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ABSTRACT

To help designers and authors understand users' intentions and work practices for synchronous business communications in a systematic way, we used ethnographic and task-analytic techniques to collect, analyze and classify evidence of the activities of potential users as they conducted their work lives. The interactions we observed among our users took place through a variety of modalities. We found eight categories of tasks for the collaborative or interactive work in which our subjects engaged. Based on these data, we were able to classify roles of potential users of synchronous business communications software into a set of "archetypes" that characterize their use: Thinkers, Producers, Authors, Networkers and Diplomats. Issues raised by our work include questions about the nature of user archetypes, user tasks, and their modalities.

Categories and Subject Descriptors

H.4.3 [Information Systems Applications]: Communications Applications (Computer conferencing, teleconferencing, and videoconferencing)

General Terms

Documentation, Human Factors

Keywords

User studies, ethnographic methods, task, modality

1. INTRODUCTION

Our field recognizes that to support users in their use of emerging communications technologies, design and documentation of these technologies should reflect the intentions and work practices of the users. One of these emerging technologies is synchronous multimedia: the capacity to have computer-mediated face-to-face conversations with shared documents. To help designers and authors understand users' intentions and work practices for synchronous communications in a systematic way, we studied the interactive communications of a diverse set of users in the business community. Our study addresses the problem by providing a taxonomy of users and uses

of synchronous business communications software; the taxonomy identifies archetypes that could be used by designers and documenters.

The sponsor of our study, Intel Corporation, was interested in clearly and coherently communicating to its developers a picture of its users of synchronous business communications systems. Of particular interest was the possibility of developing a library of profiles of potential users' communicative roles and the characteristics that define them. Intel initially imagined profiles tied to traditional business occupations, such as doctors, lawyers and bankers, but challenged us to develop a better model. To find these profiles, we conducted a observational study of actual and potential users of synchronous business communications systems. We noted and classified the observed instances of their communicative activities, looked at the interaction between the category of the activity and the modality of its communication, and then derived the profiles as role archetypes based on the classifications of the activities.

This paper, then, briefly reviews some earlier approaches to classifying group tasks, describes our own methodology, presents the results of our task classification, comments on some aspects of the relationship between task and modality, presents the user role archetypes, and describes open issues raised by our work.

2. METHODOLOGY

Several efforts have been made to characterize group tasks. We reviewed these classification systems for their appropriateness to the group task of communicating through a computer-mediated multi-modal interface.

For example, McGrath and Altman [3] identified six factors for classifying tasks: (1) properties or dimensions of task as such, (2) behaviors required by task, (3) behaviors elicited by task, (4) relations among behaviors of group members, (5) goal and product of task, and (6) criterion of task. Of these, factors 1, 5 and 6 relate to the domain task to be performed, while factors 2 and 3 describe the relationship between the task and the task performer; factor 4 describes the relationship among task participants. Because the underlying task itself is not classified by this approach, it appeared to be too abstract to help in classifying communicative activities.

McGrath's [2] task "circumplex" provided a more promising approach for our purposes. In this analysis, tasks fall into eight possible classifications:

1. Planning tasks - generating plans for action
2. Creativity tasks - generating ideas
3. Intellective tasks - solving problems with correct answers
4. Decision making tasks - deciding issues with no right answers
5. Cognitive conflict tasks - resolving conflicts of viewpoint
6. Mixed motive tasks - resolving conflicts of interest
7. Competitive tasks - resolving conflicts of power
8. Psychomotor tasks - executing performance tasks

In work preliminary to the study reported here, we found [4] that group communicative tasks could be more usefully characterized by extending the eight categories with two additional categories:

9. Information sharing
10. Information gathering

In the present study, we used ethnographic and task-analytic techniques to collect, analyze and classify evidence of the activities of potential users as they conducted their work lives. We interviewed 30 subjects and obtained ten hours of video of the daily work lives of five additional subjects. The beta users spanned a cross-section of occupations. For example, our users included the executive director of a professional organization, a free-lance technical writer specializing in user and technical documentation for hardware and software products, and a video producer at a medium-sized independent video production company.

Figure 1 presents an excerpt of an initial coding of the activities of one of our subjects. The figure shows the start and end times of the activity, the classification using the extended circumplex, a description of the activity, and notes. Not all user activity was relevant to the study. For example, the "NC task" at 4:25:20 represents a non-communicative task that fell outside the scope of our analysis. We also collected information on the modality of the communication: the interaction might be in a face-to-face meeting or via telephone, for example.

