter-Office Communications, technical materials, company bulletins, phone messages, advertisements, journals, etc. These data were recorded on the shadow sheets but having copies will allow more careful assessments of their content. In addition, the researchers collected communication artifacts during the whole of the research period; organizational charts, the weekly IPC newspaper, Divisional announcements are a few examples of such artifacts. These data provide a glimpse of the much larger communicative economy within which the Mars and Nova workgroups are embedded.

The data analysis has begun with the creation of a data base and the entry of data from the 44 shadowing sessions. Electronic messages have been manually coded for each of these sessions in an effort to increase accuracy (some of the subjects received more than a dozen electronic messages at one time and accurate coding of the details of such high volumes of material was often impossible during the session). Early analyses

of the data reveal interesting patterns and provoke important questions which are currently under examination.

VII. Emerging Findings

The data collected by the project, as described above and in the attached article, is being carefully and systematically explored with respect to the research issues of the project. The complex and multi-faceted nature of these data necessitate a spiral-like approach to their analysis; global tabulations and analyses of major features of the data are being conducted initially in order to portray the general trends and patterns within the communication and activity patterns of the studied workgroups. As these major patterns emerge, they offer differing contexts in which to examine contrasting genres of communication such as those described in the attached article. Contrasting usage patterns for such genres as the formal memo or the personal conversation may then be scrutinized at a more microscopic level, using both the detailed observational data from the project database as well as textual analysis of transcribed conversations, captured electronic mail, etc. These analyses, in turn, may lead to further hypothesis testing at more macroscopic levels of the data, and so on.

Although we are still immersed in this analytical process, a number of significant findings are emerging. Since most analyses are still ongoing, comprehensive details of the data, analyses and models will not be presented in this report. Some preliminary findings have already been described in an article recently accepted for publication; a preprint of the article is appended to this report. In the section which follows, we will discuss some initial findings, tentative conclusions and their implications for further analyses of data from the first site and research plans for the second project site. These will be described in three topical areas: the structure of workgroup communication patterns, channel choice and channel switching, and the relationship between patterns of communication and patterns of individual activities.

The structure of workgroup communication. Linguists and discourse analysts have traditionally been concerned with language structure and the rules whereby individuals are able to converse, but little attention has been paid to the organization of recurrent communications, that is, intermittent conversations among individuals who interact frequently on a recurrent set of topics, as members of collaborative workgroups do. Collaborating on a variety of work-related activities, the studied workgroup members' communication exhibits an inventory of recurrent topics. Two concepts central to our ongoing analysis of the communicative and work-related activities of these groups are the *communicative chain* and the *conversation*. A communicative chain is a sequence of related communicative events. Two individuals may engage in a series of related and interwoven discussions/interactions over a period of days or weeks, for example. Such sequences comprise a communicative chain. Chains may consist of interrelated meetings, conversations, memos, and so forth, conducted on different occasions, perhaps at varying locations, possibly involving multiple communication channels, and so forth. Communicative chains are usually composed of one or more conversations, which "thread" the communicative events together into a coherent chain. A given conversation is topically specific (whereas a communicative chain may involve multiple conversations/topics), consisting of an interactive sequence of turns the interactants take on a given topic. It is important to note, however, that although the interwoven conversations are sequential and related, in some circumstances a chain at time "a" may not appear related to the content of the same chain at point "b". This is because the chains themselves, as well as the conversations of which they are composed, are dynamic and not static: Chains evolve and change over time.

The sense of "conversation" intended here is related to but broader than that used in ordinary language. We typically think of a conversation as a single episode of interaction in which the participants take turns on a topic. But there are, of course, conversations which begin on one occasion, get to a certain point, stop for one reason or

another, and are resumed on another occasion. Although we normally think of conversations as taking place only through synchronous channels (e.g., face-to-face or telephone), our research indicates we need to generalize that conception to include other channels as well. So a series of interrelated office memoranda, for example, may also constitute a "conversation" on that topic. Similarly, a sequence of topically related electronic mail messages may also constitute a conversation. It is not just the topical relatedness of a set of utterances or messages or memos that constitutes a conversation-- a conversation is comprised of an *interactive* sequence of communications, whose constituent utterances and messages acknowledge and take previous utterances and messages into account.

