

Fitting an Activity-Centric System into an Ecology of Workplace Tools

Aruna D. Balakrishnan

HCI Institute, Carnegie Mellon University
Pittsburgh, Pennsylvania, USA
abalakri@cs.cmu.edu

Tara Matthews, Thomas P. Moran

IBM Research - Almaden
San Jose, California, USA
{tmatthe, tpmoran}@us.ibm.com

ABSTRACT

Knowledge workers expend considerable effort managing fragmentation, characterized by constant switching among digital artifacts, when executing work activities. Activity-centric computing (ACC) systems attempt to address this problem by organizing activity-related artifacts together. But are ACC systems effective at reducing fragmentation? In this paper, we present a two-part study of workers using Lotus Activities, an ACC system deployed for over two years in a large company. First, we surveyed workers to understand the ecology of workplace tools they use for various tasks. Second, we interviewed 22 Lotus Activities users to investigate how this ACC tool fits amongst their ecology of existing collaboration tools and affects work fragmentation. Our results indicate that Lotus Activities works in concert with certain other tools to successfully ease fragmentation for a specific type of activity. We identify design characteristics that contribute to this result.

Author Keywords

Activity-centric computing, workplace, user study, CSCW.

ACM Classification Keywords

H5.3. Group and Organization Interfaces.

General Terms

Experimentation.

INTRODUCTION

Knowledge workers expend considerable effort managing problematic “discontinuity,” characterized by “constant switching among physical and digital artifacts” (about every 3 minutes) and “higher-level activities” (about every 11.5 minutes) [4]. Gonzalez and Mark call these two forms of discontinuity “fragmentation” [4]. The former problem is the fragmentation of an activity across multiple artifacts, which we call *artifact fragmentation*, and the latter problem is the fragmentation of activity execution by switches to other activities, which we call *activity fragmentation*. Prior

work claims that activity-centric computing (ACC) systems are a potential solution to both kinds of fragmentation, since they keep digital artifacts for an activity in one place, providing a stable project context [1,2,5,7], but has rarely provided real evidence to support this claim. In real work environments, ACC systems exist in a rich ecology of collaboration tools (email, wikis, shared repositories, etc.)—so many choices may lead to artifact fragmentation. We conduct a study to learn when workers will choose a widely-deployed ACC system over other tools, and whether it helps workers deal with artifact fragmentation.

An *activity* is a set of interrelated actions and events around a common goal, involving a particular group of people, set of resources, and time framework [2,4]. ACC systems encourage users to structure individual and collaborative work around the construct of an activity by supporting a diverse set of actions within a single tool and enabling the consolidation of related people, artifacts, resources, and actions [1,2,5,8,12].

Prior work has provided initial validation for ACC with studies of ACC prototypes used by recruited users for up to a few months [e.g., 1,5,8]. Such studies exploring short-term use do not help us understand the use of ACC systems in real work environments [6]. In contrast, we studied Lotus Activities (www.ibm.com/software/lotus/products/connections/activities), which has been deployed for over two years in a large, global company and used voluntarily by nearly 30,000 workers in real work environments. Whereas a previous study of this system explored how highly active users defined and structured their work in this system’s Activity construct [12], the focus of this research is whether and for what types of activities users will consolidate activity artifacts in an ACC system and whether this improves the user experience. Our contributions are a description of the major, general usage pattern for one ACC system and qualitative evidence that it helped reduce artifact fragmentation for this usage pattern.

Overview of Lotus Activities

The basic organizing construct in Lotus Activities is the *Activity*, which is intended to be a locus for aggregating information and resources relevant to carrying out an activity, as well as a dynamic representation of its status, members, constraints, and plans [1,8]. Creating an Activity is quick and easy, as is adding members to it. Users can add

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

CHI 2010, April 10–15, 2010, Atlanta, Georgia, USA.

Copyright 2010 ACM 978-1-60558-929-9/10/04...\$10.00.

any number of members with different access levels: “readers” can view, but not edit, information in an Activity; “authors” can post entries into an Activity and edit their own entries; and “owners” can add, edit, or delete any entry in an Activity. Both authors and owners can add new members to an Activity. Users can post various types of entries into an Activity: basic text posts, to-dos, and discussion-structured comments. Users have three ways to access Lotus Activities: via a web browser, an RSS feed, and a sidebar extension to the company’s common email client, Lotus Notes. (See www.youtube.com/watch?v=PEG8TQ3xaqM for further details on Lotus Activities.)

