Identifying Usability Issues in Personal Calendar Tools

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Abstract. This study investigates what types of personal calendar tools people are currently using to manage their time and what usability issues they may experience with their calendar tools. Two sets of in-depth interviews and field observations were designed and carried out at a US university with twenty busy knowledge workers. The preliminary study results indicate that users who used a mixture of mobile and desktop calendar tools reported much higher perceived satisfaction and effectiveness than those who relied on single electronic tools or paper calendars. Furthermore, a number of usability issues are identified and used to propose new features, which can be beneficial to the design of more intelligent electronic calendar systems. Thus, this research not only attempts to understand the current technology-based time management strategies, but to apply this understanding to the development and testing of better calendar tools to more effectively support users' time management tasks.

Keywords: Human-Computer Interaction, Time, Calendar, Time Management Systems, Mobile Calendars, Mobile Computing, Usability.

1 Introduction

Nowadays people are faced with increasingly complex scheduling demands and multiple deadlines, which dominate a large percentage of their time. People are constantly being called to meetings with management, colleagues and clients at work and also need to coordinate their personal and family endeavors. Secretaries have trouble scheduling meetings with busy and diverse attendees. For people who take on multiple job roles, it becomes extremely difficult to manage their time. Therefore, scheduling ends up being a complex task with good time management skills being a critical factor for a successful professional life.

To manage time, calendar tools have served as a very valuable aid in people's professional lives [1]. In recent years, more and more personal mobile tools provide calendar functions, such as the iPhone, Blackberry, PDA and so on. However, due to the complicated nature of individual time management behavior, individual time management and the calendar tools are under-researched. Many variables impact an individual's time management behavior, such as people's roles, gender, social classes, education background and even biological clock systems. From the existing literature,

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little research focused on investigating what types of time management tools people use in the current mobile computing society. It is also not clear how users experienced technical difficulties with their personal calendar tools. Can better information technology be built to help people more effectively manage their time resources? Therefore, the goal of this study is to investigate these research questions.

This is done by first gathering information on the current time management technologies that people use, on the strategies they employ to manage their time and on the problems they encounter in carrying out time management tasks with existing tools. The information collected is used to design a new calendar tool that can be run on both mobile devices and on desktop computers.

The rest of this paper presents a rationale on why developing better time management tools is important. A survey of research has been conducted on time management and calendars to serve as the theoretical foundation for this study. Following a description of two in-depth semi-structured interviews and field observations that were carried out with twenty users, this paper then briefly reports the study findings on the types of calendar tools and usability issues that users experienced. Furthermore, it proposes additional new features for a more intelligent calendar system. Lastly, the study limitations, expected contributions and future research directions are discussed.

2 Theoretical Foundation

Time management is an important task for professionals to succeed in today's competitive world. Most people's time management is achieved by interacting with their schedules through their personal calendar tools. As time artifacts (e.g., clocks, calendars) were created, it became possible for people to measure, categorize and manage their invisible time [2]. Time management represents your own rhythm of time, total available time, and in particular, time allocation [3, 4]. As Arndt et al [4] mentioned, "One of the basic social needs of man is to organize this rhythm to solve the regular alternation between work, play and rest" (p. 4). Or, in more details, the allocation of time presents people's perceived freedom of timing and performing three major activity taxonomies: career-oriented, home-oriented, and leisure activities [4]. Thus, how people allocate their time demonstrates how people manage their time. In practice, time management is defined to be "about identifying what's important to you and giving those activities a place in your schedule based on your unique personality needs and goals" [5, p. 12]. Hence, people's scheduling behavior reflects their time management approaches.

Because of increasingly complex schedules, people heavily rely on their calendar tools, for example, to effectively manage various projects, especially for the "follow-the-sun" projects that are dispersed in many different time zones, coordinating project time with multiple global teams becomes very challenging. Wu and Tremaine [6] found that professionals now prefer electronic time management tools because of key features (e.g., search, visualization, sharing etc.) that make them more efficient to use. Palen [7] found that organizational characteristics and work patterns impact the use of groupware calendars and individual time patterns.

The majority of existing prior calendar studies [8, 9, 10, 11, 12, 13, 14, 15] focus on the collaborative calendar user interface design and usability issues. An innovative interface technique called fisheye visualization was implemented in PDAs to overcome the small interface constrains by enlarging focused content in the center and shrinking other contents to the boundaries [16]. A transparency technique [8] was designed and implemented in a hospital scheduling system to better view temporal conflicts for smooth temporal coordination among hospital professionals.

A theory-driven study [15] was conducted by interviewing twenty staff members from the IBM T.J. Watson Research Center. This research found that although a computerized group calendar system was available, people still used a mix of calendars, primarily relying on paper-based calendars.

