

Shared Family Calendars: Promoting Symmetry and Accessibility

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ABSTRACT

We describe the design and use of a system facilitating the sharing of calendar information between remotely located, multi-generational family members. Most previous work in this area involves software enabling younger family members to monitor their parents. We have found, however, that older adults are equally if not more interested in the activities of younger family members. The major obstacle preventing them from participating in information sharing is the technology itself. Therefore, we developed a layered interface approach that offers simple interaction to older users. In our system, users can choose to enter information into a computerized calendar or write it by hand on digital paper calendars. All of the information is automatically shared among everyone in the distributed family. By making the interface more accessible to older users, we promote symmetrical sharing of information among both older and younger family members. We present our participatory design process, describe the user interface and report on a field study in 3 households.

KEYWORDS

Elderly, home, calendar, digital paper, universal usability, family technology, privacy, layered interface.

1. INTRODUCTION

There is increased interest in the development of new technologies for families in the home. Previous research revealed the importance of respecting privacy, avoiding the creation of new obligations, and offering multiple modes of communication (Hindus 1999, 2001). Our research focuses on meeting these goals by facilitating coordination and awareness between distributed family members by the sharing of calendar information. In particular, it addresses the needs of older adults for simple modes of interaction and promotes a symmetrical, open exchange of information between family members. Our experience leads us to believe that sharing of calendar information provides a useful window into the day-to-day activities of remote family members. Grown children can see if their parents' activity level is normal or not and grandparents greatly appreciate the heightened sense of awareness of their children and grandchildren's daily lives. While we acknowledge that no single tool will suit the needs of every family, we believe that the prototypes we have developed can lead to successful products that would serve the needs of distributed families trying to keep in contact.

This paper first describes the context and motivation for the design of shared family calendars, and then reviews previous work on shared calendars and on technologies for sharing information between families. A prototype for shared family calendars using digital paper is described and field study results of prototype use in three households are presented. We conclude with suggestions for improvements and possible future directions.

2. CONTEXT AND MOTIVATION

Our work was conducted as part of the *interLiving* project, a 3-year, European Union-funded effort to work with distributed, multi-generational families as design partners to create new technologies. Using cultural and design probes, interviews and workshops, the *interLiving* project identified coordination and awareness as important needs of families. In parallel, a web survey confirmed the need for coordination between the many calendars users maintain. Finally, we studied the needs of one extended family in more detail and they helped us design and test a prototype system.

2.1 The *interLiving* project

The *interLiving* project recruited 3 families in Sweden, 3 in France, and 1 in the U.S. Each family had multiple households and generations. We began with an ethnographic approach, interviewing the families in their homes to learn about their needs for and attitudes toward technology. Next, we appropriated the idea of cultural probes (Gaver and Pacenti, 1999) from design researchers, giving the families tools such as disposable cameras, diaries, and Post-It notes to gather information about their daily lives and communication habits. As cultural probes, these artifacts were meant to provide us with insight about the families and to inspire new design ideas.

After gathering information about the families and having them become more comfortable with the project, our goal was to help them become our partners in the design of new technologies. Participatory design with families had not been reported in the co-design literature. Thus, another goal was to learn how to adapt existing techniques, primarily reported in the workplace literature (Greenbaum and Kyng, 1991) and research with children (Druin, 2002), and to develop new methods that would work with multi-generational families. We conducted workshops with individual households, entire families, and multiple families using low-tech prototyping exercises to get the families comfortable with the idea of designing things. We discovered that family dynamics plays an important role in these workshops, and we learned that occasionally separating families by gender or age was effective in enabling everyone's voice to be heard.

One of our key challenges was to develop new participatory design strategies in which family members could actively participate in the design of new technology. We did not expect the family members to become designers, but we did want them to be active in the design process. To achieve this goal, we introduced the concept of a 'technology probe' (Hutchinson et al. 2003), which combines the social science goal of collecting data about the use of the technology in a real-world setting, the engineering goal of field testing the technology, and the design goal of inspiring users (and designers) to think of new kinds of technology.

We installed each technology probe into the families' homes and observed them use it over a period of time. The probes were instrumented to capture two types of data: how the probe was used and details about relationships within the family. We developed and installed two technology probes: the MessageProbe and the VideoProbe. Each was designed to gather data about communication patterns while inspiring the family to think about new ways of communicating.

The MessageProbe was a simple application that enabled members of a distributed family to communicate using digital Post-It notes. It functioned both synchronously, with two or more family members writing from different locations at the same time, and asynchronously, with family members checking it periodically for new messages. The probes were connected only to a small set of family members, removing the need for complicated setup and remembering names or addresses. There was no need to use the mouse or keyboard – just a writable LCD tablet and pen (Figure 1). The MessageProbe was deployed in the three households of our U.S. family design partners and in two households of our Swedish family design partners. In the U.S, the probes were used primarily to write notes updating

status, news, feelings, and coordination. In particular, the probe helped reveal that coordination between households was an important issue. In contrast to the U.S. family, the Swedish messages were more playful, used mostly by two sisters to write fun notes to each other.

The VideoProbe provided a simple method of sharing impromptu images among family members living in different households. We used a video camera that takes a snapshot when it becomes steady for approximately three seconds. The images were collected, stored, and made available to anyone else in the network. Family members could browse the images with a remote control. Images faded over time and eventually disappeared, to encourage families to create new ones. The VideoProbe was deployed in four households of two French family design partners – two sisters from one family and two brothers from another family. Like the MessageProbe, the families used it in a playful way, to send funny pictures, and for communication and coordination purposes - e.g. taking a picture of a hand-written message.

The probes served as a concrete tool that the families could use to gauge how well their needs as co-located and distributed users were being met by current technologies. Through our interviews, workshops and the technology probe deployments, we identified that one of the most prominent needs among these families across all cultures and ages was coordinating between and within households.

Families need to coordinate everything from who picks children up from school and where to meet after work, to scheduling surprise parties or vacations. The dizzying array of new technologies available to help families accomplish these tasks, from cell phones and PDAs to Internet calendars, seems only to have added to the existing confusion of paper calendars, Post-It notes, and answering machines. Frequently, problems arise because the necessary information isn't available in the right place or at the right time – a PDA isn't synchronized with the home calendar and someone misses an appointment; the soccer schedule is at home when the coordinating parent is at work; the cell phone of the person that is picking someone up is turned off or out of power.

To explore these issues more thoroughly, we held more workshops with our family design partners to brainstorm about coordination needs. Across all three cultures, we saw a common desire for better ways to keep track of the multiple people and events going on between and within the various family households (Figures 2, 3, and 4). Whether it was a display of multiple people's calendars embedded in the refrigerator or a small piece of jewelry that pinched or blew air as a reminder or message, our design partners were full of creative and practical ideas for improving family coordination. We saw a continuum of devices, from unobtrusive objects to support lightweight awareness, to full-blown calendaring solutions accessible from cell phones, PDAs, refrigerators, and watches. People were located along this continuum depending on the closeness of their relationships and their practical needs for coordination. Relying on someone to pick up your children might require close coordination, while letting your significant other know you are thinking about them might just require a small bit of awareness.

2.2 Web survey

The early paper prototypes designed during the family workshops were helpful in eliciting ideas about how and why existing calendaring events might be shared electronically, and how they might be used for coordination activities. To augment our findings, we designed a survey (Hutchinson et al., 2002) to gather more information about not only how people currently do their calendaring (what they record, who they share with, etc.) but also how they handle uncertain or fuzzy calendar information. We sent it to our friends, family members, and colleagues with a request for them to forward it on to their friends and colleagues. We realized that this "chain mail" approach would probably yield responses from a

population biased towards people demographically similar to ourselves – upper middle class and technologically savvy – but we knew that this would be the initial target audience for our application.

Over approximately 2 months (end of July to beginning of September, 2002), we received over 400 responses to the survey. Due to the “chain-mail” format of the survey, we can’t be sure what percentage of recipients this represents. We are also aware that some of our results may be biased because individuals from the same family responded to the survey. Their individual calendaring habits, preferences, and problems are distinct, but their family calendaring issues (e.g. who maintains the family calendar) could be similar. Many of our respondents likely came from the HCI community as the mailing went out to our large lab mailing list. Still, we gathered much valuable information.

Demographics: Out of 401 respondents, we had near parity between men and women (49% vs. 51%). By age, we had about 30% each between 18 and 30, 31 and 45, and 46 and 60, but only 5% over 60. Fortunately, some of our family design partners are grandparents. So, we do have some representation of the needs of this demographic. More than half of the respondents (57%) were married, while about a third (35%) were single, and the remainder widowed or divorced. 60% of the respondents lived in households with more than one person, but only 28% had children living with them. We would have liked to have had more respondents with children, since we believe that they add numerous scheduling issues due to their many activities, and their need for adult supervision and transportation. However, our family design partners include children, so we do cover this demographic that way. Finally, as expected, the bulk of respondents (70%) use a computer at least 30 hours a week.

Calendar Usage: Only 17% of respondents use just one calendar to record information. Given the heavy percentage of computer users, it is not surprising that many people use computers and PDAs for recording and gathering information, but paper-based calendars are also heavily utilized. Personal and work appointments and events are the most recorded items.

