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PDAs as Time Management Tools: Experiences with Mobile Digital Calendars

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Abstract

This paper reports on a trial where a group of university students were given the opportunity to use high-end PDAs for their time management needs during two months. The purpose of the study was to gain insight through the fresh eyes of mostly novice users of electronic calendars; insight that could be used to propose improvements to current mobile digital calendar standard interface functionality and layout. Even though the students recognised useful and important features of mobile digital calendars, such as reminders, they were critical of the fact that the mobile digital calendars did not offer as much functionality as they had hoped for. The general sentiment was that the calendar experience did not offer enough clear benefits compared to their usual experience of using a paper-based calendar to warrant using them. Also, the participants identified shortcomings of the tool which further lessened their sense of benefit from using the PDA calendar.

1. Introduction

The calendar is the one function of personal digital assistants (PDAs) that is taken as self-evident and often uninteresting, rarely worth problematising. But how well are these tools really suited for the task? It is not clear from previous research whether they answer the users' needs for time management support and whether they are designed in an optimal way to support individual time management. These reflections feel more than justified considering the wide prevalence of these tools. The motivation for the study stemmed from these thoughts and the fact that despite the myriad of electronic time management tools available for both personal computers and PDAs, the calendar user experience regarding mobile digital calendar tools remains largely unexplored. Understanding the needs of the users and identifying problems and shortcomings in the current interfaces can aid in the future design of better mobile digital time management tools. Also, many recent studies on electronic calendars have had their main focus on the groupware functions, whereas the focus of this paper is on the individual calendar experience and the individual's needs.

Personal information management (PIM) can be defined as “the storage, organization, and retrieval of information by an individual for his/her own use” (Bergman, Boardman et al. 2004). Personal information management encompasses e.g. files, emails, contacts, bookmarks, notes, appointments etc. Calendar use can be seen as a sub-topic to personal information management. The focus of this paper is solely on the time management functions of PDAs; other functionality of PDAs is not looked into. Time management functions in the context of this paper are defined as appointment management (i.e. calendar), the to do-list and task management functions. The word *calendar* is used to refer to the calendar functions of any booklet, system, electronic device or software in which appointments are noted (Payne 1993). Time management is understood much along the same lines as by Koch and Kleinmann (2002); as a self-controlled attempt to use time in a subjectively efficient way to achieve outcomes. It could also be described as the organisation of time on an individual level, in a situation where the person has at least partial control over her own time use.

This paper reports the results from a qualitative study where fourteen advanced level university students received PDAs for their use for a two-month period. They were expected to adopt the PDA as their primary calendar for the duration of the study and to report their experiences weekly in an online diary, in addition to a pre-trial questionnaire, a mid-trial questionnaire and concluding group interviews. This study is explorative, and aims partly at producing hypotheses to be tested in future studies.

2. Previous Research

The use of mobile devices has been studied in various contexts and with focus on different applications. There is, however, a void in the research considering the usage of mobile digital calendars. Electronic calendar systems (ECS) have been studied as mainly desk-top applications in many studies, e.g. Hooff (2004), Lee (2003), and Palen (1999). Hooff tests twelve hypotheses predicting the usage of electronic calendar systems, the main four factors influencing usage being users, tasks, system and social environment. Lee, Hooff and Palen draw up some dimensions of studying ECS. Palen emphasizes the dimensions to be the individual user, the socio-organizational environment and the technology of the application itself. Lee and Hooff distinguish usage of ECS into personal usage and use as a communication device. Considering these dimensions and the scope of this paper, the social, interpersonal and communicational aspects are not present in this study and the calendar application is studied solely from the view of the individual's personal usage and the characteristics of the technology.