Another study was conducted by Egger and Wagner [11]. This study focused on time-management as a cooperative task for scheduling surgery in a hospital. Semi-structured interviews and observation were used to collect data on the hospital staff's planning practices and perceived temporal problems. Based on this analysis of the complexity of the surgery scheduling in a large hospital, possibilities of using computer support for strengthening the sharing of information and resources as well as providing participation in decision-making were built into a time management prototype called an "Operation Book." A major conclusion from the study is that cooperation can be supported by a system, but cannot be enforced.

Palen [7] studied the use of collaborative calendar systems with 40 office-workers in a large computer company. She reported that users kept additional individual calendars and that they used both systems for such tasks as scheduling, tracking, reminding, note recording/archiving and retrieval/recall. A key difference between this study and hers is its focus on individual time management rather than collaborative time management.

A similar time management tool study was carried out in a Computer Science department of a British university [9]. They borrowed most interview questions from Palen [7]'s study and interviewed sixteen staff members, who used a public time management tool called "Meeting Maker." This research reported how people used a suite of tools to support their personal and interpersonal time management. These tools included paper, electronic devices and other media. In particular, people expect more seamless integration between time management tools.

A relevant study focusing on personal and private calendar interfaces [17] indicates that users still prefer paper calendars although they have access to PDAs and desktop interfaces. This research provides an interesting design insight to incorporate users' emotional expressions (e.g., diaries and personal relations) to the digital calendar design.

After investigating 44 families' calendaring routines in both America and Canada, Neustaedter et al. [18] reported their findings on how a typology of calendars containing family activities were used by three different types of families – *monocentric, pericentric,* and *polycentric* - to plan and coordinate their everyday family activities. This study outlines some guidelines to further enhance the design of digital family calendars and believes that the digital family calendar tools should be designed to fit within the existing families routines.

More recently, another research [19] on the shared online calendar in the modern office environment shows that the representation of real events in calendars can be significantly improved through data fusion with incorporating social network and location data. Through conducting a field study, the performance of online calendar was significantly improved – the number of false events went from 204 using the calendar alone to fewer than 32 using the data fusion methods. The representation of genuine events was also improved when the time and location data were incorporated. The findings uncovered from this research enable the development of new applications or improvements to existing applications. When privacy and security issues become a concern, users' sensitive information has to be carefully managed. Lee et al. [20]'s study proposes a useful authentication scheme for session initiation protocol (SIP) that does not need the password table to control the Internet communication.

The two key differences between this study and other prior calendar studies are: (1) this study focuses on investigating individual time management behavior and usability issues of personal calendar tools in the current mobile society; however, the purpose for most of prior calendar research was to collect system requirements for the early generation of collaborative calendar tools; (2) this study provides up-to-date knowledge of the users' needs to manage their time with the cutting-edge mobile devices, such as the iPhone, Blackberry etc., while the majority of prior studies were accomplished when the paper-based calendars were still pervasive and some recent studies are concerned with incorporating more contextual factors to the design of digital calendars. Therefore, it is necessary to conduct this research in order to understand the current users' needs to manage their time with personal calendar tools.

3 A Description of Field Study

Two sets of semi-structured interviews were designed and conducted with twenty busy knowledge workers in a US university. Some field observations were also carried out to gain insights on how individual users dealt with their daily tasks and managed their interruptions in their offices. The roles of the study participants ranged from receptionist, faculty, administrators and PhD students. In average, they worked about 45 hours/week. This qualitative study took about six months to complete.

With the participants' consent, all interviews were audio-recorded and transcribed by two researchers. The length of the transcripts has over 300 pages, which were segmented to small units that can be coded according to the research questions. Cohen's Kappa coefficient analysis [21] was performed to measure inter-coder reliability, which reached at a satisfying level (>85%).

The first set of interviews focused on examining types of calendar tools people are using and their short-term time management strategies (those involving the current day's scheduling and temporal coordination activities) and the second set of interviews focused on understanding their long-term time management strategies (those involving weekly, monthly and yearly scheduling and long-term time management plans). When the short-term time management interviews were conducted, each interviewee showed the interviewer the schedules recorded in their electronic calendar tools (e.g. iPhone, Desktop Outlook, Google online calendar etc.).

Using the interviewees' personal schedules, they were asked to explain how and why they scheduled and allocated time on specific meetings, events or other items found in their calendars or scheduled for the coming week. Each interviewee was interviewed somewhat differently because of their different personal daily schedules.

Regarding the calendar tools, the following interview questions were used to ask individual participants:

1. What types of time management tools do you use?
2. How do you do your time management with these tools?
3. What are the problems you have using with these tools?
4. How would you evaluate your satisfaction of doing your time management on your tools?
5. How effective would you rate your time management tools for organizing your time?
6. Why did you choose the tools you are using?