Calendar Sharing: The majority of calendar sharing takes place between people in the same household, or with work colleagues. These are also the people that respondents most wanted to share with in the future.

Calendar Problems: The following were the most common problems cited (at least 20 people mentioned them), in order from most to least frequent:

- Too many calendars to maintain, synchronize, and/or duplicate information on
- Unable to access from a different location
- Paper or electronic spaces are too small to write in
- Compatibility issues with other software

Uncertain Events: The following were the most common ways of handling uncertain or tentative events (at least 50 people mentioned them), in order from most to least frequent:

- To do lists/notes/Post-It notes
- Make item visually distinct, using a question mark, pencil, or different color/font
- Guess day/time and manually or automatically move as necessary

At least 20 people also mentioned the following approaches to handling uncertain events:

- Don't record it
- Record it somewhere else on the calendar, like a margin, evening, or Sunday

- Mark it with a tentative, free, or low priority label
- Set a reminder or alarm

Synchronization and Duplication: Out of 318 people who answered the question, only 53 reported they explicitly do not synchronize or duplicate information between calendars.

Maintenance of Family Calendar Information: Of the 270 people with at least 2 members in their household who answered this question:

- 119 have a single person who mostly maintains the family calendar information
- 151 have more than one person do this
- More than 90% of the "single maintainers" were women

In summary, the web survey revealed a lot of interesting information about how people use their calendars. In particular, most maintain multiple calendars. In fact, many calendar users complain that they have too many calendars to synchronize and are unable to access their calendar data from different locations. This led us to believe that a shared calendar interface would be particularly useful. Since most calendar sharing takes place between people in the same household, it made sense to implement a family design. We hoped that this design would even promote inter-household communication, which seemed to be lacking.

3. OUR FAMILY DESIGN PARTNERS

Based on the information gathered from our family design partners and our survey, we decided to work on developing a shared calendar prototype. The U.S. family worked more closely with us on this while other families worked with our European partners on other prototypes. The U.S. family had already worked on the MessageProbe with us so we first describe that family and then summarize the results of the MessageProbe testing relevant to the shared calendar prototype design. Next we summarize the interviews conducted in the family regarding their calendaring habits and their feedback to early paper prototypes of the shared calendars.

3.1 The U.S. family

The family consists of three households. The Junior family consists of two parents and two children between the age of 10 and 13. Both parents work outside of the home and the children have a very busy schedule of school and non-school activities including early morning swim practice, music lessons, theater or dance practice, rehearsals and concerts, interspersed with occasional school-related events such as fund-raising or test preparation, as well as medical appointments and social activities. The parents also organize car-pooling to school and volunteer to help in many of their children's activities. They have a computer setup in the kitchen-family room. It is always on and heavily used. The father carries a cellular phone at all times.

The two sets of grandparents constitute the other two households. Both live close to the Junior family. They are in regular contact by telephone with their children (almost daily) and visit often. They know that they can contact the Junior family father at anytime on his cell phone and use that mode of communication regularly.

The Paternal grandparents lived about 10 minutes away from the Junior family but moved during the project to be within walking distance of their son's house. They had never used or owned a computer until we installed the MessageProbe in their house. With time, they became more comfortable with the

computer and bought their own (with the help of their son). Even though she was the most reluctant to use the computer and participate in this experiment at its beginning, the main user is the grandmother. She enjoys playing solitaire and can use the basic functions of AOL email to communicate with friends. The grandfather uses the Internet to check the stock market every day. However, using the computer remains a formidable challenge that can not be sustained without regular assistance from family members or friends. They can perform a few simple tasks using “recipes” provided by others, but any unexpected behavior of the computer results in great confusion, sometimes a request for help, but usually abandonment. The computer is appreciated when working properly but rapidly ignored when something goes wrong. Using regular tools such as Microsoft Word is a formidable challenge and the cause of many torments and snafus. Rebooting the computer is a rare event that they never perform alone.

The Maternal grandparents live about 15 minutes away from their daughter’s house. They have had their own computer for many years. The grandfather is comfortable with computer technology, having used computers regularly for work before retirement. He is a regular email user, and can comfortably help us “debug” problems over the phone when they occur. He has a strong - often well founded - skepticism about computer technology and its reliability, and strong concerns about security so this family chose not to use their existing computer but instead has one on loan from us in their living room. The grandmother has not shown much interest in using the computer herself, but was supportive of the experiment from the beginning.

3.2 Lessons learned from the family during the early use of the MessageProbe

Three relevant results came from the U.S. family experience using the MessageProbe software: 1) the desire to have more awareness between remote households, 2) the desire to improve the coordinating of events such as arranging childcare arrangements or choosing a time to visit, and 3) the desire to have more reliable hardware and software. The first issue confirmed that the CSCW literature advocating the support of remote awareness in workplace groupware applications carries over to families as well (Olson and Olson, 1997). Users in all the households wrote a number of notes wondering if another party was “there” to chat, and used the board to play synchronous games like tic-tac-toe or connect the dots (Figure 5). This need for awareness carried over to the second issue of trying to coordinate between the different households. Our family partners tried to use the board to coordinate meetings and pickups for childcare. They found this task difficult because often the requestor wasn’t sure of the other party’s schedule and if they would even see the note in time. The most obvious lesson learned was the need for more reliable technology. We provided the households with high-speed Internet access, but it frequently didn’t work. The MessageProbe software or the server at the University of Maryland supporting it sometimes crashed. When the software crashed, the grandparents had to rely on the Junior family to help them, adding an extra burden on these relatives. In another case, a family went away and when they came back, had forgotten how to use the interface.

3.3 Interviews about calendar information

After we made the decision to pursue the design of shared calendars, we conducted a new round of interviews in the three households aimed at understanding how calendar information was maintained and communicated between family members. After the first interviews, we sketched paper mockups (Figure 6) of a shared calendar and collected feedback and suggestions from the families.

The busy calendar of the Junior family is managed using a computer setup in the most used room in the house: the large kitchen where most meals are taken (Figure 7). For more than a year before we started working with them, the Junior family had been using the Microsoft Outlook calendar program to record

appointments and set reminders for the family. The parents usually enter events in the calendar but all four members of the family consult the calendar several times a day. They are pretty happy with the system, but don't have a way of checking or managing the calendar when they are outside of the house. For this household, a shared electronic calendar would therefore be an easy transition, but they might also benefit from portable devices.

In looking at the paper prototype we created, the Junior family members thought it would be useful to be able to put events on someone else's calendar, so long as it was clear whom they were coming from and it didn't imply any kind of commitment on the recipient's part. They liked the idea of keeping the grandparents in the loop with what was going on in their house, especially since they have so many activities and the grandparents sometimes have difficulty keeping track of them all. We discussed the different ways you could use the calendar: to enter traditional precisely timed events (e.g. dentist at 9am") or for fuzzy events (e.g. "shopping today"), reminders, tasks/to-do lists, and notifications. We discussed how most of those things could be done in Outlook, but not always very easily. For example in Outlook, tasks are separated from calendar entries, and fuzzy times are hard to show. Notifiers (e.g. I've gone to the gym) could be done with separate electronic "sticky" notes. But, all these features are complex to work with and are not well integrated. All agreed that it would be too difficult to use for the grandparents.

We discussed the issue of data input because a keyboard (or the tablet used with the MessageProbe) was hard for the grandparents to use. Voice annotations seemed like a useful idea for notifications and sharing requests. If you wanted to put an event on someone else's calendar, you could drag it over to their column and then add a voice annotation that they could play. Or, if you were going out to do errands and wanted others to know where you were, you could just leave a voice annotation at the time you left. The audio quality would have to be quite good though. Interestingly, the Junior family has a microwave where you can record voice messages but no one uses it.

The two sets of grandparents rely entirely on paper for their calendar information. The Paternal grandparents use a pocket calendar, maintained and used daily by the grandfather who meticulously records appointments but also keeps detailed diary information such as stock values or time spent on particular tasks (Figure 8). The grandmother relies on the calendar kept by her husband, but also keeps a separate personal list of birthdays and other special regular events.

The Maternal grandparents have a much simpler, more ad-hoc way of handling calendaring. The grandmother coordinates most of it – important appointments or events (e.g. doctor's appointments) that come in paper format are put on the refrigerator as notes. To keep track of birthdays, she writes them on 3x5 note cards so they don't have to be entered into a calendar every year. A lot of their appointments are regular events (e.g. golf and haircuts) so they don't bother to write them down. A monthly wall calendar is used to record a very small number of special events. Occasionally messages are left on the coffee machine as special reminders (e.g. I'll go for lunch with Tom today after golf).

The grandparents know that their children and grandchildren's lives are very busy, and they clearly indicated that having access to their schedules would be desirable. In looking at the early paper prototypes the idea of using voice for some features (e.g. I'm going to the store) came up. They wanted the calendar to flash or beep for reminders and messages. They liked the idea that if their children wanted to have them pick up one of the kids, they could drag that item from the children's calendar over to a grandparent calendar, and it would flash or beep until they saw it. They could accept the responsibility by clicking on it, or say no by dragging it back to their son's calendar. Given that they

don't make much effort in their current calendaring, a simple, easily accessible interface was important. Writing on the refrigerator or paper was OK; typing appointments into a computer was not.

