

# Understanding Memory Triggers for Task Tracking

A.J. Bernheim Brush, Brian R. Meyers, Desney S. Tan, Mary Czerwinski

Microsoft Research

One Microsoft Way, Redmond, WA USA

{ajbrush, brianme, desney, marycz}@microsoft.com

## ABSTRACT

Software can now track which computer applications and documents you use. This provides us with the potential to help end-users recall past activities for tasks such as status reporting. We describe findings from field observations of eight participants writing their status reports. We observed interesting trends, including the reliance on memory triggers, which were either retrieved from explicit self-reminders, from implicit breadcrumbs left while performing their tasks or directly from memory. Participants perceived spending relatively short amounts of time composing their status reports, suggesting that any technology solution must offer dramatic improvements over current practice.

**Author Keywords:** Status reports, field study, information worker, office

**ACM Classification Keywords:** H.5.2 User Interface; user centered design

## INTRODUCTION

Technological advances have made it possible to track a user's actions while they work on a computer. We can now record the programs and documents a person uses as well as the time spent on each activity. We believe that access to this information will not only allow machines to derive valuable information for the user, but also provide useful memory triggers for personal reflection, planning and reporting. To explore these ideas, we built PersonalVibe [3], a monitoring tool that tracks and logs computer window event activity.

While PersonalVibe was immediately useful in gathering quantitative data that provided us with a better understanding of how and what users do on their computers, we wanted to explore how access to this data might be valuable to the end-user. Since past research [e.g. 5] has shown that people can have trouble accurately identifying how they have spent their time while using a computer, we felt providing end-users with the data from PersonalVibe could be

valuable in a number of ways. For example, knowing the time spent on a specific task could motivate a user to make changes in work habits such as spending less time working on email or reducing the length of IM conversations.

Given the number of people who write status reports, we decided to develop the first interface for PersonalVibe data to support users in recalling and reflecting on past work. Unfortunately, initial internal deployment revealed that the interface was not as useful in supporting status writing as we hoped. To better understand the nature of the status writing task and inform a redesign, we conducted a series of field visits to observe information workers while they wrote their status reports. In this paper, we focus on understanding how people access and compile information from various information sources as they write periodic status reports that are shared with members of their workgroup or customers. While there has been excellent research on how users manage and track their tasks and to-do lists (e.g. [1]), much less has been done to understand how users compile the data needed for status reports.

We observed several trends: 1) several of our participants explicitly recorded information during the week to trigger their memory when compiling their report, 2) status report authors use a large amount of learned or perceived social knowledge about their target audience to choose what to include in the reports, and 3) status report writing, while seen as somewhat tedious, is not actually perceived to take a large amount of time (whether it does or not), so any technology created to support the task would need to be lightweight and of obvious, immediate value to the user.

## PERSONALVIBE LOGGING TECHNOLOGY

Windows XP provides system hooks that allow the tracking of various user activities. A variety of employee monitoring software packages like Netvizer™ by EmployeeMonitoring or SureTime™ by First Guarantee utilize these hooks to allow managers to see what their employees are doing on the PC, including high level activity as well as keystrokes and mouse movements. As secondary functionality, some of these programs provide feedback to the employee to support more accurate time tracking for billing.

We developed PersonalVibe with a different goal. Rather than a tool to monitor someone else, we believed that the historical record of PC activity could be useful to individual users tracking their own time. To this end, PersonalVibe

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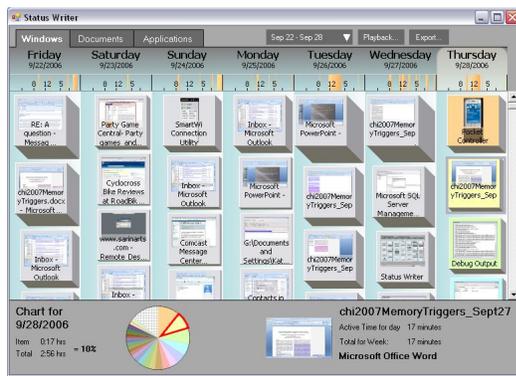


Figure 1: Interface presenting data from PersonalVibe

logs the active window, along with its size, position, application used, and, if possible, the document it has loaded. In addition, we track the keyboard and mouse activity at a high level in order to determine whether the PC is in active use or not. All information is stored in a local database to preserve the privacy of the user.

With the historical record that PersonalVibe provides, users can quickly find answers to questions like, “What documents did I work on last week?” or “How much time did I spend on this document?” In addition, the system has information about hours of use, application usage, and even window positions on the display over time. Using the data we built an interface that presented a summarized view of the activity per window (see Figure 1). We presented the data showing time spent on each item on a per day basis. Users can also filter the data either by document or application. Although we knew beforehand that this information was not labeled according to what the user perceived their tasks to be, we hoped it would be helpful in remembering the week’s activities when writing a status report.

