

IBM Research Report

How Much Is Shared in a Shared Activity

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ABSTRACT

Activity-centric collaboration involves shared work, structured in ways that facilitate both private and shared actions. This paper reports a participatory analysis of complex shared activities at each of four sites. Despite the highly collaborative nature of the work, informants reported a complex mix of shared and unshared objects and tasks. These patterns of *selective sharing in shared activities* help to inform conceptualizations of coordination and articulation, and suggest the need for local structures in environments to support end-users in co-constructing and co-conducting shared activities.

Author Keywords

CSCW. Computer-mediated communication. Activity-centric collaboration. Participatory analysis.

ACM Classification Keywords

H5.3. Group and organizational interfaces - CSCW.

INTRODUCTION

Recent studies have examined collaborative work on tasks and activities. Work has begun to focus on distinct, higher-level units of shared work, variously called “activities” [1,2,11,17,18,28], “activity threads” [20,22], “thrasks” [3], “projects” [15], or “working spheres” [7,16] — or analyzed as a more basic series of email exchanges [9,26,27]. Several of these research programs explored how these higher level structures may be composed of recognizable shared components [3,5,8,11,17,18,20,22,27,28].

Previous research has tended to assume that collaborators have a mostly common view of the shared objects in such representations, typically using concepts related to Clark’s common ground (e.g., [4]). We presents results of a 2005 participatory analysis that suggest important limits on the extent and content of such shared views, especially as regards collaborative navigation using shared concepts called “landmarks” [22].

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STRUCTURED COLLABORATION SPACES & PLACES

A variety of designs has been offered to support collaboration. Following Harrison and Dourish [12], we consider these designs to provide relatively unformed spaces, which collaborators particularize into places by creating meaningful structures, adding objects and other resources into those structures, and inhabiting those places in order to carry out work or other collaborative activities.

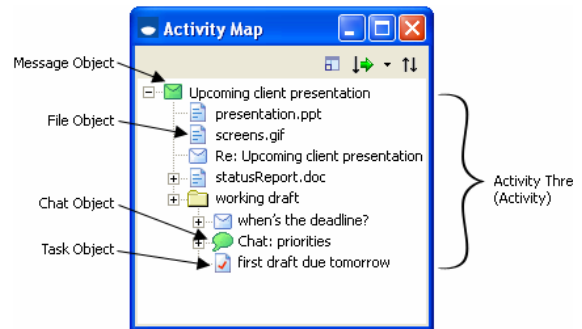


Figure 1. An example of an activity thread, showing the use of diverse collaborative objects (from [20]).

ActivityExplorer (AE) is an application that has been used to support over 200 collaborative activities ranging from lunch dates to writing conference papers to community-level informal support discussions lasting several months [20]. In AE, users create objects to plan, conduct, or record their collaborative work. These objects can be files,

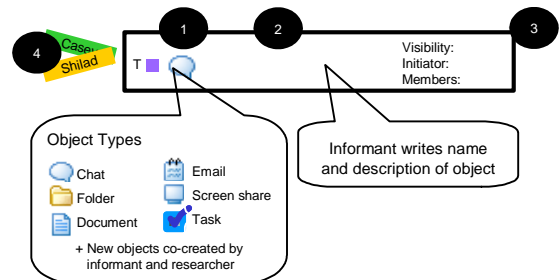


Figure 2. Materials used in participatory analysis. Each slip of paper represents one object. 1. Icon for the object. 2. Space for informant to write title of the object. 3. Space for researcher to write people involved (or other notes). 4. Landmark attribute as ascribed by informant.