Our interviews with our family partners confirmed that even closely knit families who stay in touch through regular visits and phone conversations still have difficulties remembering the dates of each others' activities (e.g. Tell me again, when are you going on that trip to New York? Are the children still taking music lessons? Is school out for Veterans Day and do you need help from us that day?)

4 RELATED WORK

4.1 Web Technology for Older Adults

One of the fastest growing populations is older users: in 2000, people age 65 and older made up 13% of the U.S. population, and their numbers are expected to double by 2030. (Federal Interagency Forum on Aging-Related Statistics, 2000). The benefits of accessing the Internet for older adults are many. They can communicate with distant family and friends, maintain independence by accessing goods and services such as shopping and banking at home, take advantage of online-learning opportunities, and gain access to healthcare information (Browne, 2000). Unfortunately, older users lag behind their younger counterparts in computer and Internet usage. Only 24% of people age 65 and older had a computer at home in 2000 and only 17% used the Internet at home (Newburger, 2001). Despite the common belief that older users are resistant to using technology, many studies have shown that they are quite receptive to using technology (Czaja and Lee, 2003). Rather, the two major obstacles that are keeping older adults from taking advantage of these opportunities are accessibility and usability.

Older adults are subject to the same "digital divide" accessibility problems as the larger population, such as differences in income and participation in the workforce (NTIA, 2000). Additionally, older adults are subject to age-related declines that affect their ability to use computer hardware and software. Disabilities in visual and auditory sensory processes, motor skills, and cognitive abilities are all common as people age (Czaja and Lee, 2003). Many respected groups have put forth guidelines for web-site design that take into account these potential disabilities, including the World Wide Web Consortium (2004), the AARP (Chisnell et al., 2004), and the National Institute on Aging (2002). Many studies have shown that simple changes to input and output, such as larger cursors, multi-modal feedback, and multi-media interfaces improves both performance and preference among older adults (Ogozalek, 1994; Worden et al., 1997; Emery et al., 2003). The ELDeR Project at Carnegie Mellon conducted an ethnographic study at a retirement home to inform design of new technologies for older adults (Hirsch et al., 2000). The Aging in Place project at Georgia Tech has designed technologies to support older adults, such as the Digital Family Portrait, which uses sensory input and a network connection to report on the activities of older adults to their remotely located children (Mynatt et al., 2001). Hine and Arnott (2002) focused on the social needs of seniors with language impairments by developing a multimedia storytelling environment. Gregor et al. (2002) developed a web browser to support older adults with visual and memory impairments. Others have looked at using distorted sound to monitor activity (Marmasse and Schmandt, 2003).

4.2 Coordination in the home with technology

Beginning with its first organized conference in 1986, the field of computer-supported cooperative design (CSCW) has produced a broad body of literature about how to design software (often called groupware) to support the work of groups of both collocated and distributed people (Ellis, C., Gibbs, S., & Rein, G., 1991; Grudin, J., 1994; Olson, G. & Olson, J., 1997.) There has been a great deal of research in the area of coordination technology, particularly group calendaring, but it is focused almost exclusively on the workplace (Beard, D. & Palanlappan, M., 1990; Palen, L., 1999; Bullen, C. &

Bennett, J., 1990; Kelley, J. & Chapanis, A., 1982; Kincaid, C. & DuPont, P.; 1985; Mueller, E., 2000, Tullio et al., 2002) In the area of information visualization, there has been some interesting work in improving the interfaces of electronic calendars through fisheye views and animated zooming, for example the Perspective Wall (Robertson et al. 1993) or Datelens (Bederson et al., 2004). However, none of this previous work has addressed the unique needs of home use and in particular distributed families.

The HomeNet study at Carnegie Mellon (Kraut et al. 2002) indicates that computers and the Internet can contribute to coordination problems by isolating people from family and friends and increasing their daily stress levels. However, the study also suggests that when used for communication, computers and the Internet can play a positive role in keeping people connected – email, instant messaging, and family web sites are just a few of the ways the Internet helps keep people in touch. Thus, many families are still unsure about the value of computer technology in their daily lives. A huge diversity of ages, abilities, interests, motivations, and technologies must be accommodated. People are much more concerned about the aesthetics of technology artifacts in their home than at work (Westerlund and Lindkvist 2002) and their values may influence their use of technology (Vaida and Mynatt, 2002). Finally, the line between home and work, and thus the technology needed to support both, is becoming ever more blurred, with dual income families and telecommuting now commonplace.

Recently, a web service named Family Wizard” was developed to help divorced couples manage child care and visitation (<http://www.ourfamilywizard.com/>). It includes a shared calendar and message board for use by family members as well as law professionals.

4.3 Digital paper and pen

A number of researchers have recognized the benefits of paper, and rather than looking for ways to replace it, they have instead explored ways to enhance it so that users can continue to rely on it. Mackay et al. (1999) summed up the reasons nicely, noting that physically, paper is lightweight, flexible, adaptable, and disposable. People can continually invent new uses for it on the fly, and manipulating and writing on paper can help aid memory. Socially, sharing it can provide peripheral awareness of other people’s activities. This is especially relevant in shared calendaring, where the placement of a Post-It note or the recognition of someone else’s handwriting can convey important meaning. Researchers have tried a number of techniques for augmenting paper to imbue it with some of the benefits of computerized information, such as storage, recall, editing, and linking to related media.

Early solutions involved using video cameras and optical character recognition (Johnson et al, 1993; Wellner, 1993). Other applications were enhanced with the use of barcodes (Ishii and Ulmer, 1997; Lange et al., 1998; Nelson et al., 1999) or a similar marking called a DataGlyph (Johnson et al, 1993). Computer vision techniques have advanced enough to allow researchers to identify Post-It notes without any special markings (Klemmer, 2001). Other researchers have embedded small radio frequency tags in books, documents, and business cards (Back et al. 2001; Want et al. 1999). Others have used graphics tablets overlaid with paper to record real and digital ink (McGee et al. 2002; Stifelman, 1996; Seiko SmartPad). Most recently, researchers have embedded tiny cameras in pens to record handwritten and typed text [Dymetman and Copperman, 1998; Nabeshima, et al. 1995; Anoto technology; Seiko InkLink, Arai et al. 1997, C-Pen), or react to invisible ink embedded in the page (Paper++). Among the most promising technologies supporting the recognition of handwritten text is the system created by Anoto (www.anoto.com) and sold by LogiTech (www.logitech.com). Anoto’s technology works by printing a tiny pattern of uniquely spaced dots on any regular paper. A camera in the pen records the coordinates of the pen tip on any such page and sends them (e.g. via Bluetooth or USB) to a computer, PDA, or cell phone to reconstruct the handwriting.

Commercial paper companies are producing calendars on Anoto paper, and Anoto has created software to allow appointments created in paper calendars to be synchronized with computer calendar programs such as Microsoft Outlook. However, the current support for calendaring with Anoto assumes and requires the same workplace interface imposed by the computer-based calendars. Users must not only write their appointment at the desired time, but also draw a line next to it indicating the duration. There is no way to integrate input from less time-specific weekly or monthly calendars, or even less uncertain data from Post-It notes. Worse, in Microsoft Outlook, there is no support for handwritten input, so the appointment shows up in typewritten text as “Pen Appointment” and users must open the appointment to actually view the handwritten information.

5 A SHARED CALENDAR PROTOTYPE

5.1 Description of the interface

Our family calendar prototype was designed to address the challenges older adults have with traditional calendaring software and computer hardware. While much of the previous research has focused on allowing adult children to check on their older parents, our research revealed a desire for more symmetric communication, so that older adults could see what their children and grandchildren were doing. Off-the-shelf calendar software is available but designed mostly for business users and overwhelming for novice older adults. Pointing devices such as the mouse can be difficult to master and intimidating. Even the pen and tablet we used for the MessageProbe were found to be clumsy and discouraged use. Our approach to address this problem was to: 1) provide alternative modes of data entry and 2) layer the calendar graphical user interface. We provide a simple interface as well as more advanced ones, with a mechanism for the families to specify which one they would like to use. To allow the grandparents to enter data in the simplest way possible we investigated the use of a digital pen and digital paper.

We designed the calendar interface by tiling multiple calendars next to each other and synchronizing their navigation. The software is an extension of DateLens, a calendar program developed in our lab (Bederson et al., 2004) (Figure 9). In our prototype, everyone can see all the calendars on their computer screen, but each household has the ability to hide the calendars they do not want to see to make more room for the others (Figure 10). For example, grandparents will most likely choose to see their own calendar and the one(s) of their children, but not the calendar of the other grandparents. In the simple mode of the interface, only a week view is available and all calendars are coordinated and can be navigated at once with the mouse and the keyboard. The next and previous arrow keys select and enlarge the next or previous day, the up or down arrows switch to the previous or next week, and the escape key shrinks the currently selected day to make all days the same size. Clicking on a day enlarges the day on all calendars and makes it more readable (Figure 11). Users can also change the size of the characters. Bigger characters are more readable, but may lead to multi-line labels and some of the text of events to disappear until the day is selected and enlarged. At the top left of the screen a home icon allows users to return to the current week with the current day highlighted.