The usage of specifically mobile digital calendars has to the author's knowledge been studied very little. Salzman and Palen take into account the mobile component of time management in their work, drawing attention to the array of tools used for organising purposes; laptops, PDAs and phones (Salzman and Palen 2004). Geisler deals in her paper with the patterns of PDA use considering separate spheres of time in a person's life, for example private time vs. work (Geisler 2002). Geisler concludes that PDAs are better suited for managing short-term tasks and meetings than long-term project planning. Other studies touching upon mobile digital calendars are e.g. Phanse and Hackbarth's study on student desired attributes of PDAs (Phanse and Hackbarth 2003) and Prekop's study on ten knowledge workers who used PDAs for 20 weeks, with the purpose of identifying which applications they used, how, and in what contexts, as well as possible problems and issues arising from the usage and how the usage evolved during the period (Prekop 2003). Phanse and Hackbarth identify the calendar, the planner/date book and to do-lists to be among the applications that are regarded to be the most useful, both among students who own a PDA and students who do not own a PDA. Phanse and Hackbarth's study does not report on how satisfied the students are with these functions. Prekop on the other

hand reports, that the participants agreed on the utility of mobilising calendar or diary information, but nevertheless few felt that it added greatly to their overall productivity. None of the users rated it to be a “must-have” application. Starner, Snoeck et al. report on a study on primary appointment management method used when mobile (Starner, Snoeck et al. 2004). The results showed that a large proportion of those who said they use a PDA or day planner did in fact not use this tool in an actual scheduling situation. Scrap pieces of paper or their memories were among the alternative methods used to later record the appointment into their PDA or planner. Starner, Snoeck et al. hypothesise that the length of time it takes to access a scheduling method is a factor that effects how often the method is used. Another valid question is, whether not only the time it takes to access the tool, but the time and effort it takes to make an entry, is important. The general thoughts arising from both Prekop’s and Starner, Snoeck et al.’s findings are, whether the calendar tools could be improved in a way that would make it possible for them to actually improve the user’s productivity or increase the user’s overall sense of life control, and whether the interfaces and data entry methods could be improved to better support appointment entry.

Studies where students’ use of mobile devices has been studied include Waycott and Kukulska-Hulme’s study on PDAs for reading course materials (Waycott and Kukulska-Hulme 2003). The authors suggest that when evaluating a new tool for an existing activity, one should look at what possibilities and constraints the new tool offers, and determine whether the possibilities overcome the constraints. This was part of the goal of the study at hand; that the students would analyse their experiences with the mobile digital calendar and form their opinion of whether the new tools offer enough benefits over their previous calendar solutions.

How calendars are actually used and how time management is carried out in practice has been studied by for example Payne in his interview study of twenty scientists’ calendar use (Payne 1993), Kincaid, Dupont and Kay in their article on users’ calendar needs (Kincaid, Dupont et al 1985) and Kelley and Chapanis in their article on professional persons calendar-keeping and possibilities for calendar computerisation (Kelley and Chapanis 1982). Paper calendars provide a good model for the ways in which time management tools are traditionally used and give some hints as to what functions and features might be necessary also in a mobile tool. Understanding how users utilise and perceive older calendar software systems can give added insight to understanding time management practice. Therefore even older studies of calendar software use are interesting in this context, even though their technology and solutions might be outdated. The effect of calendar layout on the efficiency of calendar search has been studied by White (White 1989), more specifically the impact of displaying weeks horizontally versus vertically in a calendar. Symes criticises that most of the research attention on diaries has been on their contents rather than their form and layout (Symes 1999). The study at hand sheds some new light on form and layout in the mobile digital calendar domain.

The research questions drawn from the above review of previous research are as follows:

1. Do novice users of PDAs find that the PDA calendar answers their individual time management needs satisfactorily?
2. What are the reported main benefits related to using a mobile digital calendar?
3. What are the reported main complaints related to using a mobile digital calendar?
4. How could mobile digital calendars be improved to better support individual time management?