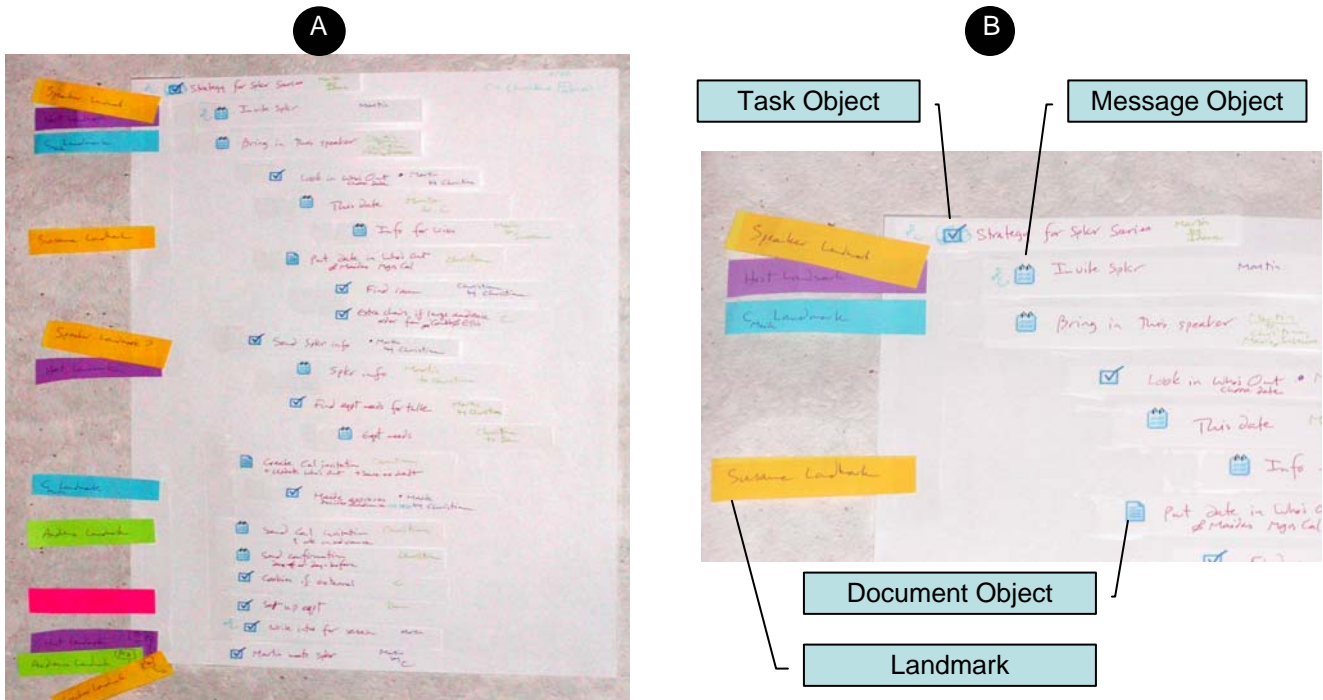


Figure 3. Example of participatory analysis from one collaborator. A. A page-long description of a collaborative process. B. Detail of analytic categories and materials. Note particularly the colored flags on the left side of the page: These represent landmarks, and each color is associated with a different collaborator.

messages (as in a discussion database), persistent chats, shared screens, tasks, or folders. AE also allows the creation of structured collections of these diverse objects. Each collection is called an Activity Thread (Figure 1).

Users of activity threads are called “members,” and membership may be specified independently for each object in the structured collection (membership may also be specified by default in less labor-intensive ways). AE also supports levels of awareness of other members and access status of objects, but those attributes are not the topic of this paper.

SHARED OBJECTS AND LANDMARKS

Published studies of AE have shown that members can successfully create and use activity threads ranging from one to 33 members, and from one to hundreds of objects. However, users showed little interest in changing the membership defaults for objects or activity threads [20]. We were therefore curious to understand the extent to which people made reference to the shared objects in AE. That is, the fact that objects are *available* for sharing does not mean that they in fact *are* shared, and does not mean that people are even *aware* of the existence of objects that may not be relevant to their own responsibilities in a shared project.

We were also curious to understand this question in terms of the concept of “landmarks” [22]. Landmarks were proposed as points of collaborative navigation in a complex place filled with collaborative objects. Based on an

analysis of commercial and academic proposal writing (in response to a Request for Proposals/RFP, or the announcement of grant-funded opportunities), landmarks were analyzed as falling into five categories:

1. Documents
2. Dates and calendars
3. Specific events
4. Systems and databases
5. Persons and roles

It was hypothesized that collaborators used landmarks to organize their shared work, to understand its current state, and to articulate their work on related subtasks.

PARTICIPATORY ANALYSIS

To understand people’s work with shared objects, we conducted a participatory analysis of 24 informants at nine sites. Participatory analysis is an aspect of the broader field of participatory design (e.g., [21]), in which informants (users) act on their own behalf as peer co-reporters, co-interpretors, and co-analysts along with the researchers or software professionals who are usually responsible to bring the results to their organizations. These methods typically move fluidly from description to critique, from discussion to invention, and are particularly valuable when it is necessary to combine ideas and concepts from multiple domains or ways of knowing. As we intended to analyze our informants’ shared activities from multiple perspectives, participatory analysis was an appropriate and effective method.