The methods of data entry can vary. The simplest method, which was used by the grandparents, is to write on a calendar printed on digital paper using a digital pen (Figure 12). When the pen is placed in its cradle the information is transferred to the computer and appears on the corresponding day. Advanced users (for example the Junior family) can use the DateLens interface or even Microsoft Outlook to enter calendar information. These interfaces allow them added functionalities, such as specifying the start and end time of an event, editing their descriptions, or deleting or moving events. They can set reminders, enter repetitive events all at once and specify their periodicity, make events private, and enter as many events as needed for any particular day. The interface for those numerous functions seems fairly simple

for users with computer experience but is overwhelming for users with limited computer knowledge. It requires users to memorize long series of actions for navigating menus, typing, setting widgets and dragging icons or scrollbars, which are very difficult for novice older adult users. The data entered with the digital paper calendar appears as it appears on paper, rescaled as needed to fit the screen space. The data entered with Outlook appears as text that can be laid out to fit the screen space.

5.2 Implementation

The calendar prototype uses a layered architecture that automates Microsoft Outlook in the background, while providing a custom view to the families. This approach enables us to create our own visualizations tailored for novice users by using any desirable features already built into Outlook, while filtering out the more complicated ones. In particular it allows us to use a standard Microsoft Exchange server to coordinate and synchronize all the calendars in the distributed households. A single Exchange server mail account was created for the family, and three calendar folders were created for that user (a standard capability of Outlook). The calendar information for each household is stored in a different calendar folder, and the three calendars are synchronized periodically on the network.

Our shared calendar interface software reads the three Outlook calendars and presents the information on a single screen. The paper and pen data input interface uses Logitech digital pens with Anoto technology. We printed the calendar ourselves on commercially available pads of digital paper with Anoto patterns, which the pen uses to identify the paper. This allowed us to create calendars of the size and layout we wanted to fit the needs of our families. When users write on the calendar and replace the pen on the cradle, the Anoto software generates an XML document to describe the strokes on the paper. All the ink written on a given page of Anoto paper is saved in a single XML file. For our software to know which portion of the XML file corresponds to each day of the calendar, we print the calendar double-sided on consecutive pages and pass the Anoto page number of the first day as an attribute to our calendar software. We parse that XML document, and using the Tablet PC Software Development Kit, we convert it to a set of ink objects (one per day of the calendar, i.e. per rectangular portion of a page) that are saved as individual attachments to appointments in the Microsoft Outlook. Our shared family calendar software renders all the ink objects in the calendar displays. It also listens for updates in the Outlook calendar folders which occur either when local users enter new information, or remote users have entered new data and Outlook has synchronized the three calendars.

We chose not to use optical character recognition to convert the handwritten information because it would force the families to write more deliberately, and we want to preserve the benefit of unconstrained handwriting. Because of the choice of using a small pocket paper calendar, there was no room for laying out the hours of the day as found on day-by-day calendars or large weekly calendars. Users of the paper calendars can choose to write a begin time for an event, or not.

We hypothesized that advanced users – i.e. the Junior family adults – might also want to use the full DateLens interface to have access to scrollable monthly and yearly views, or search and filter on the three calendars, or decouple the calendars to view and compare different weeks in different calendars, at the price of increased complexity. Therefore, options were added to allow users to access such functionality within the shared calendar interface if they chose to. In this more advanced mode the three calendars are decoupled, allowing the individual scrolling of calendars. Moving a sliders' range thumbs also allows users to change the number of weeks seen in each calendar, from one to 3 or 4 for a monthly view. Windows are resizable and individual home icons allow users to return to home for each individual calendar. Users can also enter events using the keyboard and mouse using menus and a form fill-in similar to Outlook's new event interface.

6. FIELD STUDY OF THE SHARED CALENDARS

The calendar prototype was deployed in the three households of the U.S. family for a period of about 8 months, out of which actual coordinated use and an active field study took place during two periods of two months each. The first period (November to December 2003) was plagued with technical problems but all households agreed to continue the experiment. In fact, the grandparents spontaneously requested to try again, so after another attempt at correcting the most severe technical problems we ran a second study (from April to May 2004). The software is still running in two households but we have stopped providing the custom made paper calendars.

6.1 Deployment in the families - Dealing with scheduling delays and technical difficulties

Deployment was significantly more difficult than we anticipated. There were general networking problems which were compounded by the requirements of our University network as described later, as well as bugs in our own software. The deployment to the families started in early September but we were able to collect usage data only at the end of October.

Even though our own schedule was fairly flexible and the families live close to campus, scheduling visits for interviews or to install software or debug problems sometimes took weeks to schedule. The Junior family is very busy even during evenings and weekends, and special events such as holidays or trips constrained our visits as well. For the grandparents there was either no problem setting appointments for the next day or we had to wait several weeks. Travel, moving, illness or illness of close friends created unexpected long delays. It is unrealistic to believe that retired older adults are always available and ready to deal with the complexity of interviews, computer installation, training and operation.

Despite the fact that we used fairly standard technology, we had many technical problems, most of them unrelated to the software we had written ourselves. One important constraint was that we had to use the computers of two of the households (as opposed to new hardware that could be set up in the lab), and therefore we needed to minimize disruptions to their current setup. The Paternal grandparents were happy to have us come and upgrade their new computer with new software, but changes were not acceptable to the Junior family, which relies so much on the computer that they dreaded the idea of having us modify anything in their computer. However, we had to make some changes and this created a great deal of anxiety for the family, and for us as we feared erasing precious calendar information while we were setting up the synchronization with the network server or upgrading to a newer version of Office to allow such synchronization. We also struggled with using different versions of Windows and Office, as the three computers had three different configurations. The options we had to set for Outlook were accessed through different menu hierarchies and often used different names. When something went wrong, debugging could not always be done immediately. We consistently underestimated the amount of time required to install software and even updates.

We often had to schedule additional visits to finish installing or setting up software, which could again delay installation for a week or so. The final details were difficult to arrange as we could not be in all three houses and in the lab at once to correct problems. One example of this problem occurred after we installed the Junior family version, and proceeded to install the software on one of the grandparent computers. The installation went well, ink could be written on the paper calendar, the Outlook synchronization seemed to work properly, and we could see the Junior family calendar from the grandparents' house. We left and started celebrating but the next day we had a report of ink calendar events being duplicated at random in the calendar and of duplicated events appearing in the Junior family calendar exactly one day off. After a few days of investigation, it turned out that the grandparent's computer had a different daylight saving option which had no effect locally but affected

synchronization. The anxiety ran high as we had to clear the Junior family calendar by hand of all the duplicate events and clean and reset the paper calendar XML files in all three households. Fortunately no permanent damage was done and after about two months of setup time we were ready to really start the field study.

However, some problems always remained. Appropriate university security policies require a Virtual Private Network (VPN) to be setup before connecting to the Microsoft Exchange server. Our families experienced consistent problems with keeping that connection alive. We tried to train the families to recognize that the VPN was down and to restart it, but this was not effective. Finally, we created a small program to monitor the status of the VPN and restart it automatically. Bugs within Outlook also created minor problems that still remain. For example, events sometimes get duplicated when the calendar information is accessed by an outside program (it appears as if the event had been modified and the two variants are kept).

At the end of the first period, it became clear that we needed to convince the families to upgrade their systems, in particular by adding more memory. This took a fair amount of convincing (again, because of the risks of disruption) and a long time to implement. When this was done, we were able to run the second period without too much difficulty. Upgrading the computers reduced the frequency of lost connections and allowed the Junior family to synchronize the calendars in a regular basis. New paper calendars were given to the grandparents, and no significant technical problems occurred in that second period except for one unfortunate detail. For a period of about 2 weeks the Paternal grandparents entered a significant amount of information in their paper calendars but never synchronized. A window had popped up asking them for a password to initiate the synchronization but they did not remember the importance of this request and ignored it. The window was soon covered by other windows and because the machine was never restarted it went unnoticed. Synchronization only resumed after one of the researchers visited for an interview.

6.2 Overall results

After the first two months of use, the main finding of the field test was that both sets of grandparents appreciated being able to see the schedule of their children and grandchildren. Both sets of grandparents reported checking the calendar at least once a day. During the initial visits, we were struck by the strong interest of the grandparents in seeing the schedules of their children. While we were presenting information about how to use the interface, they were barely paying attention to us and our explanations but instead carefully studying the calendar and discussing together some of the implications of what they had found (e.g. “We should move the birthday dinner earlier because there is a music lesson later that day”). This interest was made clear at every visit when we had to restart the computer or software because something had been disconnected.