3. Method

The study was conducted within an advanced level course in Information Systems and the study participants were all participants on the course. A timeline over the study and main elements of it is shown in Figure 1. How the trial was to be conducted was presented to them during the second lecture of the course and during the third lecture they were asked to complete a four-part pre-questionnaire, after which they were issued the PDAs. The questionnaire was aimed to give background information on the participants. The first part of the four-part pre-questionnaire shortly outlined their previous experience using mobile technology (mobile phones and PDAs), computer use proficiency, work life status (full-time job, part-time job or full-time student), current calendar habits and demographic information. The second part of the pre-questionnaire measured the degree of polychronicity versus monochronicity exhibited by the students, measured with the three-item modified PAI (mPAI3, Polychronic Attitude Index, Kaufman-Scarborough and Lindquist 1999). In the third part of the pre-questionnaire the students were asked about their expectations regarding the PDAs. The fourth part consisted of 33 items chosen to sketch a picture of the students' time management behaviour pre-trial. The items were adapted from the Time Management Behavior scale (TMB scale) (Macan 1994), Time Management Questionnaire (Britton and Tesser 1991) and from the author's review of popular time management literature.

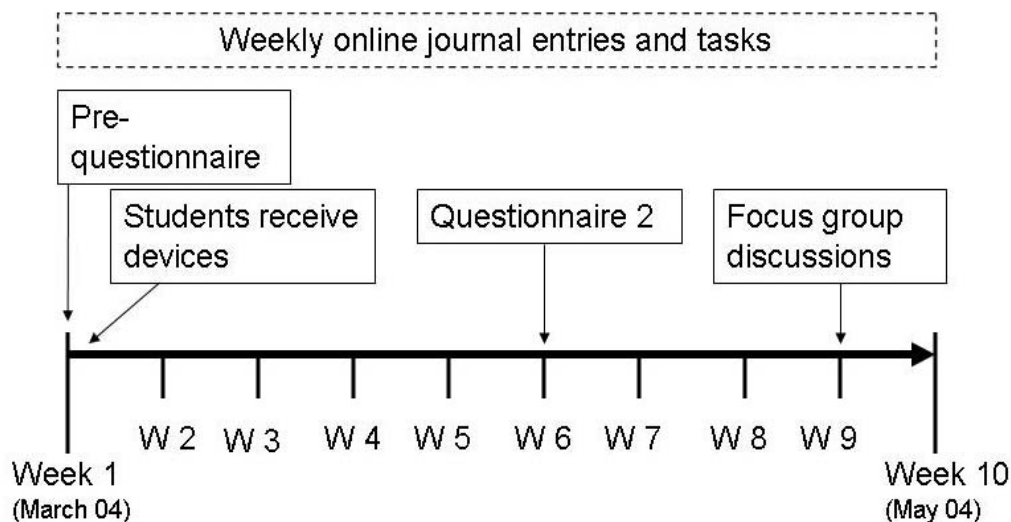


Figure 1: Trial timeline with main parts of trial

After completing the pre-questionnaire, each of the students received a new HP Ipaq h2210 PDA device. These devices were chosen for the trial because they represented a current mobile digital calendar system in an adequate way. At the time of the trial, the PDAs were among the newer ones on the market. The calendar interface on these PDAs provides the user with the usual elements available in mobile digital calendars at the moment; different temporal views (day, week, month etc.), automatic scheduling of recurring appointments, reminder functions, and task lists, etc. The students had to sign a form agreeing to return the devices in good condition with no accessories missing, but other than that they were urged to use the devices as their own for the following two months. The students did not receive any instructions on how to use the devices from the trial administrator, only the printed and CD manuals; much in the way one could imagine

the experience of a person buying a PDA. They were required to keep an online journal during the entire trial, with a minimum of one entry per week dealing with how they are using the device, what problems they encounter, how they like it etc. The journal was meant to be their personal area to collect all observations and experiences regarding using the PDA and the calendar. The journals were anonymous; each student had a code name. They could also choose whether they want their entries visible for the other students or not. They were encouraged to make continuous notes of their experiences, frustrations, pleasant surprises etc. with the calendar, in order to remember them until they have the chance to enter them into their online journals. The participants were allowed to contact the trial administrator immediately if they ran into serious trouble with their device, e.g. device break-down. An online notice board for questions and concerns was also available for their use, but was used very little.