Unfortunately, initial deployment of this interface demonstrated that many people did not find sufficient benefit from viewing the data in this manner. Some problems noted by initial users were that duration of a task was not necessarily a good proxy for the importance of including it in a status report, and that the custom application did not include enough context from other time management tools like their calendar. Because of this, many commented that the tool did not adequately summarize their work and hence did not fit into their current work practice. We decided we needed a better understanding of the techniques participants currently use when reporting on work accomplished and hence conducted a field study.

### FIELD STUDY

Our main research questions were R1) What processes and tools do people use to track what they are working on? R2) How much information on task duration do they provide? R3) How do users decide what content to include in the status reports? R4) How long do people spend tracking their work and creating status reports?

### Method

Eight people (3 females) from two different companies volunteered to be observed while writing their weekly status reports. The participants were split evenly between companies and several were in the same workgroup. This allowed us to observe the different methods employed by people involved in related jobs in similar business environments. We also chose to include both managers and individual contributors so that we could explore potential differences between these groups. (See Table 1)

Company A is a management consulting firm specializing in contract and applied research for local governments and utilities. At Company A, each participant worked in a group that included 2-3 people, so some status was verbally reported. However, due to the consulting nature of their business, each person had a weekly requirement to enter the time they spent on different projects into a time accounting system – these reports could be viewed by managers and in some cases were directly shared with them. Participants at Company A received a software gratuity.

Company B is a large software company where the authors work. These 4 participants were from 2 different groups each with 8 people in them. In these groups, the members summarize their accomplishments every week in an email to other group members. P7 and P8 are co-authors of this paper. Participants at Company B received a lunch coupon.

In the study, we observed participants writing their status reports, asked clarifying questions, and then used a checklist of questions to make sure we had covered everything of interest to our research during our observation. Each observation took between 1 and 1½ hours. In addition to answers to our questions, we identified 307 additional notes from our observations and then used affinity diagramming to categorize and tally the behaviors we encountered the most often and to identify common themes.

### Findings

#### Processes and Tools (R1)

Through our observations and affinity diagramming, we concluded that participants employed a diverse range of strategies to track their time and activities. Specifically, we saw large variance in the degree to which participants would perform explicit actions that would later remind them of their activities and the time they had spent on them. Some users would continuously track and record their work during the week, making the status report writing primarily a compilation exercise, others would wait until they had to write their status reports to search through various information sources in order to reconstruct their time.

Of our participants, P2, P3, P4, P5 and P7 seemed to adopt the approach of explicitly and continuously tracking their activities. As Table 1 shows, these participants used a variety of methods to record their work during the week. For example, P2 used a combination of digital timers and a paper notebook, P4 used an excel spreadsheet and P5 tried to edit a draft email message every day. These participants

	ID	Gender	Manager	Time to create (min. per week)	Ongoing tracking	Materials used
Company A	P1	Male	Yes	<30	No	Calendar, memory, email
	P2	Male	No	30-45	Yes	Digital timers, notepad, occasionally sent mail, calendar, if he mostly used the notepad that week
	P3	Male	Yes	15-20	Yes	Paper day timer
	P4	Female	No	90	Yes	Excel worksheet with notes, calendar and last week's report if she was not diligent about notes
Company B	P5	Female	No	30	Yes	Attempts to keep running email draft during week, calendar,
	P6	Male	Yes	15-20	No	Calendar, sent mail
	P7	Male	No	60- 85	Yes	One note file
	P8	Female	Yes	30	No	Memory, task pad, calendar, email

**Table 1. Participant information. We observed participants writing weekly status reports, except P8 who wrote a monthly group status report which including summarizing her status and that of other group members.**

then relied primarily on the previously recorded information as *triggers* when compiling the status report, supplementing these with other data sources as necessary.

It is important to realize that even if the participants tried to use the continuous approach they sometimes experienced breakdowns where they forget to record things, and had go back into their digital store to reconstruct work done. For example, P4 said “if I haven't gone in every day and put in my hours and kind of written what I did that day then it [reporting] will take longer because I have to go back through my calendar to figure out”

In contrast, participants P1, P6, and P8 did not seem to explicitly perform any additional actions during the week to record what they accomplished. They instead relied on a variety of materials, such as their calendar and email, when they sat down to compile their status reports to trigger memories of what they had done (see Table 1). However, P1 and P8 also explicitly described relying on their memory to remember past work in addition to the other tools.

There exists a continuum on various axes (explicit continuous tracking vs. not, and digital vs. human memory, etc.) that is useful for structuring thought in this space. Technologies to support people in time tracking and creating status reports must support the continuum of approaches utilized.

#### *Triggers vs. Detailed Memories (R1)*

We observed participants using both digital and physical artifacts, as well as their own memory, in order to recall and reconstruct activities. In our analysis, we found it useful to think about two types of information: triggers and details. Triggers provide just enough information for the participant to remember having done something, whereas details allow them to fully understand the extent of the activity.