The grandparents entered data on the paper calendar on a semi-regular basis, when the connection and software was functional. They regularly apologized for not having that many things to include in the calendar. The Junior family on the other hand was so plagued with technical problems that they had not looked at the shared calendar very often and could not synchronize their calendar to show it to their children on a regular basis. The Junior family repeatedly indicated that their limited use was due to the technical challenges and not lack of interest. Because the Junior family was only occasionally checking the grandparent’s calendar, the grandparent’s motivation to enter information in their calendar was limited. The Maternal grandparents never had any difficulty using the pen or the calendar, but clearly indicated that they were not motivated to enter data if their daughter was not going to look at it. In two cases the Maternal grandfather even entered illogical entries in his calendar to see if that would be noticed by the others. Despite limited use, both sets of grandparents spontaneously requested new paper

calendars when the first ones expired, without us asking them if they were interested in continuing this experiment (which was scheduled to stop at that time).

The pen and paper calendar was easy to explain and quickly learned. “How much simpler could it be?” said one of the grandfathers. The only technical problem encountered with the pen was that it had to be returned to the cradle the proper way and not upside down. It seemed a problem on the first day but never again after that. The pen never ran out of power, mostly because it was usually kept in its cradle. It was found unnecessary to carry it around since the data was not transferred until the pen was returned.

Training was always an important part of the visits to the Paternal grandparents. We created custom help sheets together but those were usually put away. We also spent a fair amount of time with the Paternal grandparents discussing how to use other tools such as Microsoft Word (in particular how to turn off automatic features such as the spell checker that left unsightly red and green marks) or how to eliminate the annoying popup ads that appear when browsing the Internet.

After a month and a half of use, the Paternal grandmother requested the ability to enter appointments directly into the calendar by typing. She explained that while the pen-based interface was simple, she felt that her handwriting didn't look nice enough on the screen. She used to type on a typewriter so typing was not a problem and she wanted her text to look as nice as the text entered by her children. We switched her software to be in the “intermediate” mode that allowed her to enter appointments directly. The interface is similar to Outlook, but simpler (Figure 13). Nevertheless it was still difficult for her to enter events with the keyboard and we worked with her to prepare a set of written directions to help her remember what to do. This feature has not been used much and we suspect that it is too complex to be used in its current form. This request indicates that digital paper may be a powerful tool to introduce older adults to computers, but that once they feel more comfortable, they may be ready to switch to more conventional modes of interaction. While we were explaining how to enter text with the keyboard to his wife, the grandfather indicated that he still much preferred to use the paper calendar and had no intention of using the keyboard.

After the memory upgrade took place, the second period of use started. Again, the grandparents strongly indicated their appreciation of being able to see the calendar of their children. They both clearly expressed regrets that the experiment would stop (e.g. “I will miss knowing what [my daughter] is up to”). The Junior family reported that they were glad to know that their parents could follow what was going on in their lives, but also said that they had not consulted the shared calendar very often. Reasons invoked were: being very busy, knowing already pretty much what their parents were up to (thanks to the regular phone conversations), and that nothing too exciting had happened in the lives of the grandparents during that period. When interviewed, each household was able to give examples of things that they had learned via the calendar that they would not have known otherwise (e.g. one of the children was going to get braces, or an update on the health status of a sick friend of the grandparents). On the other hand they could not think of any occurrences of miscommunication or problems created by the information shared via the calendar).

Both sets of grandparents reported looking at the calendar every day (or occasionally every other day). The entry of events in the paper calendar increased for the Paternal grandparents but decreased for the Maternal grand parents. Again, the Maternal grandparents were less motivated to enter information if their children were not looking at it regularly and unconvinced that there was much of interest in their regular lives that deserved writing on a calendar. They commented that their activities occurred either every day - so their children knew about it, or very occasionally – such as doctor appointments, but that didn't not happen much during the study. They indicated that other modes of communications worked

well for them (e.g. “it’s so easy to talk to [his son-in-law]”). They also had stronger complaints about the technology (e.g. “If it was wireless and worked properly I might use it more.”). The Paternal grandparents entered information in their calendar in bursts, entering five to 10 events at once, then none for a few days, except for special news (e.g. they reported the birth of twins in a family that their son knew as well).

The Junior family reported that they liked knowing that their parents could see what they were doing, and that there had not been any incidents related to unwanted information being shared. They ended the interview by telling a story of a niece who was using Instant Messenger as a way to tell relatives (and friends) her whereabouts in life. They told us how they appreciated the sense of awareness they had gained over the month by simply seeing her name appear with tags such as “looking for a new apartment” or “gone to the movies”. They saw this as a related type of technology that allowed them to stay in touch in a light way with family members, and help them feel confident that the shared calendar was a promising concept even if in the course of this short study they had not looked at their parents’ calendar very often.

6.3 Incremental changes made to the interface

Through the course of our experiment, we have gone through several iterations of the software. The changes have been driven by comments from the families using the application. The initial improvements were made to improve the readability of the text and ink. The grandparents said that they could not easily read the text of the events, and suggested that the text was often clipped while there was plenty of space to display it (Figure 14). The day names (Monday, Tuesday etc.) were also hard to read. We added an option for setting the font size of the text, and displayed the event as a simple list instead of trying to place the event at a fixed position corresponding to the time of the event. This also reduced the need for scrolling when events occurred early or late (in fact it eliminated it entirely during the testing).

To increase the readability of the ink, we first tried to set a limit to the rescaling of the ink, which led to clipping of some of the data. This was found misleading as some information was simply never noticed, and it was decided that it was better to be able to see the whole content than to clip it, even if this meant that the ink would appear smaller on the display. On the other hand, it was found acceptable to pan the ink on the available display space to see it better. For example, if all the text for a day was handwritten at the bottom right of a rectangle on paper, it would still appear zoomed in as much as possible to fit the area of the display corresponding to that day, making it more readable.

As we tested the usability of the interface, we also removed more DateLens features that were not needed for the family calendar. For example, the Weekend and Weekdays buttons were removed (all days were found equally important), the scroll bars were removed (the weekly calendar was found sufficient and the arrow keys fine to navigate), and the calendars were labeled with users names instead of generic labels such as “Calendar 2”.

A concern for the Junior family was the issue of privacy. Even though this was rarely necessary, it was deemed important to provide a mechanism to “hide” certain events when needed. This could easily be addressed by the privacy feature of Outlook. When necessary, events can be made private when entering them using Outlook, and the shared family calendar simply ignores them. This has only been used for one event during our field study. Grandparents could make appointments private by simply writing with an ordinary pen instead of the digital pen (this has not been used during the test).

7. LESSONS LEARNED AND CONCLUSIONS

Our field study has highlighted three important lessons when working with multi-generational families to design new technologies. First, awareness of distributed family members' schedules is important, not only to grown children, but also to their aging parents. Previous research had focused on allowing grown children to check on the status and schedules of their aging parents, but our research demonstrates that a more symmetric sharing of information is desirable. Second, technology used in peoples' homes needs to be stable, consistent, and easy to trouble shoot for all generations, but in reality, this may not be possible. Unlike in a controlled lab situation, we had to accommodate the use of existing computers in our families' homes, deal with sometimes unreliable commercial Internet providers, and work within the constraints of university network rules. Finally, as a result of these issues, doing research with families requires a lot of time and a lot of patience, on the part of both researchers and families. Families have busy lives and have to accommodate visits from researchers to install sometimes malfunctioning technologies that they don't always understand how to use. Researchers must travel to families' homes, often outside of regular work hours, and troubleshoot the technology glitches that result from working in an uncontrolled environment with often inexperienced users. However, despite these challenges, we feel the project was a success. We identified a new use scenario for shared family calendaring, demonstrated the feasibility and usability of a layered calendaring solution using digital paper and pens, and developed new techniques for working with families as partners in the design of new technologies.

Our interviews highlighted that even closely knit families that stay in touch through regular visits and phone conversations still have difficulties remembering the dates of each others' activities. Our field study suggests that users who maintain home calendars will glean valuable information from peeking at each other's calendar, and that the heightened sense of awareness of current and planned activities might actually increase the amount of communication. In particular we observed a clear increased awareness of the Junior family's activities by the grandparents.

Technical problems and the overwhelmingly busy lives of the Junior family limited their use of the shared calendar but their impressions were positive. We observed that different family members used the calendar in different ways. For example, one grandfather diligently recorded many events, while one grandmother never really touched the computer but reported simply looking at the calendar everyday. Finally we confirmed that the digital pen and paper was an effective way to create easy-to-learn, non-threatening technology for older adults.

Based on our findings, we recommend future research in two areas. First, broader studies of the use of shared family calendars with more families. We believe it will be useful to see how well our results with layered interfaces and the use of digital paper and pen by older adults generalize to other families. Second, the development of other technologies to support symmetric sharing of information between remotely located family members. We believe that this is an important use scenario that merits additional study.