The participants were also required to complete tasks each week following the trial administrator's instructions. The tasks varied each week, from answering a set of questions regarding their use of the devices to trying out a new calendar application for the PDA.

After six weeks another questionnaire was made available to the students online. The questionnaire consisted of questions related to the items on the pre-questionnaire, charting whether the PDA had actually met their pre-trial expectations and whether their time management behaviour had changed during the trial or not.

The trial was concluded by focus group interviews during the last week of the trial. The students attended an interview with the trial administrator and another facilitator, in groups of three or four students. During the interview they got the chance to discuss their experiences during the trial, voice opinions and hear out others. The interviews were approximately 1 – 1.5 hours in duration.

4. Background Information and Mid-Trial Opinions

4.1 Participant Backgrounds

The fourteen participants were between 21 and 26 years of age. Most of the participants were full-time students, only one was working full-time and another four part-time. All of the participants were majoring in Information Systems, Computer Science or Engineering. All of the participants owned and used a mobile phone at the beginning of the study; three of the participants owned two devices. The mobile phones were used for some time related functions; e.g. alarms were used frequently by ten of the participants, and reminders were used frequently or occasionally by most participants. The mobile phones were not as often used for keeping record of appointments; ten of the participants said that they use their mobile phone for calendar entries seldom or never. There were, however, three participants who used their mobile phones frequently for calendar notes and one who occasionally used it for this purpose. Three of the participants had some previous experience of using a PDA. Most of the participants rated their computer experience as either "professional" or "expert". Only two of the participants felt that they were "novices" in this regard, four of the participants rated themselves as "good amateurs".

4.2 User-Friendliness and Utility of PDA Calendar

Expectations regarding the user-friendliness and utility value of the mobile digital calendars were mainly sunny before the trial. All but three of the participants expected

that the PDA calendar would enable them to manage their time better than they were previously able. Six weeks into the trial, when rating whether the calendar had actually enabled them to manage their time better, the eight participants who had expected this to a high degree all reported a lower realised value. On the other hand, those two participants who expected quite low value on this point, reported a higher realised value than what they expected pre-trial. Expectations regarding the ease of use of the PDA calendars were high; only one of the participants was unsure whether it would be easy to use. The positive expectations were also realised; in the mid-trial questionnaire all of the users could agree to the statement that the calendar was easy to use.

4.3 Time Management Characteristics of Participants

Eleven of the fifteen participants reported pre-trial that they usually enter all of their appointments and engagements in their calendars. Only one of the participants stated pre-trial that he only enters the most important appointments into his calendar. Another participant said pre-trial that he uses the calendar very little. There were no major changes in these behaviours after six weeks of using the PDAs, except for one user who used his calendar very little initially, but used the PDA calendar frequently, and another user who during the trial used the calendar much less than he usually uses his regular calendar. All but one of the participants reported that they carry their regular calendar with them at all times. The PDAs the participants carried with them slightly less, but nevertheless most of the time. Before the trial started, only five of the participants could completely agree to that they have the skills they need to manage their time well and this did not change much during the trial. Most could however not agree to the statement that their studies and jobs just do not match the way they want to use their time, neither pre-trial nor mid-trial. Only three participants said that they spend time every day evaluating their schedules and three participants said that they review their activities every day. There were no major changes to this behaviour during the trial. Most of the participants preferred a week view to view their calendar data, but when asked mid-trial how they would rate the different calendar views on the PDA, the week view on the PDA received quite low marks. Consequently, the week view was used very little and the daily view was in practise the most used on the PDAs. All but two of the participants were rated as polychronic through the mPAI3. When analysing the findings from this angle, no major differences emerged between the polychronic and the monochronic respondents.