Throughout the rest of the paper, we use the term “activity” (lowercase a) to refer to workers’ conception of their work, as defined in prior research [4], and we use the term “Activity” (capital A) to refer to the computational construct users create in the Lotus Activities system.

METHOD

We recruited 22 Lotus Activities users with varying degrees of adoption via email. They completed a survey, helping us understand the ecology of tools they used for various group management and collaborative tasks. Next, we interviewed them about their adoption and use of this ACC tool.

Participants

We used a stratified sampling methodology to select 22 participants. We defined the usage strata of Lotus Activities’ total user base of 29,776 by membership frequency: 79% were *occasional* users (defined as a member of 1-4 Activities), 16% were *moderate* users (5-19 Activities), 3% were *heavy* users (20-49 Activities), and 1% were *committed* users (more than 50 Activities). Next, we randomly chose (via random number generator) several users from each category. Our sample included 8 occasional, 7 moderate, 5 heavy, and 2 committed users.

Participants were all employees of the same large, global company. They came from four different business units: Global Business Services (2), Research (2), Sales and Distribution (8), and Software Group (10). They represented both managers and non-managers. Most participants worked full-time in the US (15), three were in Canada, two were in Japan, and one apiece were in the UK and the Netherlands. Eight participants were female, 14 were male. Their age range was 22-59, with a median age of approximately 37. All names used are fictitious to maintain our participants’ anonymity. A previous study of highly active Lotus Activities users gives additional detail on the full user population and the different types of work users completed with Lotus Activities [12].

Ecology-of-Tools Survey Design

All participants were asked to fill out a brief survey prior to their interview and 19 of 22 participants did. We measured the range of tools they used and whether certain tasks were supported across more tools than others by asking participants to assess how often they use 6 different tools

for 8 specific tasks. For each tool and task combination, participants answered whether or not they used that tool to perform that particular task.

The set of tools in the survey are all commonly used by individuals at this company: Lotus Activities, Lotus Notes (email, calendar, to-do list), Lotus Notes Databases (shared repositories), wikis, instant messaging (IM), and meetings (either phone or in-person).

We gathered two categories of tasks for the survey from the Straus and McGrath task-type circumplex, a seminal task classification scheme in group support literature [11]. *Group management tasks* involve sharing materials, supporting awareness of projects, coordinating work among participants, and reusing work materials. *Collaboration tasks* involve generating ideas, solving problems, drafting documents, and making decisions.

Interview Protocol

We conducted one hour interviews with all 22 participants to focus on specific projects for which they had adopted the ACC organizational paradigm. We explored with participants whether and how organization by activity affected their ability to collect related artifacts together and how this affected their experience, since such organization is the ACC literature’s proposed solution to artifact and activity fragmentation. Interviews were recorded and transcribed. Transcriptions were coded for common themes using grounded theory [10].

RESULTS

Overall, participants felt that adopting Lotus Activities reduced their experience of artifact fragmentation in their collaborative activities. However, this did not negate the need for other tools. They still used many different tools for the same group management and collaboration tasks (see survey results in Table 1). They also used different tools within individual activities (elucidated in the interviews). We found that Lotus Activities was employed specifically for *bounded activities* – shorter-term efforts with clear endpoints. For this type of activity, Lotus Activities served as a place to aggregate artifacts *as the work progressed*. Other tools were used to support synchronous communication (IM, meetings) and to store results after the activity was complete (e.g., wikis, shared repositories). Users did not experience artifact fragmentation in using these tools, because they either did not produce large amounts of artifacts to collect, or were used for different types or during different temporal phases of activities. However, users did think that email fragmented their work, because it was more difficult to consolidate the considerable content being exchanged in email within the Activity context.

Bounded, In-Progress Collaborative Activities

A principal finding is that participants used Lotus Activities to aggregate artifacts for a specific type of activity, something that had been poorly supported by other tools such as shared repositories or email: the management of

Table 1. Percentage of participants using each tool by task type

Task Type	Lotus Activities	Email	Shared Repository	Wiki	IM	Meeting
Group Mgt.	51	64	46	26	32	43
Collaboration	36	67	29	8	49	80

bounded, collaborative projects as they were in progress (i.e., actively being carried out). This theme was discussed by ten users. By “bounded” we mean activities that have a definite goal and a shorter-term end-point. Note that activity details or end-points did not need to be clearly defined at the work’s *onset* for participants to determine whether the work was short- or long-term in nature. Thus, we saw Lotus Activities being used for activities ranging from clearly defined to ambiguous or ad hoc. Tim, a moderate user and IT specialist, describes:

[Lotus] Activities... is the most effective way when I've got a specific short-term kind of project that involves multiple people where I will use it as a place to store our documents and our communications as well as assign to-dos and track those...