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10. APPENDIX A: FIGURES

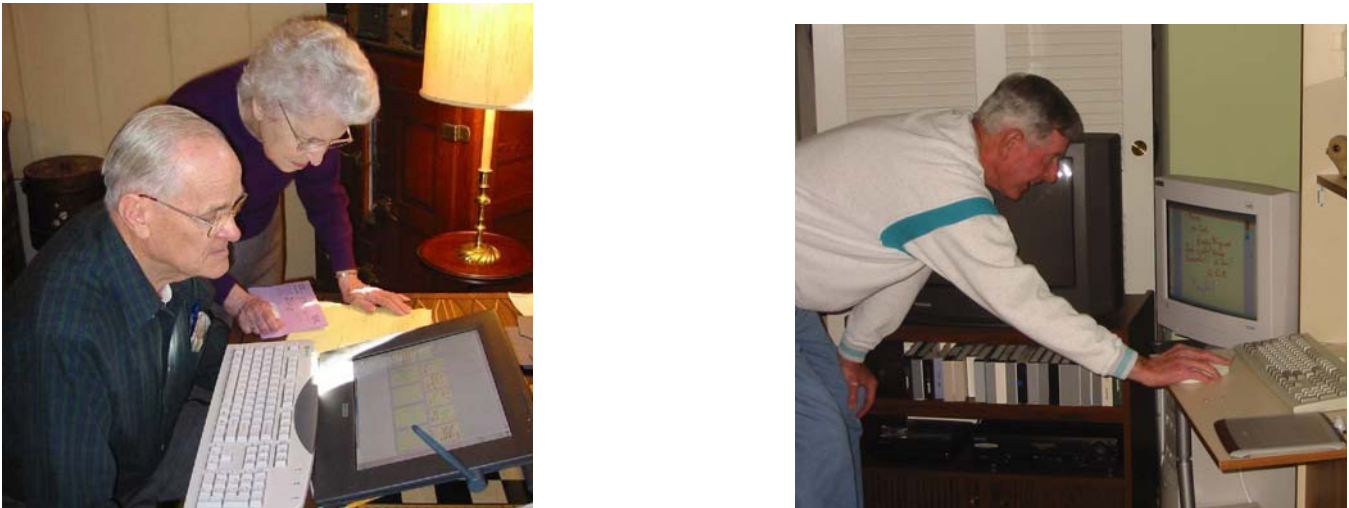


Figure 1: Using the MessageProbe in the homes of the U.S. family



Figure 2: Augmented awareness prototypes designed during the family workshops: a bracelet that shines (left) and a phone that blows air (right) to indicates that another family member is thinking of you.

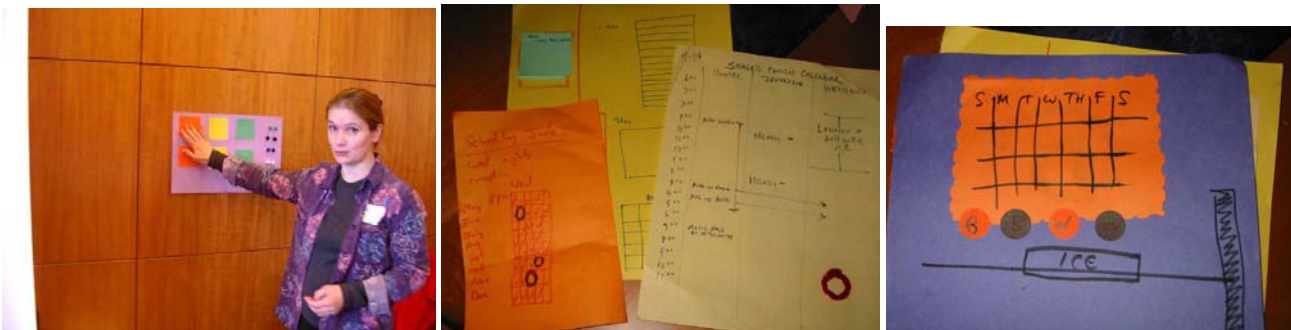


Figure 3: Shared calendar prototypes designed during the family workshops: for the wall (left), or the refrigerator (middle and right)

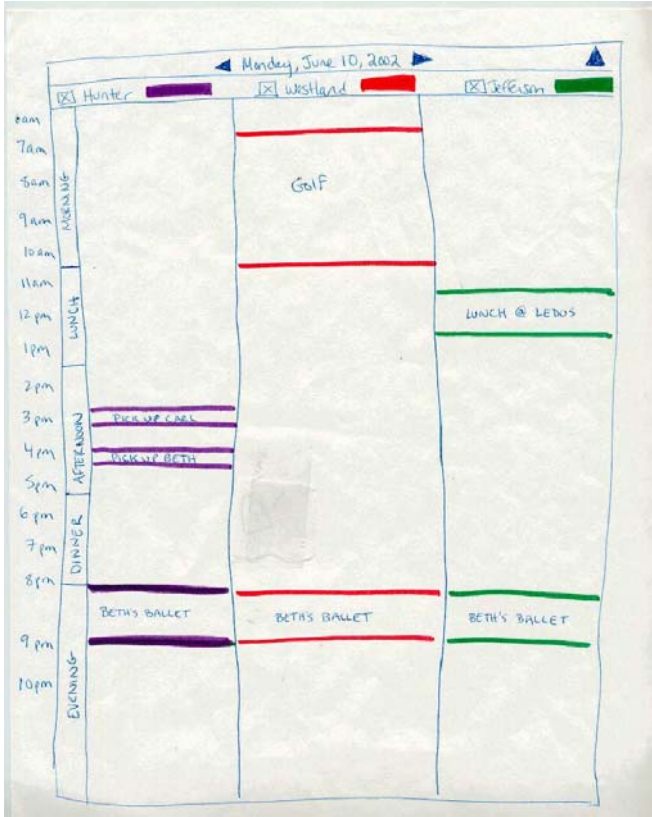


Figure 6: Early paper mockup showing the three shared calendars for the three household, populated with realistic examples, used to collect early feedback on our planned prototype.



Figure 7: The Junior family's daughter using the computer in a corner of the large kitchen. On that computer the Outlook calendar is updated and checked several times a day.

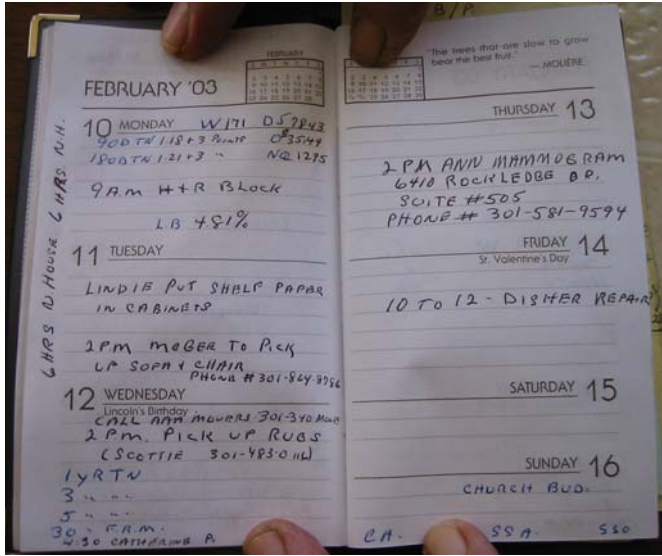


Figure 8: The meticulously kept pocket calendar-diary of one of the grandfathers. A few appointments are recorded, plus several diary entries such a stock prices or hours worked on particular tasks.

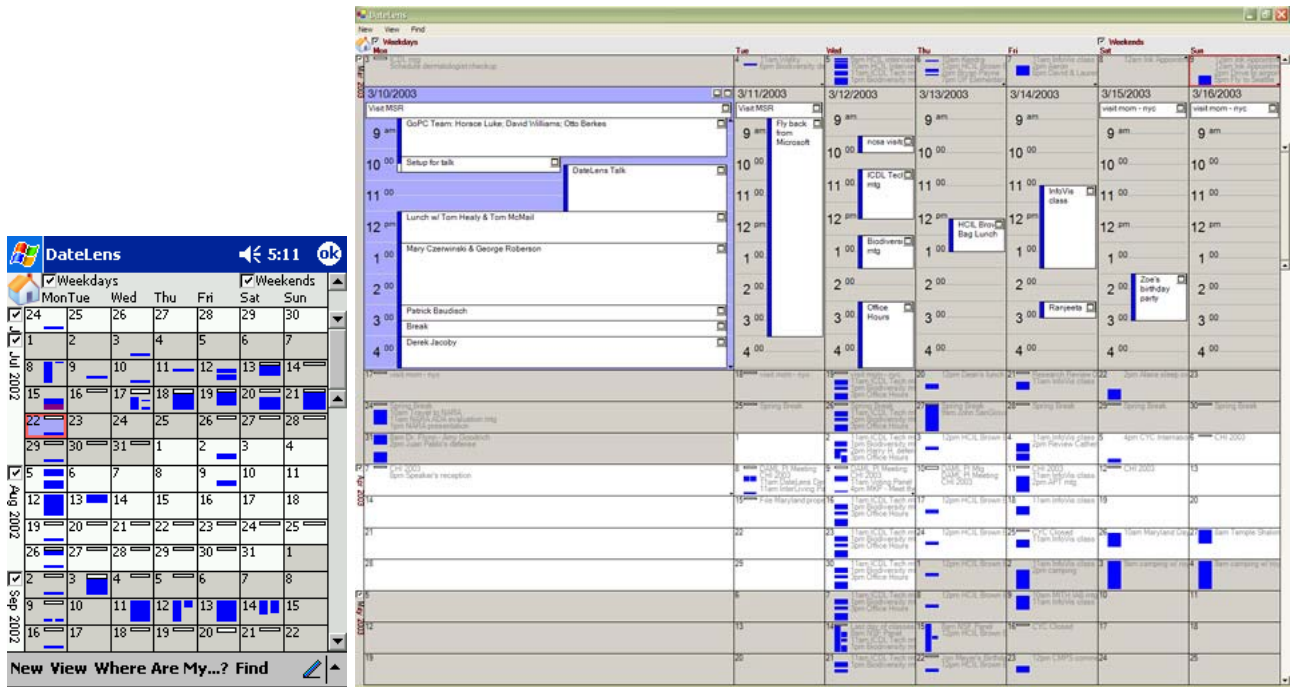


Figure 9: DateLens was designed for small mobile devices (left) but can also be used as the desktop application. It uses fisheye views, multiple views and visual data summaries to assist users navigate the calendar.