5. Results

5.1 Benefits of Using the PDA Calendar

The main benefit of using the PDA to manage their time was the possibility to set *reminders*. These were used by most of the participants. Another feature that was well-liked by the participants was the “*today screen*”, which is the first thing the user sees when powering up the device (see Figure 2). The today screen compiles information about the current day’s activities and gives the status of unfinished and urgent tasks. The participants also found it very useful, that they are possible to include *virtually unlimited information* about a meeting, task or appointment, without space limitations. The utility of this feature is however somewhat lessened by the fact that most of the participants were not sufficiently comfortable with the input methods to do lengthy notations.

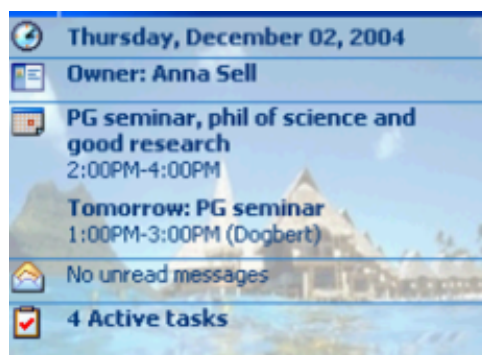


Figure 2: The “Today screen”, with the current day’s activities and summary of tasks

5.2 Main Threads during Interviews

General sentiment

Many of the participants felt that the electronic calendar was not a big improvement compared to their usual paper calendars, and that they would have expected a lot more functionality and enhancements. Those who had used desktop software such as Microsoft Outlook were also disappointed with the apparent lack of functions compared to desktop programs. For example, they would have liked to have even simple search functions incorporated into the calendar. There was also demand for possibilities for customisation according to the user’s wishes and habits, e.g. that the user could create an own kind of colour code for meetings.

The dilemma of multiple devices

Even though all but one of the participants said that they always carry their calendar with them, this was not true for the PDAs. Even though the students wished to have their calendar data with them at all times, they found that they were not comfortable with carrying the PDA at all times. They did not like the fact, that since all of them already carry a mobile phone at all times, the PDA was another device to “take care of”. The participants appreciated the PDA’s functionality, i.e. the possibility to play games, install software etc, but many of the participants would have liked everything combined to a mobile phone. Even though current mobile phones generally have smaller screens than the PDAs, four of the participants already use their mobile phones’ calendars partly for their time management and all participants used them for some time-related functions (alarms, reminders). The main complaint regarding the phones for this function was that the input possibilities are poor. The main statement was, that the PDA was “cool for other stuff”, the calendar they would rather have on the mobile phone which they carry with them at all times. This reflects another view of the students – they felt that the calendar was among the least interesting features of the PDAs, a real “everyday technology” – nothing to get excited about. This also might reflect the fact that most of the students were full-time students, i.e. their time management needs were not very demanding. A student might get well on with the more limited features of the mobile phone calendar, whereas one would think that this is rarely enough for a busy professional.

Calendar layout concerns

Certain topics related to the calendar’s layout were stated again and again by the participants, not only in the interviews but also in the participants’ trial journals. The most frequent was that the tasks on the task list were not visible in the calendar view. Tasks are most often not related to a certain day, but they might still have a specific deadline. Many are used to keeping their task in the calendar pages of their paper calendar and to viewing them simultaneously with the calendar data. Sometimes a task

should be accomplished a certain week, which means it would be useful to see it in the calendar interface during that week, however not strictly on a certain day, a certain time. Most current electronic calendar interfaces enforce a system of entering meetings with a strict Start time-End time format, whereas real life calendar entries are often more fuzzy than that.