Because each individual interviewee worked on various schedules for their daily work, the following interview questions were used as a guide to gather their short-term time management strategies:

1. What are the biggest time wastes in your daily work?
2. Does this daily work mirror most of your ordinary life?
3. Can you please tell me how you get rid of these time wastes?
4. When do you feel you are losing control for your time management? If yes, please indicate some situation.
5. After viewing your time management planned and completed tasks, are you going to change your time management strategies? How?

Individual long-term time management strategies were asked in the second set of interviews which took place a month later. The interview questions used to gather information on long-term time management strategies are as follows:

1. When you have too many things to do, what kind of time management strategies do you use to get your work done on time?
2. When you have important deadlines, how do you usually handle your family demands?
3. When you have too many meetings, how do you deal with more important work?
4. Do you feel you lose control of your time management? If yes, Why? If not, why not?
5. Do you usually participate in any social events? If yes, why? If not, why not?

4 Preliminary Study Findings

This section briefly reports the findings from the above described qualitative study. The interview data were coded and further analyzed. From the first set of semi-structured

interviews, a variety of tools, patterns, and strategies of time management were identified. Seventy-five percent of the participants used electronic tools and only twenty-five percent of them still relied on traditional paper-based calendars (most of them are seniors). More specifically, nine out of twenty people utilized a mixture of electronic time management tools, six used single electronic tools and only five participants still relied on traditional-paper based tools, e.g., one person used a wall calendar and the other four used pocket-sized paper calendars.

Table 1. Users' Perception of Calendar Tool Satisfaction and Effectiveness

Type of Calendar Tools	No. of Users	Perceived Satisfaction	Perceived Effectiveness
Paper-based Tools			
Pocket-sized	4	3.5	3.75
Wall-sized	1	5	5
Electronic Calendars			
Single Tools			
Mobile Calendar	4	3.5	3.38
Desktop Calendar	2	3	4
Mixed Tools			
Desktop+Mobile+other Calendars	9	4.33	4.39

Perceived Satisfaction: Least Satified:1:2:3:4:5:Very Satisfied
Perceived Effectiveness: Least Effective:1:2:3:4:5:Very Effective

In addition to asking respondents what they used for time management, they were also asked about their satisfaction with each time management tool. Interviewees responded to the question "How would you evaluate your satisfaction of doing your time management on your tools?" on a Likert scale ranging from (1=least satisfied) to (5=very satisfied). In addition, they were asked to give the interviewer an assessment of how effective they felt each of the tools they used was in supporting their time management needs. For the question, "How effective would you rate your time management tools for organizing your time?" users responded on a Likert scale ranging from (1=least effective) to (5=very effective). Each respondent was then asked to give the underlying reasons for their responses. Table 1 shows the types of time management usage and the summarized results from the two Likert-scale questions.

For the paper-based calendar tools, only one person, who used a wall calendar, was happy with his tool and perceived high effectiveness. The other four people who utilized pocket-sized paper calendars reported average satisfaction and perceived tool effectiveness. The following statements indicate how two interviewees who still used paper-based calendars commented their tools:

Interviewee A: *I haven't recently found anything to be better, but I am not satisfied…The main problem is…as I said some of these things are at home…There are calendar tools, and I can sit and make the second copy, but that is too much work. The tradeoff is that I just hope nobody steals it.*

Interviewee B: *One problem with paper calendar is that you cannot delete something that is probably over…But using a computer-based calendar, it is easy to erase things…and the paper calendar is really a mess in this case. I don't need to copy everything again and again in an electronic calendar.*

On the other hand, people who used a mixture of electronic tools reported much higher perceived satisfaction and effectiveness than those who relied on single electronic tools or pocket-sized paper calendars. Several reasons were given for using a mixture of tools: (1) The tools were used collaboratively so that one had to be maintained on a desktop computer; (2) The desktop tool was more convenient but the mobile device, such as a cellphone, provided scheduling information when away from the office; (3) The tools were used to maintain different schedules, one for home and one for work; (4) Private information was kept on the mobile device, which could not be kept on the public desktop calendar. For example, another two interviewees who used electronic calendar tools stated:

Interviewee C: *Yeah. You know, I use my cell phone to manage my time, which is also a computer. Outlook has a calendar. I have it in my desktop computer. They both hold the same information. My cell phone is much more convenient to use when I travel.*

Interviewee D: *I only have an electronic calendar (user only has a Blackberry)…I also use the white board on the wall as my reminder of important things.*

The users had several major complaints about their ability to effectively manage time with their personal calendar tools. Many of the user complaints with calendar tools came from inability to flexibly schedule more complicated time events with multiple people, difficulties to find right time information among the dispersed and inconsistent time resources, and inflexibility to effectively handle time conflicts between important events and coordination with multiple parties at work and at home. More detailed usability issues with personal calendar tools are listed in Table 2.