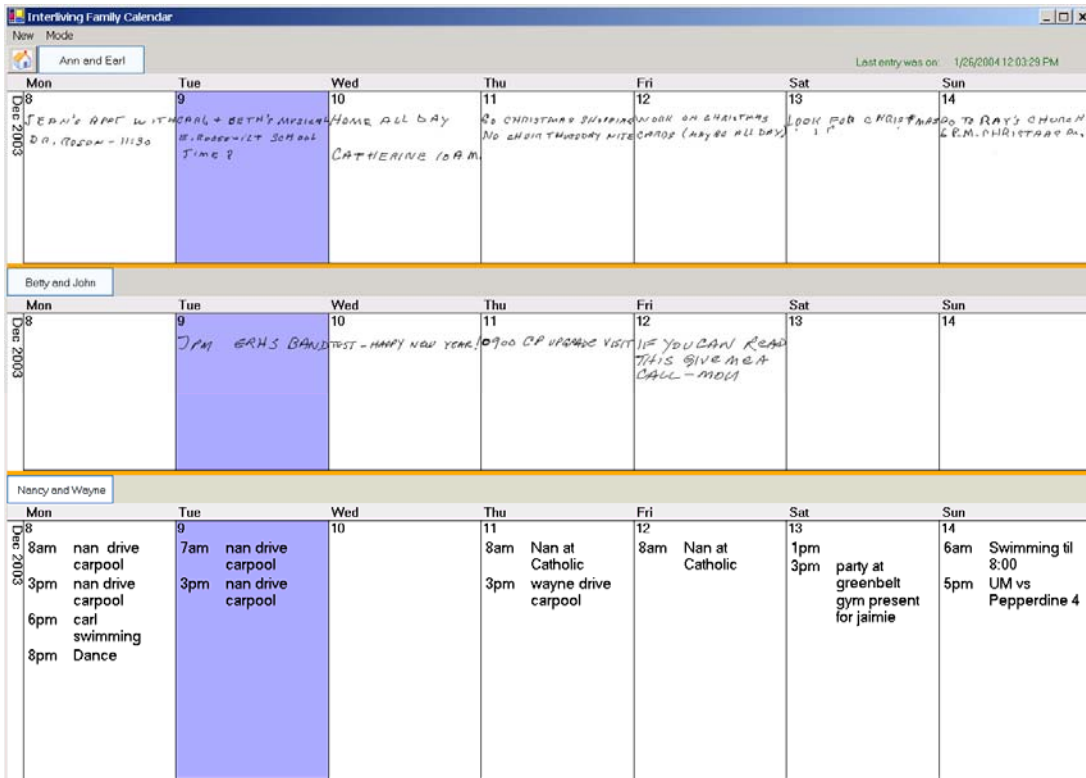


Figure 10: The basic interface shows a week view of the 3 calendars, one per row. The information on the top two calendars was handwritten by the grandparents. The information in the lower calendar was entered with Microsoft Outlook by the Junior family.

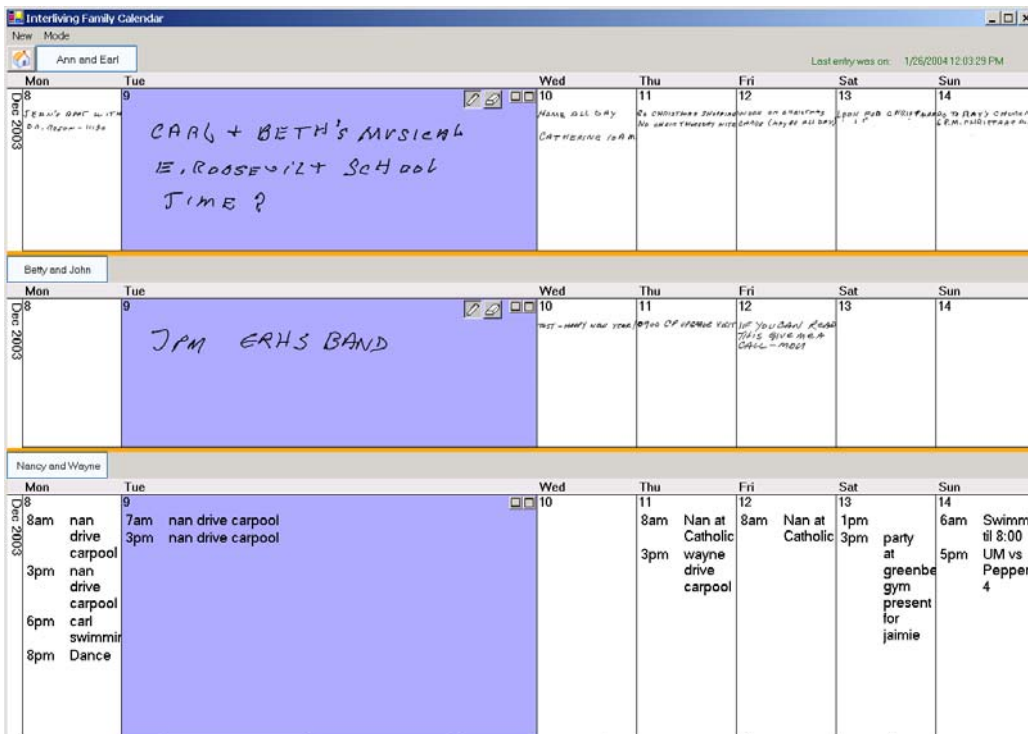


Figure 11: Clicking on a day enlarges the day to improve readability.



Figure 12: The grandparents write on their small pocket calendar printed on digital paper (left) and replace the pen on the cradle to transfer the information to the computer (right).

Interliving Family Calendar						
New Mode						
Ann and Earl						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
1 8am Go to Annapolis	2 9am Work on Christmas cards	3 9am Hope to work on cards today	4 7pm Choir practice	5 9am Go Christmas shopping until we nearly drop!	6 8am Carl's swimming meet	7 12am Carl's swimming meet
Betty and John						
Nancy and Wayne						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
1 8am nan drive carpool 3pm nan drive carpool 6pm carl swimming 8pm Dance	2 7am nan drive carpool 8am email Catherine 3pm nan drive carpool 5pm test 5pm test 2 9pm UM vs Wisc 2	3 9am Nan at Catholic	4 8am Nan at Catholic 3pm wayne drive carpool	5 8am Nan at Catholic	6 8am Swim Meet at Fairland	7 6am Swimming til 8:00 8am Swim Meet at Fairland 2pm dance til 3:00

Figure 13: One of the grandmothers found typed text nicer looking than the handwriting. Other grandparents preferred the simplicity of the paper calendar.