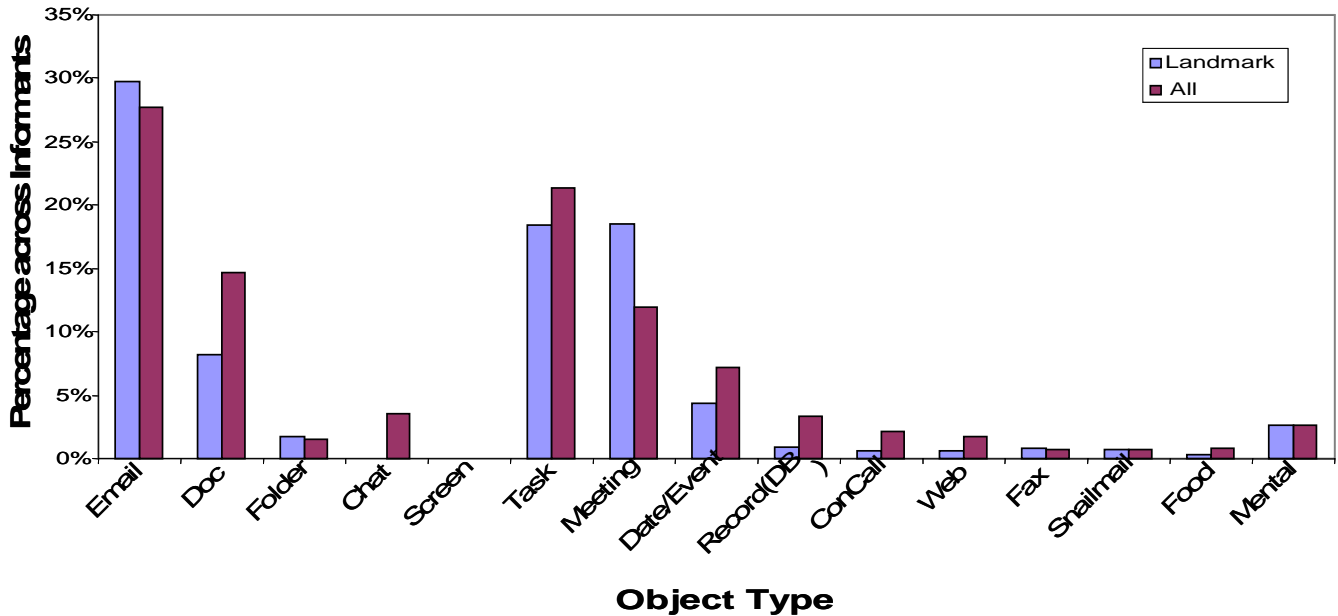


Figure 4. Omnibus results across 24 informants.

We used a variation of the CARD method [19] that had been used for the analysis of landmarks [22]. The pencil-and-paper materials in this method allowed informants to manipulate objects similar to those in AE, but without having to figure out user interface interaction dynamics. More crucially, the paper-and-pencil materials allowed informants to create new types of objects as needed, beyond the list of six object types listed in the “Structured Collaboration” section, above. Details of the new object types created by informants, and new relationships types created among objects, are beyond the topic of this paper, and will be reported separately.

Figure 2 shows an example of a paper-and-pencil representation of a persistent chat object. The informant would choose this type of object (slip of paper) to represent a chat communication (see “1” in Figure 2). The informant would fill in a title (“2”) for the chat activity or subactivity; the informant or the analyst would often fill in the names or roles of the people who were involved in the chat (“3”). Finally, at the end of the session, the informant would indicate whether the object was a landmark for her/himself or for other collaborators, or and for whom (“4”).

The 24 informants included researchers, technologists, product specialists, customer-relations meeting planners, consultants to the banking industry, human relations staff, administrative assistants, and selected staff of a non-profit organization that convenes and conducts scientific meetings. At each site, we chose an activity that was important, that was done often, and that involved variations, exceptions, or work-arounds each time. Across the nine sites, four sites allowed us to work with more than one person involved in a shared activity. In this paper, we focus on the results of the people in those shared activities.

RESULTS

We transcribed and tabulated the paper artifacts that were generated by the participatory analysis sessions. Overall, our study collected information on 687 objects from the 24 informants at nine sites. Figure 3 shows a representative description of an activity consisting of multiple objects. Figure 4 presents a brief summary of these activity data across the nine sites. The first five object types in Figure 4 are those currently supported in the ActivityExplorer product design [14] (email¹ or messages, documents, folders, persistent chats, and shared screens). The sixth object type, tasks, was supported in the 2003 research prototype [20]. The remaining object types were conceptually created or invented by the informants. Informants organized these objects into hierarchical structures with the same formal attributes as activity threads (Figure 1).

The remainder of this paper focuses on the data from the four sites with multiple informants. Each informant participated in a separate participatory analysis session — i.e., without other informants present (Future research may use participation methods for collaborative work analysis by groups of co-analysts, as surveyed in [21]). Table 1 summarizes the data from these four sites.

We will go into considerable detail on the first site, to indicate the kind of analysis done on all sites. In the interest of brevity, we will provide less detail on the remaining three sites.

¹ Email has not yet been integrated into the product version of ActivityExplorer. Users create messages which function similarly to entries in discussion databases.

Site	Number of Informants	Total objects	Total landmarks	Shared objects (%)	Shared landmarks (%)
1. Inviting a speaker	6	59	11	18 (31%)	5 (45%)
2. Planning a committee meeting in a non-profit	3	103	48	12 (12%)	1 (2%)
3. Planning a customer meeting	2	44	20	2 (45%)	1 (5%)
4. "Onboarding" interns	8	271	64	25 (9%)	13 (20%)

Table 1. Summary of data from the four sites with multiple informants.

We first preface the analysis with a brief description of the activity being described, including references to the roles of various informants. A close inspection of the shared objects follows.

Inviting a speaker

Six informants described the process of inviting a speaker to make a technical presentation. In their organization, this was a weekly occurrence, and was considered to be part of the outreach of the department to other parts of their larger organization. Participants included the administrative assistant, the technical support specialist, the operations manager (boss of the two previously mentioned people), the organization's record-keeper, the host/inviter, and a member of the audience. At a high level, the activity proceeded as follows:

- The Host proposed a speaker
- The speaker was approved at a managers' meeting
- The Host invited the speaker
- The speaker sent title, abstract, and bio for the talk
- The Administrative Assistant drafted an announcement of the talk, and arranged for various resources
- The Operations Manager approved the announcement
- The announcement was distributed
- One day before the talk, the Host reminded the speaker, and the Administrative Assistant reminded the Audience
- The Technical Support specialist prepared equipment to support the talk
- On the day of the talk, the Technical Support specialist set up the equipment, the speaker arrived and was greeted by the Host, the Operations Manager met the speaker, and the talk occurred
- After the talk, the Technical Support specialist put the equipment away, and the Host thanked the speaker

What was Shared?

These six informants described a total of 59 unique objects, of which 18 were shared (mentioned by at least two

informants). When asked, informants indicated that 11 of these object served as landmarks for themselves or for others. Of these 11 landmark objects, only 5 of them were indicated by two or more informants.