One interesting trend we saw when participants relied on digital materials, such as the electronic calendar, was that they were frequently looking for triggers to remind them of things rather than for complete details. As P5 said in reference to how she uses her calendar, “I need triggers to help me remember what I did.” Given the right trigger, most

participants were able to recreate useful details from memory, similar to the recall seen using images collected by the SenseCam system [2]. For example, P3 needed only to review short project name entries in his day timer to recall what he had been doing. However, we did observe a few times where people remembered a meeting or email interaction, but needed to rely on some digital artifact to supply details such as who attended the meeting.

This suggests that as we design interfaces to show historical usage data, selecting and showing items that can serve as memory triggers will be far more important and useful than inundating the user with all the available details. It would appear that people need help mainly with prospective memory, or with remembering to remember, rather with the recalling the full details of the activities themselves [4]. Obviously, it would still be useful for the system to provide easy access to the details when required.

#### *Level of Detail in Time Tracking (R2)*

We sought to understand how carefully people currently tracked the time they spent on tasks and how carefully they might want to track the time. The importance of careful time accounting is, of course, directly dependant on the job roles of our participants. We saw that participants at Company B did not report any duration information in their status reports nor typically track duration of tasks. They did not feel this information was of interest to co-workers.

As a consulting firm, we anticipated that Company A might be more concerned about task duration. They did, in fact, report their time more carefully, using time tracking software which allocated time in 15 minute intervals. However, only P2, who made use of digital timers, tracked his time this closely. P4 rounded to the quarter hour while P1 and P4 rounded to the half hour. Again, the context is very important; during the interviews we learned that although Company A does report hours worked to clients, their contracts are typically of a fixed price nature and thus additional hours did not generate more money. Companies that bill based on time spent would no doubt have different time tracking needs. We believe that because the system cannot tell a priori what level of detail a user may need, it needs to

be flexible in allowing the user to interact and scope the level of detail they care about.

#### *Content Chosen Based on Audience (R3)*

In order to determine how software could detect and present effective memory triggers, we explored what people cared about when writing their status reports. We saw a surprising amount of thought put into what the person had been working on that would be of most interest to the audience reading the report. For example, P7 described that he, “put service activities at the bottom [of report], because nobody cares about that.” P6 reported that he explicitly thought about “what do I want to share with others.” Particularly at Company B, status reports were viewed as a means to communicate with others in their workgroup.

This suggests that even though we may be able to summarize low level events into memory triggers, we will be unlikely to have success in building tools that attempt to automate the entire status writing and time tracking process. Time tracking is a highly personal activity, particular to the individual and their workgroup. Therefore even if a tool could optimally remind a user of the tasks they had worked on, we believe that there will remain an important manual step in which the user crafts the final outcome.

#### *Time Spent on Status Writing (R4)*

Finally, we set out to explore how much time users perceived spending on time tracking and status report writing. We wanted to know if it would be sufficient to make current processes smoother and more efficient, or if a new system would have to provide drastically new functionality.

As Table 1 shows, times reported for status writing ranged from 15 minutes per week to 15 minutes per day with 30 minutes on Friday to compile (90 minutes total). These are the participants’ self-reports, and previous research [5] suggests that these numbers could be inaccurate. In fact, since P8 was running our logging software we found that although she reported spending 10-15 minutes, the task had actually taken 30 minutes. However, the fact that the participants perceive the status writing task as being a relatively small fraction of their time means any tools designed to help them will have a high barrier for adoption. The tool must provide substantial value or require very little increased time to use.

### **DESIGN IMPLICATIONS**

The field study suggests a number of design implications for reworking our interface and others with similar goals.

**Show triggers with details on demand:** Recognize that time spent on an activity is not the best trigger. We will now experiment with a variety of digital triggers (e.g., date, people you have instant messaged, document titles, etc.).

**Keep human in loop:** Recognize that the tool does not need to and should not attempt to automatically generate

the status report, but that it should facilitate the human trying to identify the most useful information to share.

**Augment tools that people already use:** Most users start the report writing by consulting their email and calendaring tools. Our tools should be designed to work with these tools and augment the data people derive from other sources.

**Support ongoing tracking in a lightweight manner:** Many people engage in the ongoing generation of memory triggers while they work. Our tool should provide a lightweight means for them to create a digital trigger without interrupting the natural workflow.

### **CONCLUSION**

We reported on an *in situ* study of how people assemble and write their status reports. Our goal was to observe real world patterns of practice in this area, with an eye toward technologies that we are developing to assist users in this task. While we observed only a small number of users, we did identify some interesting trends that can contribute to designs that support information workers in performing this task. We are realistic about the challenges of providing digital triggers. For example, many forms of communication, e.g., phone calls, office visits, are simply missing from the digital record. However, we are optimistic about the potential to provide triggers mined from personal logging data that can help people more easily and perhaps more accurately remember what they have accomplished.

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