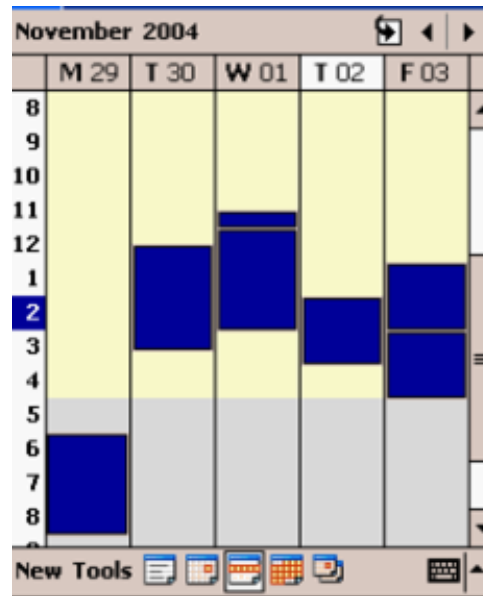


Figure 3: The calendar's week view, with dark colour denoting an appointment

Another frequent complaint related especially to this software, was that in the week view you could only see whether a time slot is occupied or free, not the appointment texts (see Figure 3). This made the week view “completely useless” according to many of the participants. They were not only interested in getting an overview of how busy a week is, i.e. the ratio of occupied slots versus free slots, but also in viewing simultaneously what sorts of activities they have during the week.

Electronically induced amnesia

An interesting and seemingly odd finding, that seems to warrant reporting, was that many of the participants complained that their own memories seemed to fail them after they started using the PDA calendars. At first this seemed only like a funny peculiarity, but as it kept coming up in the interviews it raised the researcher's interest and curiosity. Several participants reported, that they were now completely dependent on their calendars, whereas they before could remember many of their appointments without looking in their calendars. Could it really be that calendar event recall is impaired by some aspect of electronic calendaring? It seems e.g. a feasible thought that a paper calendar presents more anchors for the memory to hook onto than an electronic calendar, considering the normal variations in the hand writing and different colours, weights and sizes of pens. Another reason for this phenomenon might even be a high sense of trusting the device and delegating to it completely the task of remembering schedules, which takes away from the personal need to *remember* the calendar data. This is a question that calls for further scrutiny.

Keeping in sync

All of the participants synchronised their calendar data to a PC, some occasionally and others very systematically every day. They found synchronisation to the PC generally easy, except when attempting to synchronise over the Bluetooth connection which posed initial problems to some of the users. The PC data was only used for backup, even though it would have been a viable thought that they would use the PC for long-range planning or other activities where a larger screen would be useful. A synchronisation problem the participants encountered was, however, when they wanted to synchronise the calendar data to their mobile phones. Most of the participants never managed to do this. This was a highly wanted and needed task, much more so than PC synchronisation, since many of the students would have liked to choose the device according to the situation, e.g. take along only their mobile phone during the weekends and use the PDA during the week. The difficult or impossible synchronisation meant that this was in practise impossible.

Writing worries

Input was a problem for many users. Most coped with it after the beginning, but the majority were struggling to get started and to find an input method to their liking. Some said, that even though they would have liked to keep notes of e.g. books' and authors' names on the PDA, they usually just wrote it on a piece of paper instead, finding the input methods too slow and cumbersome even at the end of the trial. This mirrors the findings of Starner, Snoeck et al. where the authors noted that appointments are often written on a piece of paper first before transferring it to the mobile digital calendar (Starner, Snoeck et al. 2004).

The most important benefits and complaints stated by the students are summarised in Table 1.

Table 1: Summary of main benefits and complaints stated by the participants

Main benefits	Main complaints
Reminder function	Difficult synchronisation between mobile devices
Day summary ("today screen")	Dilemma of multiple devices
"Unlimited" space for entries	Calendar and task lists not connected
	Poor week view
	Slow or cumbersome input methods

6. Discussion

At the end of the trial many of the participants stated that they would like to own a PDA in the future. They were however quick to point out, that this was not because of the digital calendar, but because of the other functions on the PDA, e.g. wireless surfing, games, extra applications etc. The calendar on the PDA had failed to support them in a way that would make it indispensable or even much more attractive than a paper planner. It is clear that there is room for improvement, if the mobile digital calendar cannot compete with paper calendars. It is sad, if the words of Kincaid et al (1985) are still true today: "Our survey shows that the simple paper calendar is a tool whose power and

flexibility is matched by few, if any, of the current commercially available electronic calendars”.