Figure 5 shows diagrammatically the objects and landmarks that were mentioned by the six members at the **Inviting a Speaker** site. The six horizontal lines are sequences of objects mentioned by each of the six informants, respectively; each object mentioned by an informant is represented by a small symbol on that informant's line. Landmarks are shown by a lighter oval around the small symbol. Shared landmarks are further denoted by a vertical line through multiple, simultaneous lighter ovals. The informants are named by role, and the shared landmarks briefly described.

At this site, 18 objects were mentioned by two or more people (i.e., 18 objects were shared). For example, object 12 was the shared decision to choose a particular date for a particular speaker in the weekly series. While this was an important moment in the planning process, it was not described as a landmark by any of the participants. A strong contrast is offered by object 11, which represented discussions with potential speakers. These discussions were conducted by the Host, and were therefore not shared with the other informants. Note, however, that this object was not *private* from the other participants. They knew that the host was contacting potential speakers. What makes this object unshared is simply the fact that no other informant participated in the discussions with potential speakers, or any artifacts related to those discussions.

Similarly, object 22 appears to be private to the Administrative Assistant, but it is the (elective) ordering of extra chairs to accommodate a larger audience when a popular speaker visits. Like object 11, this object is not private in the sense of being a secret. It is merely a subactivity that is known by others, and that is assumed to be accomplished by one person.

Interestingly, object 50 (order cookies for an external speaker) is important enough to be mentioned by the Operations Manager, as well as the Administrative Assistant who is responsible to do this. In this case, the courtesy (and hence reputation) of the organization is at stake, so the Operations Manager is conscious of the need

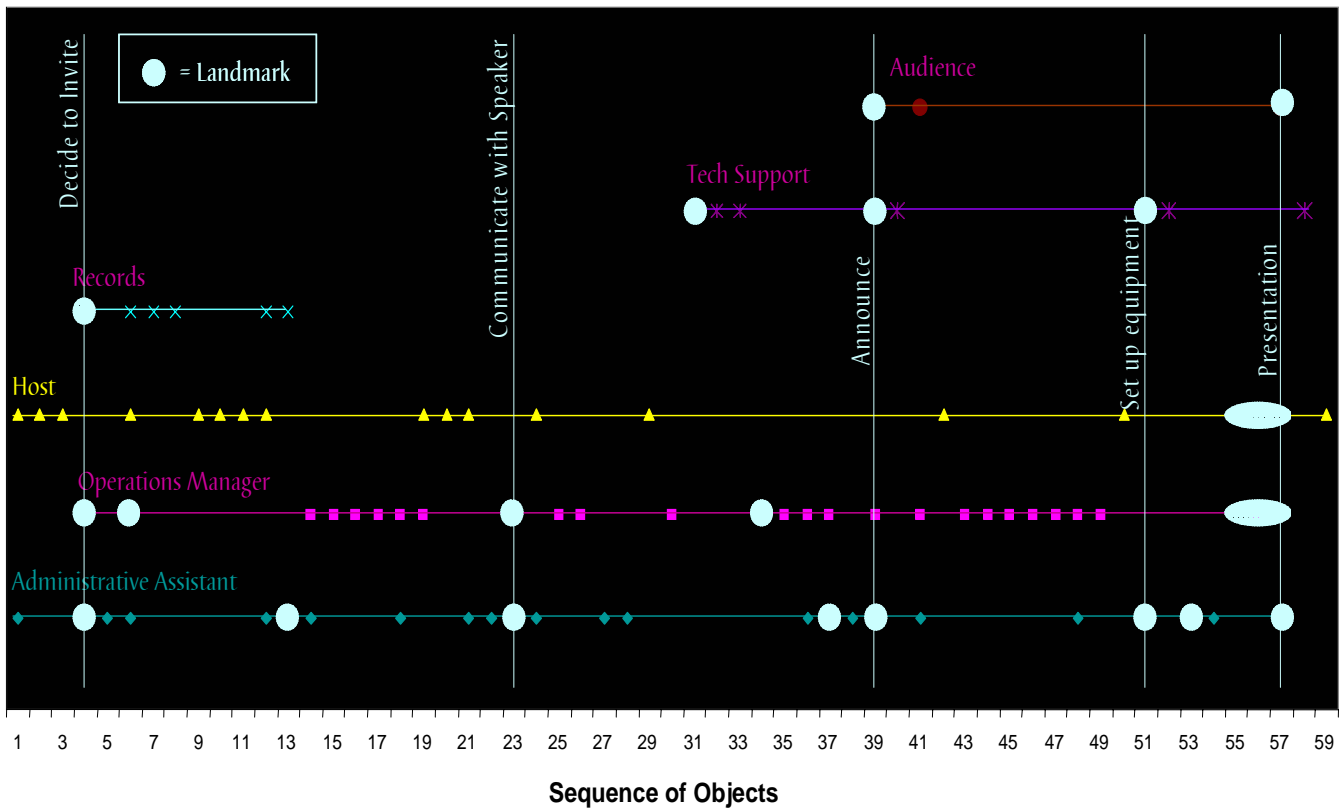


Figure 5. Objects and landmarks in the **Inviting a Speaker** site. Six informants: Administrative Assistant, Operations Manager, Host, Record-keeper, Technical Support, and Audience. Small shapes represent objects mentioned by each informant. Grey circles indicate landmarks, as identified by each informant. The Sequences of Objects axis is not proportional to calendar time.

for this step – even though it is assumed by everyone that the Administrative Assistant will take responsibility and action for this subactivity.