Lotus Activities was used to collect artifacts needed and generated as a bounded activity was carried out. These included, to a large degree, materials for group management, as indicated by survey results (see Table 1). By aggregating artifacts, Lotus Activities helped reduce fragmentation of bounded, in-progress activities. This filled a previously unmet collaboration need, as Beverly (a Technical Sales Manager and committed user) noted: “We use it for all of these little ad hoc projects that come up. Activities really fills the gap for things we did in email...”

ACC Approach & Other Tools: Complementary or Not?

Most other collaboration tools our participants used (with the notable exception of email) did not detract from their ability to aggregate activity artifacts in Lotus Activities. We describe their complementary roles in this section.

Wikis & Shared Repositories: Long-term Work & Storage

While Lotus Activities was used for bounded projects, many users believed wikis and repositories were better for supporting work with a long-term or open-ended lifespan (11 users noted this theme for repositories, 6 noted this theme for wikis). Participants also transitioned end-products to wikis or repositories for long-term storage after using Activities during the execution phase of a project. For example, Mark, a Consultant and heavy user, said:

A wiki is for a more elaborate effort of consolidation of information that we have been creating over the course of months, whereas the Activity is just for that set of concrete tasks – let’s say one week, two weeks, three weeks – where you have to do something very specific... Once it is done, you may want to share that on the wiki.

Wikis and repositories tended to be used in conjunction with Lotus Activities either for a different temporal phase

of an activity (i.e., after completion rather than while in-progress) or for a different type of task (i.e., long-term rather than short-term work). This complementary relationship did not contribute to a fragmented experience.

IM & Meetings: Directed Communication

Synchronous communication tools were favored for tasks like brainstorming, decision making, and task delegation discussions (summarized as “collaboration tasks” in Table 1). However, their use in support of the same bounded, in-progress projects as Lotus Activities did not appear to detract from users’ ability to create a unified set of artifacts. In fact, these Lotus Activities was used in a complementary way to support synchronous collaborations, a theme mentioned by six participants, including moderate user and IT specialist Tim: “We use Activities to gather info, and decisions are made as a result of looking at that information [during a meeting].”

Email Disrupts Aggregation

While most tools examined in this study were complementary to each other and did not create a fragmented experience when used together, email detracted from users’ ability to aggregate activity-related artifacts. Seventeen out of 22 interviewees stated that one of the main reasons they turned to Activities was to replace email as the tool for driving collaborative activities. Prior work has noted that email inboxes provide a fragmented experience: discussions are split across long email threads and communications about all activities are intermixed [3]. IT specialist Kevin noted that Lotus Activities provided a less fragmented experience for his team’s collaborative projects: “Everyone is realizing that email is not an effective way to keep that cohesive stream of thought. They are starting to move to [Lotus] Activities.” A small number of teams, like Kevin’s (4 teams total), avoided email and instead included asynchronous communications about their project in their Activities (as described by IT Sales Specialist, Henry):

Activities help breed a different way that people work. If everyone else is posting things in the Activity and one guy sends me an email around, he’s not getting responded to because things are in the right place, things are getting overlooked. They tend to get the message that wow [Lotus] Activities is the place they want to be if they want to get results.

Design Characteristics Drive Tool Adoption and Use

While an ACC system can help reduce artifact fragmentation by consolidating work materials for an activity in one place, design characteristics and other available tools may affect which types of activities the ACC system is chosen to support. Our data help us understand what characteristics of Lotus Activities led to its use for bounded, in-progress projects. One major reason for this was a perception of greater shared ownership with Activities than with a repository or wiki. All participants noted feeling comfortable modifying Activities and nine stated that Activities were equally owned by all contributing members. This is unlike prior studies of shared

repositories, which found that users are hesitant to remove or edit content posted by others [9]. As Henry explained:

The group owns the Activity. We'll tend not to make everyone a manager or owner but we try to give enough rights so people can have control over the content. That is the beauty – that I can create it but I don't want to be the single owner.

Another major reason people turned to Lotus Activities for in-progress, bounded work was its lightweightsness: according to participants, Activities were much easier to create than repositories or wikis.