Not only may a given conversation take place over a sequence of occasions, multiple locations may be involved as well. Donna and Tom may begin a conversation by the water cooler and finish it several days later in a conference room. Multiple channels may also be involved in a given conversation. Some conversations may begin face-to-face, then switch to telephone, then to electronic mail, etc.

Discourse analysts have not yet seriously considered the special problems and issues inherent in conversations that are extended in these ways, conversations involving a series of interactions involving multiple times, locations and channels. Our research indicates, however, that such conversations are typical rather than exceptional components of communication within workgroups collaborating on particular projects or tasks. Workgroup members are generally parties, at any given moment, to an interwoven set of ongoing extended conversations. This seems to be a fundamental characteristic of the communicative environment of a collaborating workgroup: The fabric of workgroup activity is woven together from its constituent threads of conversation.

A number of crucial theoretical and applied questions arise about the practical accomplishment and potential technological support of such communication patterns. How do workgroup members mark topical boundaries and transitions within their

collective web of conversations? The varying potentialities and constraints of alternative communication channels are of considerable interest in this regard. How do experiences with and perceptions of the distinctive communicative qualities of the various channels (e.g., their rapidity of feedback, rhetorical effectiveness, confidentiality, permanence and formality of information, etc.) condition the selection of (and intra-conversational switching between) alternative channels for various types of conversations?

In analyzing our data, we are identifying communicative chains and conversations which occurred among the studied workgroups as part of their collective accomplishment of designated tasks. Following procedures from the ethnography of communication, we are categorizing those communications into various types or genres used in this setting. Some genres are specialized to a particular communication channel, whereas others occur through multiple channels.

Channel choice and channel switching. When a particular genre of communication is conducted in some instances through one channel and in other instances through another channel, the particular channel selected in a given situation often carries special social significance and may impact both the content and form of the communication. Alternations between use of face-to-face and telephone conversation, for example, may carry different social meanings and potentialities. If face-to-face is the norm within a group for discussing certain kinds of issues, then use of the telephone in a given instance will likely carry some special social significance. These meanings are usually bound to the channel *choice* itself; if the party initiating the phone call were known to be out of the office or otherwise unable to carry out the conversation face-to-face, no choice is perceived as having been made and there are no ensuing social implications.

Channel choices are generally made and interpreted within a contextual framework shared by workgroup members. Channel choice behavior seems to be closely

related to not only the genre of communication, but also to the *roles* of the interactants. A given person generally has multiple roles within a workgroup which bear on his or her interactions with group members. In a matrix managed organization such as the one studied, individuals have both organizational roles and titles as well as designated roles within particular projects. Individuals also have roles related to personal relationships. For example, in many organizations a request made to one's supervisor to perform a non-routine task has very different force when made face-to-face than when made with a written memo. On the other hand, when one's supervisor makes the request, the channel choice implications are generally quite different.

Our emerging model of channel choice behavior requires a situationally based characterization of the interactants' roles and their attendant rights and obligations in interaction. The notion of *markedness* is useful in understanding the significance of channel choice in workgroup communication. When two (or more) alternative linguistic forms may occur in a given context, the occurrence of one form is often said to be unmarked whereas the occurrence of another is said to be marked. The unmarked form is in some sense the default, the one which "normally" occurs; occurrences of the marked form stand out or carry a special emphasis. In given contexts, use of a particular channel seems to be marked or unmarked in the same general way as other linguistic variations. Often channel choice and channel switching is marked with respect to the roles of the individuals involved. Looking again at the previous example, requests to perform a non-routine task tend to be marked when conveyed in writing from a person to his or her supervisor, but to be unmarked when made through face-to-face conversation.