Figure 1. Excerpt of Initial Task Coding			
Time	Task	Activity	Notes
4:24:29-4:25:20	Decision Making (Info-Gathering)	Talking to another person	(Talking about UPS)
4:25:20-4:30:07	NC task	Working alone on computer	(Small "chat" near end)
4:30:07-4:30:44	Problem-solving	Working on project	
4:30:44-4:31:33	Executing performance task	Fixing problem	
4:31:33	NC task	Failed phone call	

3. USERS' TASKS

A major focus on our work was to determine what users actually do in the way of collaborative work or business interaction. We found the McGrath circumplex and its

extension not as helpful as we needed. While comprehensive in the dimensions it accounts for, the circumplex did not account for characteristics that, as we analyzed the data, were useful in describing actual domain tasks. Accordingly, we went back to the basic data and developed a new task classification approach that accounted for the salient differences observed in the activities of users. The classification was formed using a spiral, bottom-up method with three iterations.

3.1 Overall Results

We found eight categories of tasks for the collaborative or interactive work in which our subjects engaged. Some of these categories have succinct labels; others have longer labels because they express ideas for which we do not yet have simple words or phrases. Here are the eight categories we found:

1. Communicating or distributing news
2. Jointly creating a document or plan
3. Jointly agreeing on the status of things or circumstances
4. Sharing a document or plan created by one entity for approval by or feedback from another
5. Negotiating
6. Getting information from others
7. Managing, supervising or coordinating others' activities
8. Training or teaching

While these classifications are based on the sample of potential users we observed, we also checked these results from the 30 interviews and five videotaped subjects against an additional sample of 30 subjects. Subject to the inherent limitations of our methodology, as discussed below, the classifications were highly consistent.

3.2 Examples

Our categorization of the activities may be made clearer through examples of communicative activities classified in each category. With each example is a figure representing the number of times that the activity was mentioned in an interview summary or was observed in a videotape. Note that these numbers do not represent relative frequency or extent of task in daily work life. Rather, they should be viewed as indicators of the extent to which (a) our subjects had activities in common and (b) the category is reliable.

We found 14 instances of users' activities that we classified as "Communicating or distributing news." Examples of these activities included:

- Explain status of changes in the software to quality assurance team
- Communicate schedule status to clients
- Communicate new results to clients
- Communicate problems to clients

- Explain status of changes in the software

We found 29 instances of users' activities that we classified as "Jointly creating a document or plan." Examples of these activities included:

- Meet with the client to get a specification
- Coordinate assembly of video with editor
- Meet with client to define subject and scope of project
- Meet with faculty to plan new programs or revise current ones
- Meet with specialists to devise individual plans for special-needs students

We found six instances of users' activities that we classified as "Jointly agreeing on the status of things or circumstances." Examples of these activities included:

- Meet with project staff to exchange information about the site status
- Meet with students to discuss the events of the past week
- Determine and communicate client's needs and capabilities
- Meet with parents to review children's progress

We found 34 instances of users' activities that we classified as "Sharing a document or plan created by one entity for approval by or feedback from another." Examples of these activities included:

- Get client to accept proposal and product
- Obtain approval of a client proposal from an account executive
- Get approval of scripts/stories from producer
- Prepare and email draft article

We found eight instances of users' activities that we classified as "Negotiating." Examples of these activities included:

- Decide which applications will be converted as part of the system installation
- Negotiate levels of budgetary support for particular departmental offerings
- Negotiate rooms for courses
- Meet with providers of services to present the needs and get proposals back

We found 19 instances of users' activities that we classified as "Getting information from others." Examples of these activities included:

- Track project status
- Talk with people who have information relevant to state of industry
- Assess the potential sales for a territory
- Interview people involved in a news story
- Meet with client to assess needs

We found 29 instances of users' activities that we classified as "Managing, supervising or coordinating others' activities." Examples of these activities included:

- Coordinate meetings with center members
- Supervise the activities of policy committees
- Guide developers implementing changes to the product
- Supervise entry of data backlog
- Schedule and participate in conference calls

We found eight instances of users' activities that we classified as "Training or teaching." Examples of these activities included:

- Train station staff to use the new system
- Install systems and provide training
- Participate in parenting classes to present program devised for parents
- Deliver lectures

The reliability of the classification of these examples, as for all of the other instances, is subject to the inherent limitations of our methodology. While all classifications were confirmed by three members of the research team, the relatively small size of the dataset precluded meaningful assessment of inter-rater reliability. Furthermore, the selection of beta users was made by the project sponsor and was not a random sample, so the set of categories should be regarded as a useful start rather than as a definitive statement. At the same time, we note that every category has multiple instances of activities and that the classification process produced few instances in which there was substantial disagreement among the coders.

4. MODALITY

The interactions we observed among our users took place through a variety of modalities, ranging from face-to-face meeting to faxes.

Fifty-one of the activities occurred in face-to-face one-on-one meetings. Thirty of the activities occurred in face-to-face group meetings without an agenda. Thirty-six of the activities occurred in face-to-face group meetings with an agenda. One instance occurred in a multiparty telephone conference call. Thirty-seven of the activities occurred in telephone calls between two persons. Three of the activities occurred via e-mail, four by fax and three via physical mail. We were unable to determine the modality of 18 of the recorded activities.