The landmarks in Figure 5 present a somewhat different story. Although informants named a total of eleven landmarks, only five of these were shared, and none of these landmarks was shared among *all* informants. In some cases, the absence of complete sharing is not surprising. For example, object 4 is the decision to invite a speaker, and of course the Audience is not made aware of this decision. However, the Host did not designate this decision as a landmark, which is a puzzling omission.

Later in the process, object 39 is the official announcement of the talk. The Administrative Assistant designated this event as a landmark because it was the responsibility of the AA to send the announcement. The Audience informant designated this event as a landmark because it helped the Audience to plan their schedules.

At a subtler level, the Technical Support staff also designated this object as a landmark, because this was the moment at which the scheduled talk became “official” or “real,” at which point the Technical Support person became responsible for finding out what equipment was needed by

the speaker, and for providing that equipment in time for an orderly presentation session (object 51, “Set up equipment,” which is a landmark for the Technical Support specialist and also for the Administrative Assistant, who makes sure that the operation runs smoothly). At an even more subtle level, the Operations Manager did *not* designate this object as a landmark, because of trust in the Administrative Assistant to send out the announcement properly.

Finally, the presentation (compound of related objects 55-57) is a landmark for nearly everyone — except the Record-keeper, whose work ended earlier with an entry on the shared wiki page (object 13, which is known to the Administrative Assistant as part of the “smooth operation” responsibility), and the Technical Support specialist, who by this time has already set up the equipment and made sure that it worked (object 51).

We were surprised at what seemed to be a relatively low level of sharing of objects and landmarks. Nonetheless, the organization’s series of presentations was a success. It appears that the members of this shared activity perform their work quite well through trust and just enough knowledge of one another’s activities. Sharing this activity does not appear to require sharing every component of it.

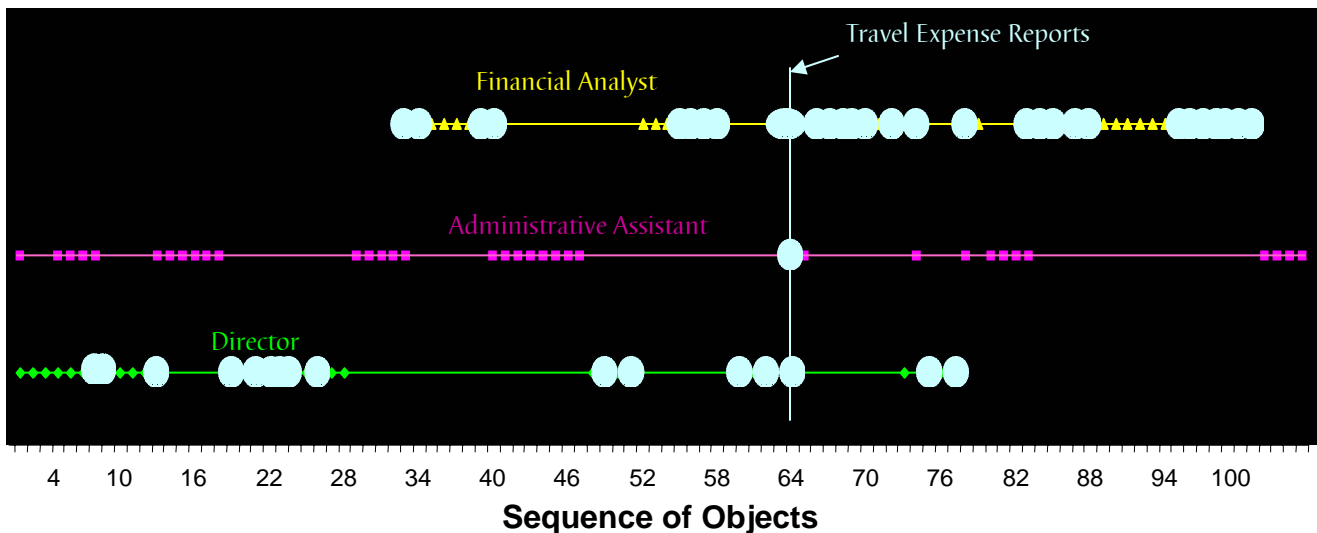


Figure 6. Objects and landmarks at the **Planning a Committee Meeting** site.

Planning a committee meeting

Three informants described the planning and follow-up to a research committee meeting held at a non-profit institution. Committee meetings are one of the major events held at this institution, and are supported by very well-understood working practices. At a high level, the activity proceeded as follows:

- The Director chose potential dates for the meeting
- The Director and the Administrative Assistant polled committee members and the subject-matter experts (SMEs) for their date preferences
- The meeting date was chosen and communicated to the committee members and the SMEs
- Arrangements were made by the Administrative Assistant, with supervision and approval of the Financial Analyst, for hotel rooms for the committee and speakers, and for restaurant reservations
- The committee meeting occurred
- The Administrative Assistant and the Financial Analyst processed bills from the hotels, receipts from the restaurants, and travel expense reports from the committee members and the speakers

What Was Shared?