There are also contexts in which varying channel choices do not reflect differences in their markedness or appropriateness with respect to workgroup communication patterns. In such cases we observed very pronounced individual differences among workgroup members' channel choice behavior. We call these

variations individual channel *preferences*. In situations where both face-to-face and electronic mail are appropriate to workgroup communications, for example, one individual may prefer to use electronic mail, whereas another prefers face-to-face. A poignant example is described in the appended article. Many personal and environmental factors seem to shape these channel preferences. They seem to be part and parcel of an individual's *communicative style*. Some ideas about how individual communicative style and the working style of a group may be empirically and theoretically related are presented below.

Relationship between patterns of individual activities and workgroup communication. The shadowing data include notations of the various activities in which individuals were engaged at various times as we followed them through their workday. As noted above, we attempted to categorize observed activities in emic terms, i.e., in terms of how the participants themselves perceived and discussed them. One series of analyses being conducted on the shadowing data calculates the number of these emically categorized activities that an individual is working on (i.e., has not yet completed) as he or she moves through the day. At any given moment, a number of tasks may be suspended, pending later completion. If we define the number of such tasks pending at a given moment as the depth of the individual's "stack," the size and ways in which an individual manages his or her "stack" of pending activities can be traced.

There are two compelling reasons to think that this may prove to be a theoretically powerful and practically useful formalism. First, variations in the calculated stack depth seem to reflect observable and experienced differences among individuals in terms of how "busy" they are, as well as differences among days in terms of how "busy" a given person is. Second, the individuals themselves often appear to perceive their own activities in terms of this "stack"/"multi-tasking" metaphor. We occasionally observed individuals, when interrupting one another, saying "push" to the individual being interrupted (who metaphorically had to put whatever task was in

progress at that time on his or her "stack"), whereas when leaving, announcing "pop" to indicate the most recently suspended activity could now be resumed. This jargon would seem to be a direct reflection of the native view of how multiple tasks impinge on and interrupt each other and the ways in which individuals manage their multiple activities. Indeed, individuals often extended this computer operating system metaphor in describing their jobs as "interrupt driven", referring to work patterns wherein the worker's efforts were displaced throughout the day as new problems emerged and assigned tasks were given higher or lower priority.

Is such a metaphor significant only among engineers and computer scientists (such as those whom we were observing) working in a highly computerized environment itself managed by a multi-tasking, stack oriented operating system (Unix)? Or is there something more generic here, common to workgroup activity and communications? We tend to believe the latter to be the case. Even though office workers in general may not use such cute technical terms as "pop" and "push" to announce their "interrupts," there seems to be widespread experience of the underlying metaphor. In Lakoff and Johnson's terminology, the multi-tasking metaphor is one which office workers "live by" (1980). We need only think of how often the conflicting demands of multiple tasks and interactants requires us to put someone or some task "on hold," or how often things get "stacked up," and so forth. Indeed, one of the major problems of organizational life seems to be finding a work style which efficiently handles the multi-tasking nature of one's work environment.

It is in this regard that the utility of our stack formalism for analyzing relationships between workgroup communication and activity emerges. A promising feature of our data is the relationships observed between the ways in which individuals manage their "stacks" of activities and the patterns of communication they maintain with fellow workgroup members.

VIII. Implications for Research in Second Site

Results of our research conducted in the first site have some clear implications for how we should go about conducting research in the second setting. We will briefly consider the implications for the selection of an organizational setting and workgroups for study and for improvements in our research methodology.

Selection of organization and workgroups. We feel that the nature of the organization and workgroups studied in the second site should differ from those in the first site in a number of important respects. The division of the company as well as the specific workgroups studied in the first site were focused on high technology engineering and product development. Most individuals studied used computer systems not only as a primary medium of communication but to perform much of their technical work as well. To explore the generality of some of our emerging findings and theory regarding the relationship between the nature of workgroup activities and communication patterns, it seems advisable to study workgroups in the second site which are not engineering groups and whose members do not use computer technology for conducting most aspects of their work (although electronic mail could well be a means of communications used in some of the groups).