Prior research [1] indicated that there could be significant interactions between task and modality for multimodal communications interfaces. Accordingly, we cross-analyzed the tasks and modalities to determine patterns of tasks across the different modalities. Our results confirmed the existence of this effect. We found that when users share a document for purposes of getting approval or other feedback, they overwhelmingly do so in face-to-face, one-on-one meetings (22), compared with group meetings (10). Moreover, of these

ten group meeting situations, eight had an agenda, indicating that they may have enough structure that a synchronous multimedia communications system may be acceptable.

We also found that when users communicate face-to-face, one-on-one, they most commonly share a document or plan created by one entity for approval or feedback by another, jointly create a document or plan, and, to a lesser extent, communicate or distribute news and her manage, supervise coordinate others activities. We thus consider these to be among the most suitable activities for support by a synchronous multimedia communications system.

5. USER ROLE ARCHETYPES

Based on the data developed for the task categories, we were able to classify the roles of potential users of synchronous business communications software into a set of "archetypes" that characterize their use; these archetypes were developed through analysis and classification of the kinds of tasks that users do. To develop this classification, we re-expressed the users' original tasks in terms of their task categories, composed users into groups based on similarities in distributions of task categories, and then expressed the users' roles based on common features of their occupations. We used an iterative grouping process for the classification process, with alternating bottom-up and top-down passes.

The data suggest that there are five general kinds of roles for users engaged in collaborative work. The roles can be characterized as Thinkers, Producers, Authors, Networkers and Diplomats. These labels represent archetypes of users' roles. We not mean to suggest that all of the users that we interviewed or observed fell entirely into a single archetype. Rather, these labels represent primary focuses of activity. We believe that the set of classifications is reasonably complete, as we formed an initial set of classifications based on the first 15 interviews and then found that the data from the second set of 15 interviews fit into the classifications with few exceptions. The users represented a fairly heterogeneous sample of business and professional people, all of whom use computers in their daily work life.

Each of the role archetypes is characterized in terms of a set of specific communicative activities:

- Thinkers produce specifications and plans for others to follow. Activities of Thinkers include jointly creating a document or plan, sharing a document or plan created by one entity for approval by or feedback from another, and managing, supervising or coordinating others' activities.
- Producers create and share technical products for use by others. Activities of Producers include sharing a document or plan created by one entity for approval by or feedback from another, and jointly creating a document or plan.
- Authors synthesize and express information; their products are intended for reading by others. Activities of Authors include getting information from others,

sharing a document or plan created by one entity for approval by or feedback from another, and jointly creating a document or plan.

- Networkers work with others, provide community, and help others solve their problems. Activities of Networkers include training or teaching, getting information from others, and jointly agreeing on the status of things or circumstances.
- Diplomats bridge communities and help to solve problems arising from conflicts among communities. Activities of Diplomats include managing, supervising and coordinating others' activities, and jointly agreeing on the status of things or circumstances.

The distinctions among the role archetypes may look subtle but the archetypes do differ in significant ways. For example, the Producer and Author archetypes share the tasks "sharing a document or plan created by one entity for approval by or feedback from another" and "jointly creating a document or plan." One difference between the two is that Authors also get information from others. So the difference, intuitively speaking, is that producers create and distribute, and authors gather from others and then create and distribute. Another difference is that Producers create things that are used by others, and Authors create things that are, specifically, read by others.

We want to emphasize that our study involved differentiating roles of users rather than users as people. Indeed, roles can overlap within an individual. Some people may use only a subset of the roles, and some may incorporate several roles into their work. But the roles should not be confused with the sum total of an individual's behavior. At the same time, because the role archetypes express the users' functional dimensions, they should be of use to designers of communications systems who wish to meet specific patterns of users' needs.

6. CONCLUSIONS

We began this paper by looking at, adapting, and then going beyond previous approaches to classification of user tasks for group work. We found that it was possible to develop an empirically based approach to classification that was more highly oriented toward real-world domain tasks. Based on workplace observation of 35 diverse users, we were able to articulate eight categories that could account for the users' communicative activities. Then, based on the distribution of the categories of activities among the users, we articulated five role archetypes that differentiate the roles that users play in collaborative work carried out through communication.

The current work raises a number of issues that could help to determine the shape the use of computer-mediated communication. These issues include questions about the nature of user tasks, user role archetypes, and their modalities:

- Do the different user archetypes produce or employ different artifacts?
- Do the different activities and artifacts correlate with modality?

- Do the archetypes correlate with modality? That is, do different kinds of users systematically use different ways of interacting?

Other issues relate more fundamentally to what it means to cooperate via computer mediation:

- What proportion of cooperative work is synchronous?
- What is the length of true synchronous activity as compared to the overhead of meetings?
- How much more quickly do tasks get done using this sort of system?
- How intermittent is synchronous work? Are there lots of small conferences or rather a few long ones?

Designers could use-indeed, they need-the answers to these questions to build synchronous business communications software systems that more fully meet the needs of real-world users.

7. ACKNOWLEDGMENTS

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