The three informants described a total of 103 objects, of which 12 were shared. Of the 103 objects, a total of 48 were landmarks, of which one was shared (Figure 6). Interestingly, the one shared landmark was *not* the occurrence of the committee meeting, apparently because neither the Financial Analyst nor the Administrative Assistant had a direct role in conducting the meeting. Instead, the one shared landmark was the troublesome task of obtaining travel expense reports from all committee members and speakers, in order to begin the lengthy and

bureaucratic processing of those reports so that the travelers would be reimbursed.

We speculate that this team had little need for sharing of either objects or landmarks, because they had worked together on many such committee meetings, and understood very well how each person's work contributed to the success of the entire meeting process. In this case, what was shared in the collaborative activity may have been a relatively complete mental model of what each person did, so that there was little need to represent each person's work toward the success of the whole. It would be interesting to return to this group and request a three-person analysis session, to test this hypothesis.

Planning a customer meeting

The planner and one technical speaker at a customer meeting described the work of planning an annual sales-oriented meeting for corporate customers. At a high level, the activity proceeded as follows:

- The Planner selected a date and location for the customer meeting
- The Planner communicated the event to the customers
- The Planner obtained lodging and other requirements or needs from the customers
- The Planner made hotel and catering arrangements for the meeting
- The Planner solicited technical and business presentations to educate the customers
- The Speaker volunteered to make a presentation
- The Planner's management approved the Speaker's proposal

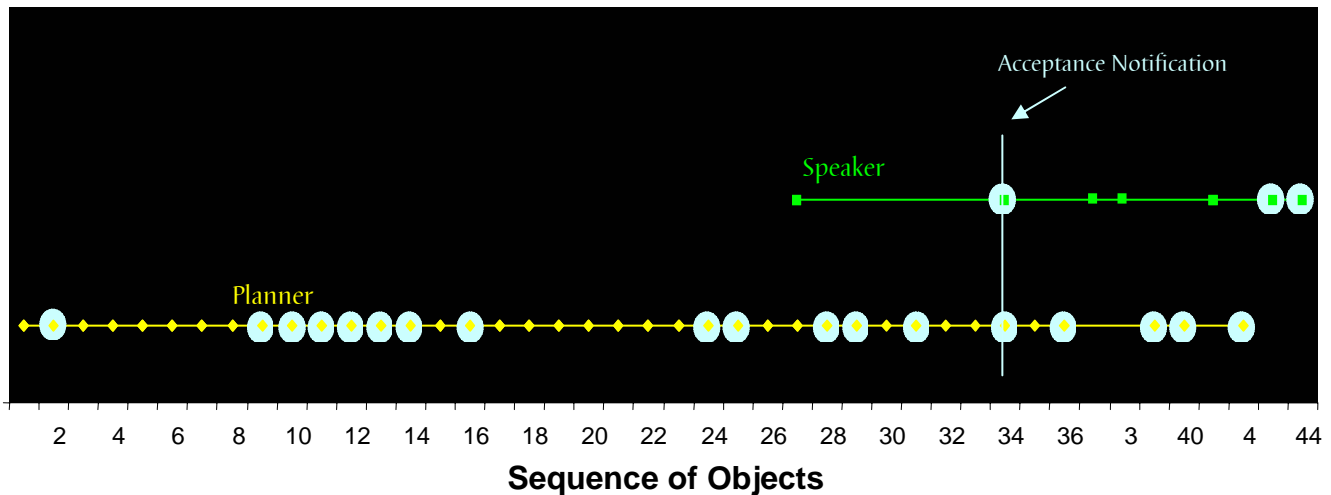


Figure 7. Objects and landmarks at the **Planning a Customer Meeting** site.

- The Speaker attended orientation meetings with other Speakers
- The Speaker arrived at the meeting and made her/his presentation

What Was Shared?

The Planner and the Speaker described 44 objects, of which 2 were shared. Of the 44 objects, a total of 20 were landmarks, of which one was shared.

This pattern (Figure 7) is somewhat similar to the preceding site, in that a single landmark was shared, despite the complexity of the work. In this case, the scant sharing can be explained in part because the Speaker was involved in a very small part of the Planner’s work. Also, after the acceptance (landmark), of the Speaker’s proposal, the Speaker’s work was largely independent of the Planner’s work. The other explanation of the scant sharing is similar to the roles in the preceding case of the Administrative Assistant and the Financial Analyst. That is, by the time of the Speaker’s presentation at the customer meeting, the Planner’s work was completed, and therefore the two workers did not *share* a landmark, despite the landmark status of this event for the Speaker.

Onboarding interns

Eight people described the process of bringing interns into a research organization (bringing interns “on board,” hence the slang of “onboarding”). This was a process that was used by the organization every summer. Thus, it was familiar to the six members of the organization who participated in the study (summer coordinator, mentorA, mentorB, operations manager, technical support specialist, and administrative assistant). However, the process was of course not at all familiar to the two interns who participated (Intern-A and Intern-C). The process of “onboarding” was long and bureaucratic, with many steps that were surprising

to the interns, but known to the six permanent staff members. The following high-level steps occurred:

- The Summer Coordinator surveyed needs and negotiated a budget and headcount for summer Interns for specific Mentors
- Each Mentor interviewed candidate Interns
- Each Mentor recommended an Intern for the summer program, and completed a comparative justification for hiring that Intern
- The Human Resources department conducted the formal and legal aspects of making a job offer to each Intern candidate
- The Intern candidate accepted the offer
- The Summer Coordinator arranged for the Interns’ first day experiences, including meetings with the Operations Manager, the Administrative Assistant, and the Technical Support staff.
- The Interns arrived and completed a many-step first-day process
- The Technical Support staff worked with Interns to resolve technical problems
- One Mentor organized a series of Intern talks about their plans for their summer work

What Was Shared?