Although the intended focus of the project is on communication within both spatially compact and spatially dispersed groups, the workgroups studied in the first site had relatively little spatial dispersion. We therefore plan to contrast spatially dispersed and compact workgroups in the second organization studied.

Because of the emerging significance of interactants' work roles in shaping the communication phenomena under study, we would like to study workgroups whose memberships partially overlap, so that the communication patterns of given individuals can be contrasted as members of distinct workgroups in which they have contrasting work-related roles. This will give us more systematic data on the impact of varying roles on workgroup communication.

As we better understand the relationships among organizational roles, workgroup activity and workgroup communication patterns, a framework can be developed in which we should be able to generalize findings and theory from the two organizations studied in this project to a variety of other organizations. This framework will also enable us to begin the critical process of linking together micro-level studies of individual and workgroup behavior in organizational contexts with more traditional but macroscopic organizational research.

Research methodology. In evaluating the strengths and weaknesses of our methodology and instrumentation developed for the first site, we have determined that the basic approaches used were quite effective and productive:

- Conduct an initial ethnographic study of the organization and several key workgroups and individuals, focusing on native views and perceptions (i.e., those of the employees) of the organization, its workgroups, and patterns of activity and communication.
- After analyzing and interpreting data collected from the initial ethnographic phase, utilizing more structured techniques and instruments to follow and document the activities and communications of selected workgroups over a period of time.
- Use full-day-at-a-time "shadowing" of individual workgroup members as the context for structured observation and recording of ongoing workgroup activities and communications.
- Use observation techniques and instruments during shadowing which describe ongoing activity in terms of the emic (i.e., native) categories and perceptions previously identified by the ethnographic research.

In the process of analyzing data from the first project site, we have identified a number of ways in which we can refine and improve these techniques:

- More explicit probing of individuals' channel choice and switching needs to be incorporated into the shadowing process. Although we have, for the first site, rich sources of information about the factors impacting channel selection in general, we did not collect systematic data about why particular choices and switches were made. Great care will have to be taken to develop procedures which provide valid information about particular choices, on one hand, while not being too invasive or disruptive on the other. Observers certainly cannot probe each decision or choice as it occurs, but perhaps probes could be utilized on an occasional (but nevertheless representative) basis. Alternately, probes might be used retrospectively at the end of a shadowing day, in a debriefing session. Perhaps some combination of the two techniques could be effectively used.

- Our interest in further investigating the relationships between individuals' management of multiple tasks and objectives (their "work style") and management of workgroup communications (their "communication style") requires better tracking of their work activities and objectives. The day at a time shadowing schedule used in the first site allowed us to systematically record the status and progress made on tasks started within that particular day. With some additional instrumentation used at the beginning and end of a shadowing day, it should be possible to collect information more systematically about activities which begin before and/or will be completed after the day in question. This will improve our ability to model the individual's dynamic "stack" of ongoing activities, as described above.
- The shadowing schedule used in the first site, in which individuals were shadowed for a day at a time on a rotating, quasi-random basis (with each individual shadowed multiple times during the data collection period), has some clear strengths and weaknesses. It gave observers a fairly good view of the progress of activities that took place during a given day, and a reasonable composite picture of workgroup activities that took place over an extended period of time. Relatively little information, however, was recorded about activities of intermediate duration, which were often critical or unexpected tasks, categories about which we would like to know more. In developing the research plan for the second site, we need to consider whether more highly structured shadowing schedules might be more effective, e.g., ones which are adapted to following selected key events and group processes rather than being quasi-random.