Two design characteristics may have contributed to perceptions of both shared ownership and lightweightsness: simple, liberal access controls and limited structure. Participants described how the lightweight design of access controls made it time-effective to create informal spaces for managing shorter-lived collaborations. Access controls in Lotus Activities are simpler and more liberal than many other shared workspace tools; in particular, all “owners” and “authors” can also *add new members* to the Activity. A committed user and IT specialist Mary described access controls in a shared repository, which led to uneven ground between the repository manager and other members, and how this contrasted with Lotus Activities:

[The main change was] I would say access. [Before], you... needed to track down the person who was the manager of the database or who had the permission to add other people at the right level. The flexibility at which an owner can just go in, create a new Activity and just start adding people. And then those people can just add other people, they don't have to go back to the owner. That's just amazing.

These lightweight access controls, in turn, encouraged Lotus Activities to be used for bounded in-progress work, as described by Beverly:

For all the ad hoc stuff, instead of having to create a [formal shared repository]... we just do it in Activities because you can easily add people, remove people, they can add more people that may be needed to work on the project.

Lotus Activities also allows limited structuring on posted content: users can add sequentially ordered entries, which can be reordered or organized into titled sections. These limited formatting and organizational options afforded just “throwing in” materials without additional effort spent on structuring them. This helped users feel more comfortable modifying others’ content, in contrast to wikis for example, which take more effort to format and organization. Occasional user and IT specialist, Donna, explains:

When other people set up wikis, they go in and edit it, I am uncomfortable doing that because I feel like I am messing with someone else's work. With Activities, people are a little bit more inclined to go in 'cuz it is more for brainstorming. But I think it is also related to structure. So in a more structured environment you feel a little bit hesitant playing with it. In an unstructured environment you may be more forthcoming to participate.

In summary, Lotus Activities was favored for in-progress, bounded work, in part due to simple, liberal access controls

and limited structure, which contributed to a sense of shared ownership and lightweightsness.

CONCLUSION

Our observations indicate that to reduce problematic artifact fragmentation, ACC systems need to create consolidated access to activity artifacts, not necessarily reduce the number of tools used. At this goal, Lotus Activities was successful for bounded, in-progress activities, though fragmentation due to email remained problematic for many teams. This result was facilitated by simple, liberal access controls and limited structure which contributed to a sense of shared ownership and lightweightsness.

ACKNOWLEDGMENTS

We thank Barton Smith and Jimmy Lin for assistance developing study materials, and Thomas Erickson and Sara Kiesler for insightful comments on drafts of this paper.

REFERENCES

1. Bardram, J., Bunde-Pedersen, J., Soegaard, M. Support for activity-based computing in a personal computing operating system. *Proc. of CHI*, 211-220, 2006.
2. Christensen, H.B., Bardram, J. Supporting Human Activities - Exploring Activity-Centered Computing. *Proc. of UbiComp*, 107-116, 2002.
3. Ducheneaut, N., Bellotti, V. E-mail as habitat: an exploration of embedded personal information management. *Interactions*, 8(5), 30-3, 2001.
4. González, V., Mark, G. Constant, constant, multi-tasking craziness: managing multiple working spheres. *Proc. of CHI*, 113-120, 2004.
5. Kaptelinin, V. UMEA: translating interaction histories into project contexts. *Proc. of CHI*, 353-360, 2003.
6. Kraut, R.E., Rice, R.E., Cool, C., Fish, R.S. Life & death of new technology: task, utility & social influences on the use of a communication medium. *Proc. of CSCW*, 13-21, 1994.
7. Moody, P., Gruen, D., Muller, M.J., Tang, J., Moran, T.P. Business activity patterns: a new model for collaborative business applications. *IBM Syst. J.*, 45, 683-694, 2006.
8. Muller, M.J., Geyer, W., Brownholtz, B., Wilcox, E., Millen, D.R. One-hundred days in an activity-centric collaboration environment based on shared objects. *Proc. of CHI*, 375-382, 2004.
9. Rader, E. Yours, mine and (not) ours: social influences on group information repositories. *Proc. of CHI*. 2095-2098, 2009.
10. Seidman, I. *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences*. Teachers College Press, New York, 1998.
11. Strauss, S.G., McGrath, J.E. Does the medium matter? The interaction of task type and technology on group performance and member reactions. *J. Applied Psych*, 79, 87-97, 1994.
12. Yarosh, S., Matthews, T., Moran, T.P., and Smith, B. What is an Activity? Appropriating an Activity-Centric System. *Proc. of INTERACT*, 582-595, 2009.