Together, the informants referenced 271 objects, of which 25 were shared. Among the 271 objects were 64 landmarks, of which 13 were shared.

Because of the complexity of this case, Figure 8 shows only the 64 landmarks, and not the remaining 207 non-landmark objects. Like the other three sites, this site also shows surprisingly few shared landmarks, despite the complexity

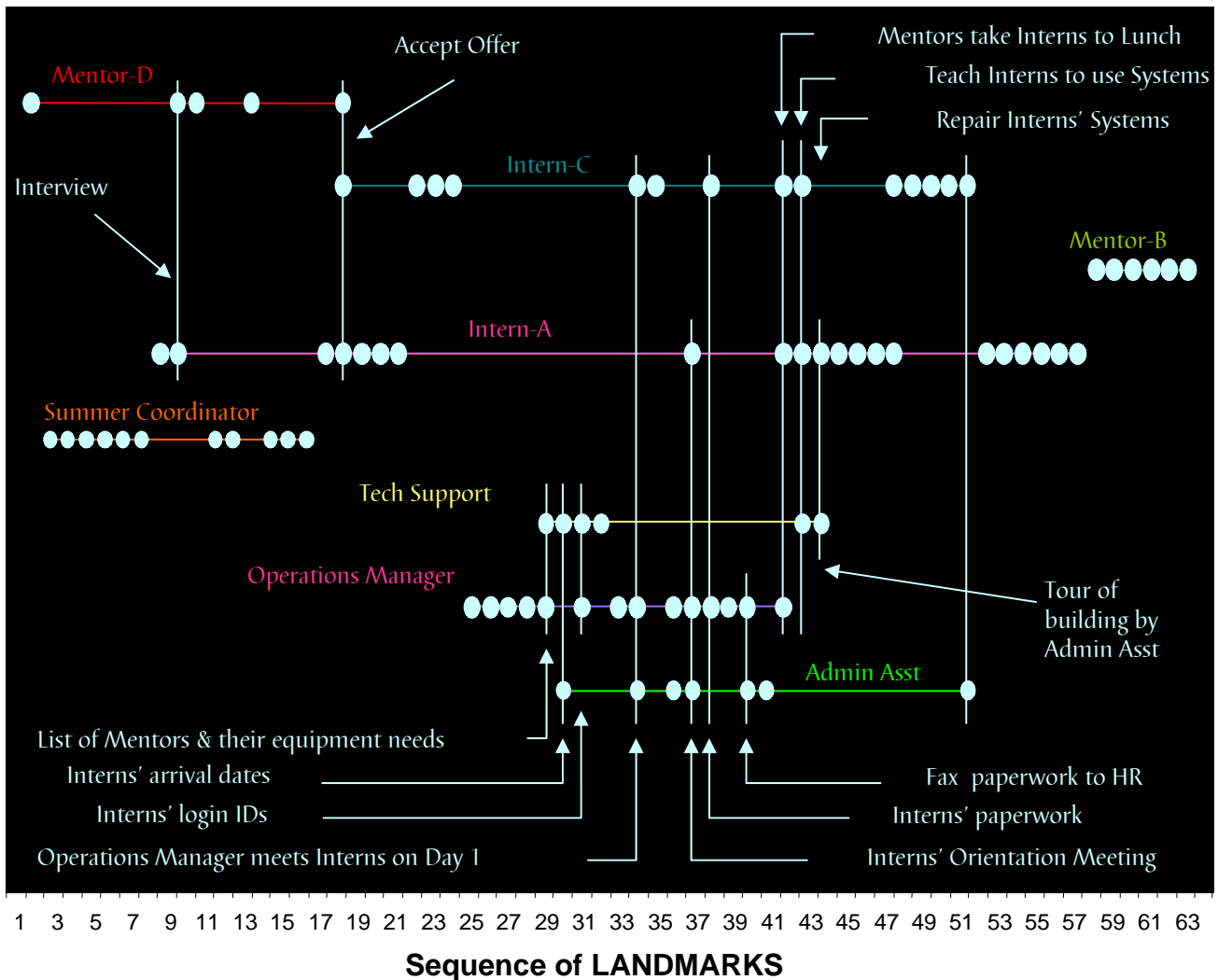


Figure 8. Landmarks only (without objects) for the **Onboarding Interns** site.

of the collaborative. Part of the explanation, as with the other sites, is the independent nature of many of the contributions. For example, the many private steps taken by Intern-A were important to that intern (therefore, there are many landmarks such as landmarks 19-21 on Intern-A's line), but were not visible to anyone else – even Mentor-D. Similarly, the Operations Manager's work (landmarks 25-28) before the first shared landmark with the Technical Support staff (landmark 29) was also concerned with important but solitary efforts. Both Intern-A and Intern-C described a series of orienting moves that were landmarks for each of them, even though they shared those activities with no one else (landmarks 45-50 and 52-57)

By contrast, the acceptance of the offer of employment (landmark 18) was a landmark for both the Interns and the Mentors (Intern-A, Intern-C, and Mentor-D). Similarly, a number of crucial steps involving intranet IDs were of landmark importance to both the Operations Manager and the Technical Support staff (landmarks 29-31), and one of

these preparatory steps was also important enough to be a landmark to the Administrative Assistant (landmark 30).