IX. Status of Second Site Selection

We are presently negotiating with a Fortune 500 company, which has offices in Portland and throughout a multi-state region, to serve as the second site for our project. The offices in Portland include a marketing division of the firm, which includes a variety of workgroups well-suited to the requirements of the project in general as well as the specific criteria detailed above. Several of the workgroups are spatially dispersed and use a variety of communication technologies to collaborate remotely. Key individuals can be identified who belong to (and have different roles within) multiple workgroups, some of which are spatially dispersed and some of which are geographically compact.

We expect to complete preliminary negotiations with the prospective site by the end of August, at which time additional information and details will be discussed with the COR.

X. Emerging Applications

Progress during the first two project years suggests several ways in which project outcomes will enhance military capabilities in the areas of unit performance, organizational effectiveness and personnel training. These potential applications fall into three major clusters: (1) design of organizational workgroup communication processes; (2) design of communication support systems; and (3) enhancing organizational effectiveness through increased cooperation. Each of these is considered briefly below.

Ongoing analyses of data collected in the first site suggest several ways in which organizational and workgroup communication processes can be improved through more effective matching of communication channels and message structure to characteristics of specific workgroups and tasks. Observed relationships between these variables and communication and decision-making outcomes will have implications for both organizational design and procedures as well as for the training of personnel to make more task-effective channel choices, particularly personnel assigned to spatially distributed organizations or units. Leadership training for many types of tasks is also expected to benefit from increased understanding of the crucial role of communication in the day-to-day accomplishment of cooperative activities. Furthermore, extending our research to spatially distributed organizations in the second site will point to the ways and situations in which computer-mediated and other telecommunication channels can be used to permit spatially dispersed units or task groups to function effectively when alternative channels are not accessible or may not be desirable.

Technology has a vital role to play in support of both communication and cooperative activities in the organization. Other ARI funded research is examining ways in which decision-support systems (DSS) can aid military decision making. The present project will complement that work by indicating how characteristics of workgroups and the cooperative task environment should be incorporated into the support apparatus. Whereas a DSS might provide a database and a problem-centered framework in which to

consider decision alternatives, for example, a *communication support system* (CSS) of the type proposed here would facilitate the cooperative work process of the group itself, enhancing the capabilities of its members to exchange pertinent information, opinions and perspectives. Such a CSS will need to be, on the basis of preliminary data, tailored to the work style characteristics of the groups and its members.

A critical need in most workgroups is having ready access to pertinent information for problem solving and decision making. Problems occur when there is too much information available as well as when there is too little. Our research indicates that the "information overload" that is becoming so characteristic of environments in which databases, management systems and electronic mail prevail can seriously impair critical communication and work activities. To retain the advantages of computer-mediated communication and cooperative work support systems, organizations must develop effective ways to manage the flow of electronic information. Individuals in the first site exhibited a wide variety of multi-task management and information filtering strategies. Within these strategies are a number of promising techniques that might be incorporated into communication support systems. Computer-based, "intelligent" filters could help locate pertinent information as well as protecting them from an overload of irrelevant information. If the net result of such filtering is, indeed, enhanced access to pertinent information, then improved problem solving and decision making should be expected on the basis of Franks and Bransford's ARI-funded research, which highlighted the problems which accompany "uninformed access" in problem solving. We also expect that these communication support systems will be to help workgroups and their members to implement reasonable tradeoffs between what our research indicates are often conflicts between needs for being accessible to others for communication and needs for not being interrupted too often.

The final area in which the project has potential applications for ARI/DOD is not one that was originally contemplated. Our research on the communication and

cooperative behavior of task groups suggests that both task outcomes depend critically on the degree of cooperation among group members. Although this is certainly not a new or even unexpected development, the power of this factor in interaction with other variables being studied has suggested that useful applications of the research may turn up in this arena as well. Usually one thinks of cooperation as the result of shared goals or values among task participants. But even holding such variables constant, the degree of cooperation present may vary significantly with characteristics of the communication *process* used. The applications mentioned above (organizational design, communication support systems) should thus offer yet another--and potentially very significant--benefit: the ability to enhance the degree of cooperativity present through careful design and training of organizational and workgroup communication processes.

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