New employees also indicated that there was no explicit ways for them to learn their job time constraints/requirements, which were mostly implicit to them at the beginning, but it took them for a while to learn more about social-temporal norms at their organization. Overall, most users understood their time constraints. However, due to the reality that the current calendar tools mainly offer schedule recording functions, which cannot support more complicated time management tasks. Additional functions/features are needed to build more intelligent time management systems.

Table 2. Identified Usability Issues in Personal Calendar Tools

Usability Problems Encountered by Personal Calendar Users
• Schedules had to be constantly copied from one place to another
• Dates and times for important events conflict with dates and times for other equally important events
• Scheduling meetings was very difficult because of different time constraints of individual participants
• Scheduling events was difficult because all event associated information and activities had to be kept track of
• Schedules are often flexible but their adjustment requires information that is often not available
• Calendar tools did not support ambiguous scheduling, that is a flexible time usage that served as a reminder
• Announcements of new scheduled time usages often came too late to adjust for other time uses
• Time usage fell into categories and individuals wanted to see the categories separately
• Important dates had to be learned from experience since they were neither published in prominent places nor made known as important
• Shifting a repeating event was always difficult due to the numerous conflicts and obstacles

5 Proposed Key Features for More Intelligent Calendar Systems

Based on the usability study findings (see Table 2), new system requirements for more intelligent calendar systems are identified and developed to support the users' time management needs. The following additional features are therefore proposed to enhance the design of the current calendar systems:

- The capability for users to trivially categorize their scheduled events
- The capability for users to sort, display and download scheduled events based on category
- The capability for the system to display time usage based on category
- The capability for the system to learn scheduling patterns from its user and automatically adjust settings to match these patterns
- The capability for the system to add support documents to the schedule, such as last meeting's minutes, project milestone reports, financial statements etc.
- The capability to transfer reminders to currently available media - that is, instant messaging, a ringing cellphone or a large wall display panel
- The capability to support multiple displays of time usage and schedules depending on the display device capabilities
- The capability to flexibly handle time conflicts based on the importance and priorities of time events
- The capability to automatically combine relevant time events in a personal calendar from the existing online resources

- The capability to advise users of useful time management strategies to improve the quality of individual time management
- The capability to automatically suggest available time solutions for scheduling a meeting with multiple people
- The capability to visually display the time activities among collaborators with the different levels of privacy disclosure based on users' preferences.

The new calendar systems, to be effective, need to have the above proposed intelligent features that allow users to specify what goes where. It is also evident from the interviews that users did not feel that their calendars gave them information on how their time was used. Thus, additional summaries of time usage information were considered invaluable for the busy professionals. Another key factor that came out of the interviews was the difficulties that users found in using electronic calendar systems, either because of their user unfriendliness or due to their privacy concerns of sharing the usage with others. These issues, too, should be addressed in the redesign and implementation of the new calendar system.

6 Study Limitations, Expected Contributions and Future Research Directions

In summary, this qualitative study successfully identifies useful usability issues in personal calendar tools with twenty users, which suggest that a number of additional intelligent features and functions are needed for calendar systems to effectively support personal time management tasks.

One study limitation that should be noted is that this study does not necessarily represent an accurate distribution of the personal calendars in use by general users. The study sample was small and the interviews captured data at a point in time. The other limitation is that the study participants work in an academic institution. Although the institution setting represents a large collection of conflicting time patterns, it would be beneficial to have more diverse organizational settings to ensure the study results more generalizable. This is therefore part of the future research plan.

The value of this work is a quantitative demonstration of the existence and distribution of different types of personal calendar tools and the usability problems that users have encountered in their personal time management practices. The usability findings suggest some important missing features in the current electronic calendar systems. A second value is in recognizing that many of the time constraints that entrain our lives cannot be readily encoded in the current calendar systems indicating that the power of the computer in supporting personal time management is under-utilized.

This paper only reports the preliminary findings and further qualitative data analyses are still ongoing. More theory-based coding schema is being built to analyze the interview data. For example, in a business setting, the organizational-temporal structures including explicit (e.g., project deadlines) and implicit structures (e.g., organizational-temporal norms) may affect personal calendaring behaviors. The in-depth coding analysis could demonstrate how the external temporal structures interact with individual time experiences, how the temporal structures can be effectively

incorporated into both organizational and personal calendar systems, and how the individual time management strategies are tied with personal effective use of calendar tools. The long-term goal of this research is to develop such a design for a more intelligent calendar system that will provide users more flexibility and control to support their time management tasks, and will empower organizations to better coordinate time with their individual workers. Such proposed functionalities are expected to form new requirements for a more intelligent calendar system. Technically, it is important to improve the Internet communication protocol [20], mobile ad hoc networks [22], the design and implementation of the fast sent protocol [23] and the improvement of mobile networks reliability protocols [24] to support the efficiency of the digital calendar design in the future.

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