This site's outcome is similar to those of the other sites. Some landmarks were shared, but the majority were not – and only one landmark was shared by more than three members of the activity. Similarly, only 9% of the 271 objects were shared (not shown in Figure 8). Again, we have seen a successful shared activity that appears to depend on its members' separate work practices, coordinated and articulated at the multiple landmarks.

Describing the Shared Landmarks

For shared landmarks and objects, we were curious to see if members described the same landmark using the same type of object. In general, they did use the same type of object.

The exceptions were simple matters of how the landmark signified to each member. For example, at the **Inviting a Speaker** site, object 39 was the landmark of the announcement of the talk. The Administrative Assistant,

who sent out the announcement, described the landmark using the object type of Email. The Audience also used this object type. However, the Technical Support specialist, who had to take specific action in response to the announcement (planning to set up equipment), described the landmark with the Task object type. Also at this site, the presentation itself was a Dated Event object type for the Administrative Assistant and the Audience, but was represented by a specific Task object by the Operations Manager (“make sure the speaker has a cup of water”).

There was a similar Email-Task combination for the only shared object in the **Planning a Committee Meeting** site. There was perfect agreement in object types for the landmark in the **Planning a Customer Meeting** site.

The most complex pattern of landmark-sharing occurred in the **Onboarding Interns** site. Nonetheless, almost all of the shared landmarks had matching object types (e.g., Meeting-Meeting or Email-Email-Email). Most mismatches were as in the preceding paragraph, such as a landmark that was a Meeting object for one member (Technical Support staff), but that resulted in a Task (object) assignment for another member (Intern). The only exception occurred when an Intern’s Task (object) resulted in paperwork that was saved in the Operations Manager’s Folder (object).

Thus, despite the complexities, members showed very strong agreement in the ways that they described landmarks (as types of objects).

DISCUSSION AND CONCLUSION

These results help us to understand how people share their workplace activities, and how those shared activities can be represented in activity-centric computing systems.

Selective Sharing in Shared Activities

Sharing of objects appears to work well when it is selective. Our informants showed that most objects are not explicitly shared, and that the work goes on quite well when only a minority of the objects are shared. The types of work described by our informants appear to involve extended and complex independent activities, which are brought together for coordination and articulation at landmarks. These results are similar to reports from more structured domains (e.g., [10,13,24]), and argue against proposals for complete exposure of all shared activity data (e.g., [1,2]). Our results suggest a less formal version of private-vs.-shared, such as has been explored through public views of private work areas that are situationally improvised (e.g., [6,25]).

However, even the sharing of *landmarks* was less than we anticipated. Of the 143 landmarks described by our informants, only 14% were explicitly shared. Moreover, the pattern of sharing was often partial, even for the shared landmarks. That is, for sites with more than two members, there was only *one* landmark that was shared by all the members of the site (the travel expense report problems at the **Planning a Committee Meeting** site).

As mentioned earlier, we hope to conduct a second study in which multiple members of an activity contribute as a group to the participatory analysis of that activity. We suspect that we would see some increase in the proportion of explicitly shared objects, and possibly some decrease in the proportion of one-person landmarks. However, based on the kinds of activities described by the informants in this paper, we anticipate that selective sharing will continue to characterize people’s work in shared activities. We anticipate turning our attention to questions of *How much selective sharing is useful?* and *What materials and processes should support selective sharing?* and *How much awareness is required to make selective sharing effective?*

Revising the Landmark Concept

This report also helps to clarify the “landmarks” proposal of [22]. That earlier work suggested five categories of landmarks: Documents; dates and calendars; specific events; systems and databases; and persons and roles. Our results, as shown in Figure 3, require revision to that concept. We found strong support for the categories of documents; dates and schedules; and events (especially meetings). However, we found very modest use of systems and databases as landmarks. Our study did not provide a direct test of the category of persons and roles as landmarks, so we do not have conclusions with regard to that part of the landmarks hypothesis.

We did find, however, that tasks are a major type of landmark, and should be studied further as part of the landmark hypothesis. Other work in activity-centric collaboration has also argued for the importance of representing shared tasks and task-like structures [3,5,8,11,17,18,20,27,28].

Mediation: Making Spaces into Places

People appear to coordinate their shared work activities through patterns of selective sharing. This phenomenon can help us to understand the role of mediating objects and systems. Activity theory posits an important role for mediating concepts and tools, and for the division of labor across shared work [23]. Our results help to show that the division between private concepts and shared concepts is crucial, with direct implications for the division of labor.

Part of the research program of activity-centric collaboration is to provide resources for sharing activity representations. These resources must be open to the creation, by end-users, of structures to support the objects and practices in their activities. These resources are thus a kind of space [12], waiting to be turned into places of use. Our research has helped to define the types of local structures that will need to be provided to, and interpretable by, end-users, as forms of what might be called “activity primitives” in such spaces and places. Objects and landmarks, the selective sharing of each, and the relationships among them, will be key to successful environments for activity-centric collaboration.

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Contribution and Benefit Statement

Describes patterns of sharing in activity-centric collaboration.

Helps researchers and designers to understanding sharing issues for structured activity/task resources.