The obvious improvements to be made would be to include search functionality and add some possibilities to customise views, colours and fonts. But it is worth to think about some more profound and less evident developments as well. Could we e.g. step away from the meeting management centred view of time management and work to integrate the calendar with e-mail and task lists, two functions that are for many users inseparably tied to time management (on the link of time management and e-mail, see e.g. Salzman and Palen (2004)? On the next level, it would be desirable to incorporate contact information and links to files related to the appointments, in order to create a truly useful experience for the user, with the right information easily accessible at his fingertips (see Waling and Sell (2004).

Improving possibilities for easy synchronisation is essential, not only with regard to group calendaring functions, but also considering the individual’s needs to choose a suitable device for every occasion. A PC, a laptop, a mobile phone and a PDA are suitable for different situations and a user should be able to switch between these effortlessly and without worrying about the actuality of the data on each device. As emerges from older calendar studies, many calendar users have even before today’s digital times used multiple calendars (Kelley and Chapanis 1982) (Kincaid, Dupont et al. 1985), but perhaps for different reasons than the users of digital calendars. In Kelley and Chapanis’ study some professionals used as many as six calendars at time, for reasons ranging from displaying the same information in different ways to displaying private information separately from business information. These rather simple wishes could and should be catered for in a well-designed mobile digital calendar. Regarding that the users’ wishes and needs in this regard are in all probability not that different today it should be made possible to easily display the same information in different ways and also to display different combinations of information, e.g. only private information, private and work related together, or the parents’ work calendars combined with children’s school schedules. The possibilities to display information in different ways are in practice today mostly limited to displaying the information in a day, week, month and possibly year view. Other feasible options would be to allow the user to display the information with chosen keywords highlighted, e.g. that all meetings with a certain name would be displayed more prominently, and to extract from the calendar information clusters of related appointments, and display the clusters in a graphical format to show and compare time allocation to different sorts of tasks. These tasks go beyond what is traditionally seen as “time management” or “calendar usage” and might or might not be feasible for users of digital or mobile digital calendars. It is of interest in future research to find ways in which we could apply the Braudel rule - extending the limits of possible in everyday life (Keen 2001) - to calendaring and find new functionality that the users are willing to use and which can be realised on a mobile unit despite current constraints in screen size and input technologies.

7. Conclusion

Despite very eager and optimistic start-out attitudes, the students found that the mobile digital calendar did not offer all they had hoped for. They did not feel that the electronic calendar offered them enough benefits compared to their usual paper calendars and compared to desktop software – even though mobility was a key essential element of a good calendar to the students. This seems to point in the direction that current mobile digital calendars are designed without considering the full possibilities offered by the powerful modern PDAs and without looking outside the box – essentially the same functionality is offered as in paper planners, even though the calendar experience could

be greatly enhanced and developed. The students also criticised the overview capacities offered by the digital calendar tool, the poor possibilities for synchronisation across devices and the input methods available.

The time management needs of university students are typically not as demanding as those of busy professionals and it would therefore be of interest to repeat the study with e.g. a group of managers to see whether the same problems and wishes apply for a knowledge worker sample and whether they would have different concerns than the students. It must be noted, though, that engaging professionals to whole-heartedly participate in a time-consuming study of this kind is not easy.

The relatively low number of participants means that the results can not be generalised to a larger population. This study is however the start of a larger study delving into the usage of mobile digital calendars and as such serves its purpose well. Also, the low number of participants enabled the researcher to gather a very rich set of material on which to build future studies. The study will be repeated with another group of students, again engaging fourteen participants. The author is also presently conducting a series of interviews with professionals, who are current or previous users of mobile digital calendars, in order to gain knowledge on reasons to adopt or reject this technology, as well as accounts on how well the tools are suited for the professionals' purposes.

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