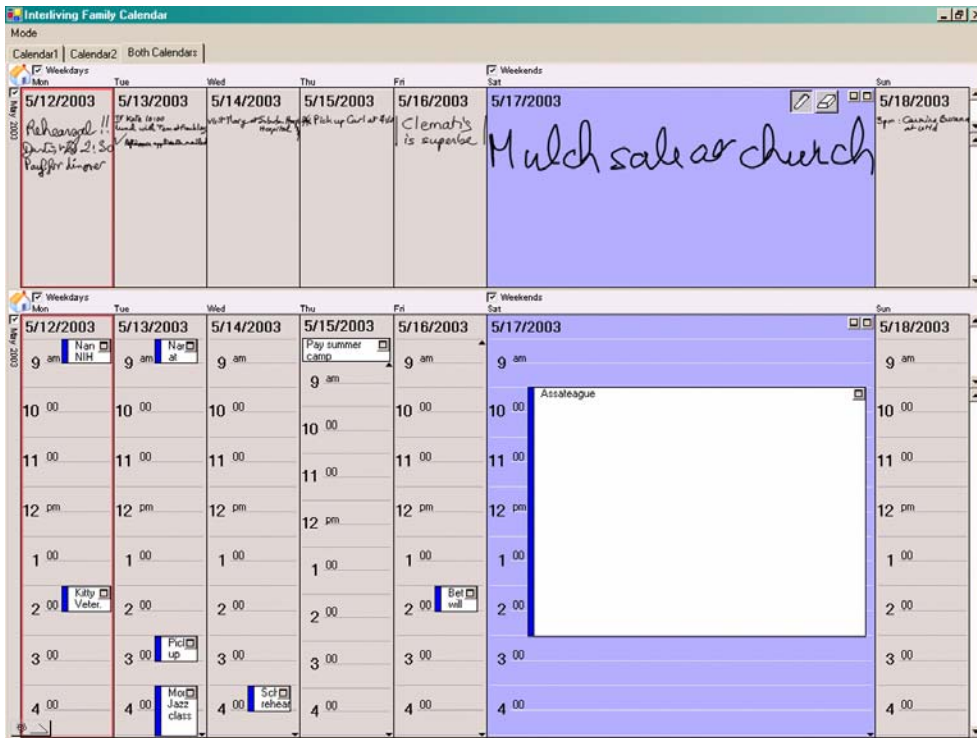
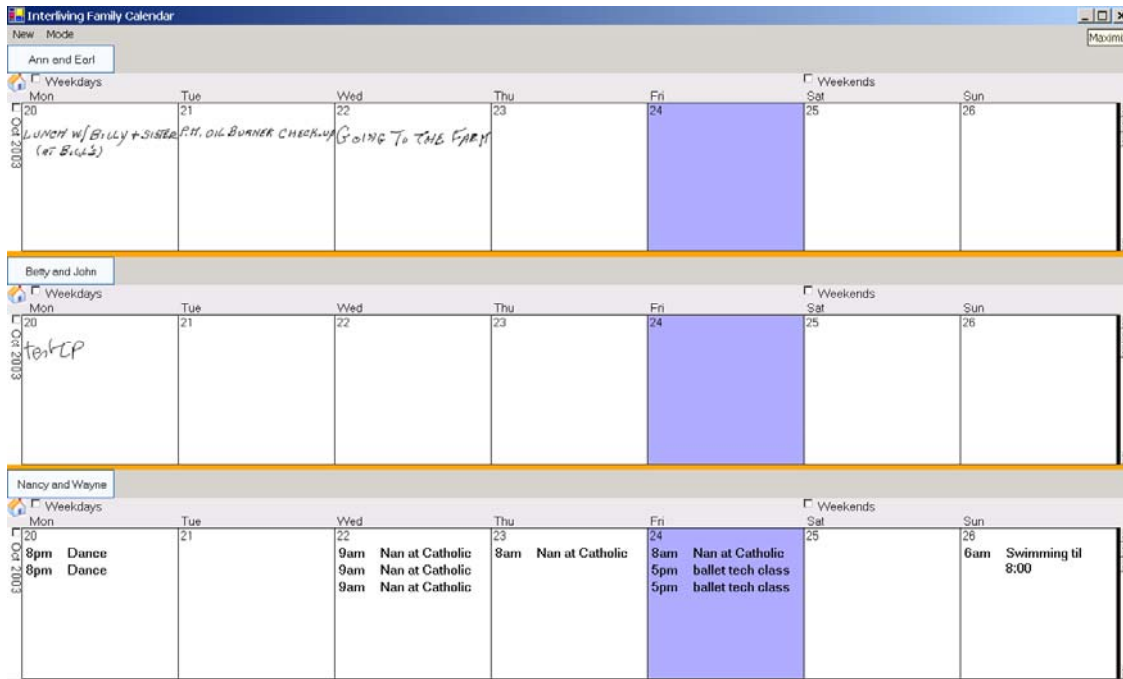
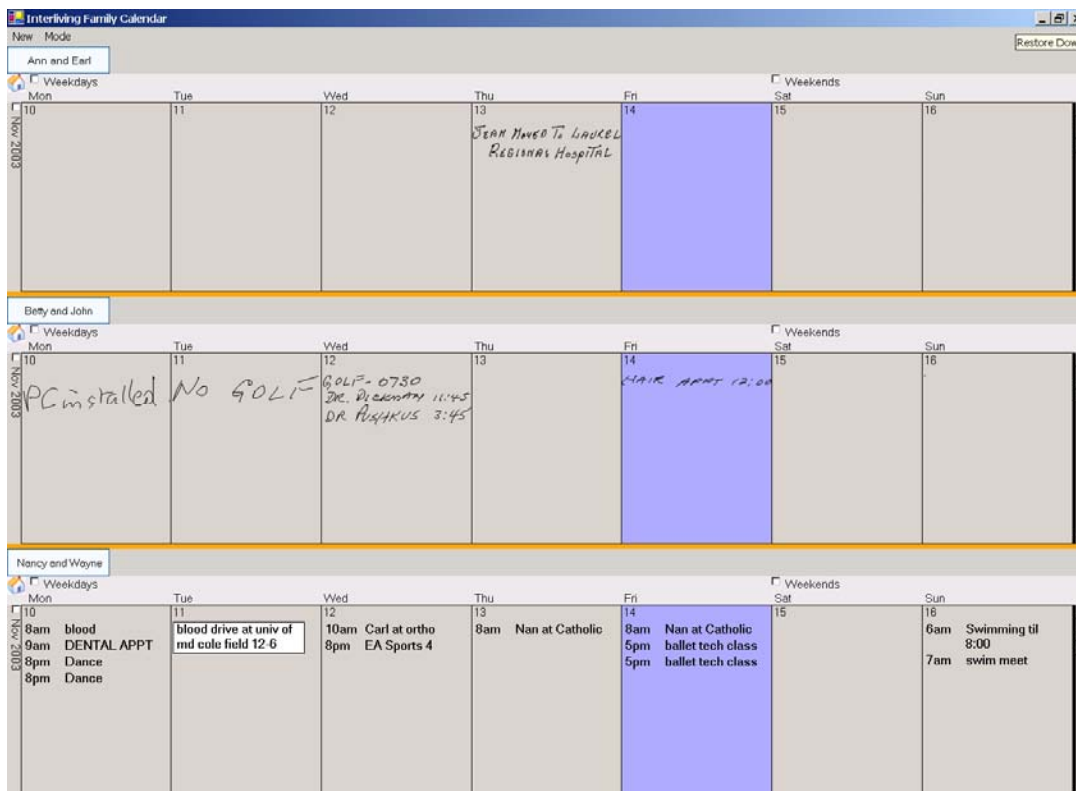


Figure 14: An early version of the interface with unnecessary controls, event descriptions displayed in too small a font and often clipped.

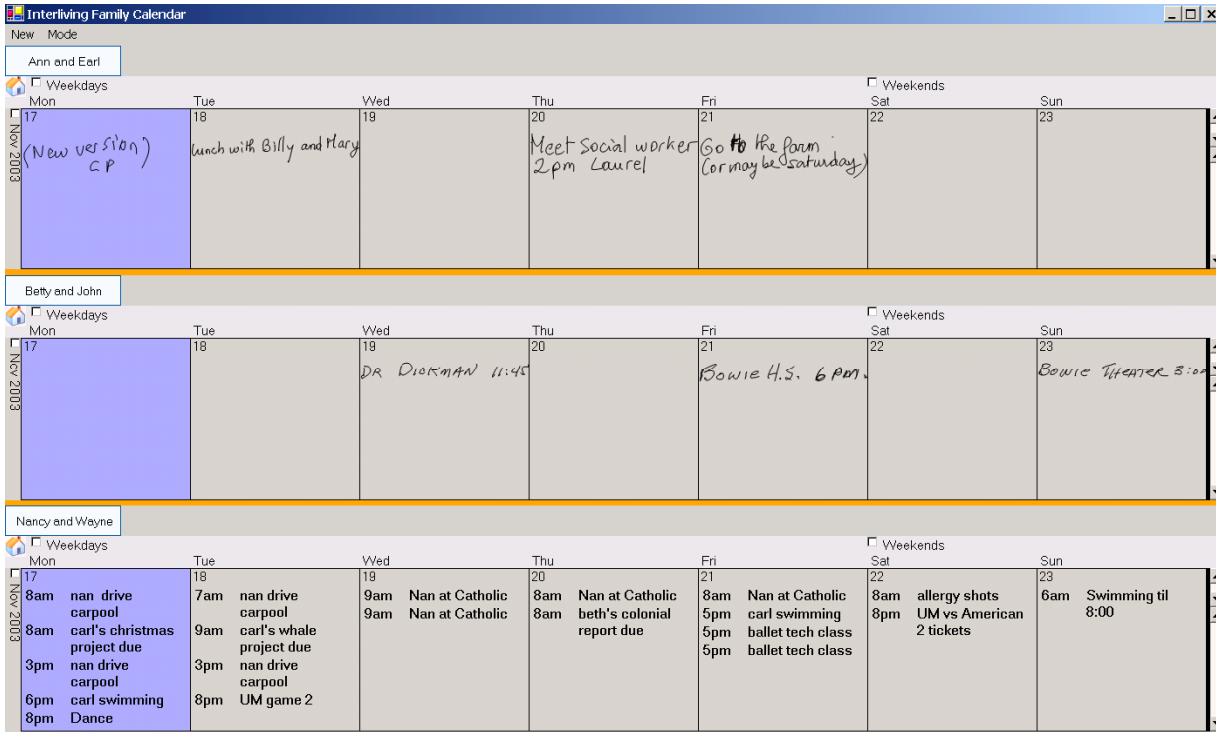
APPENDIX B: SCREEN PRINTS AT DIFFERENT STAGES OF THE FIELD TEST



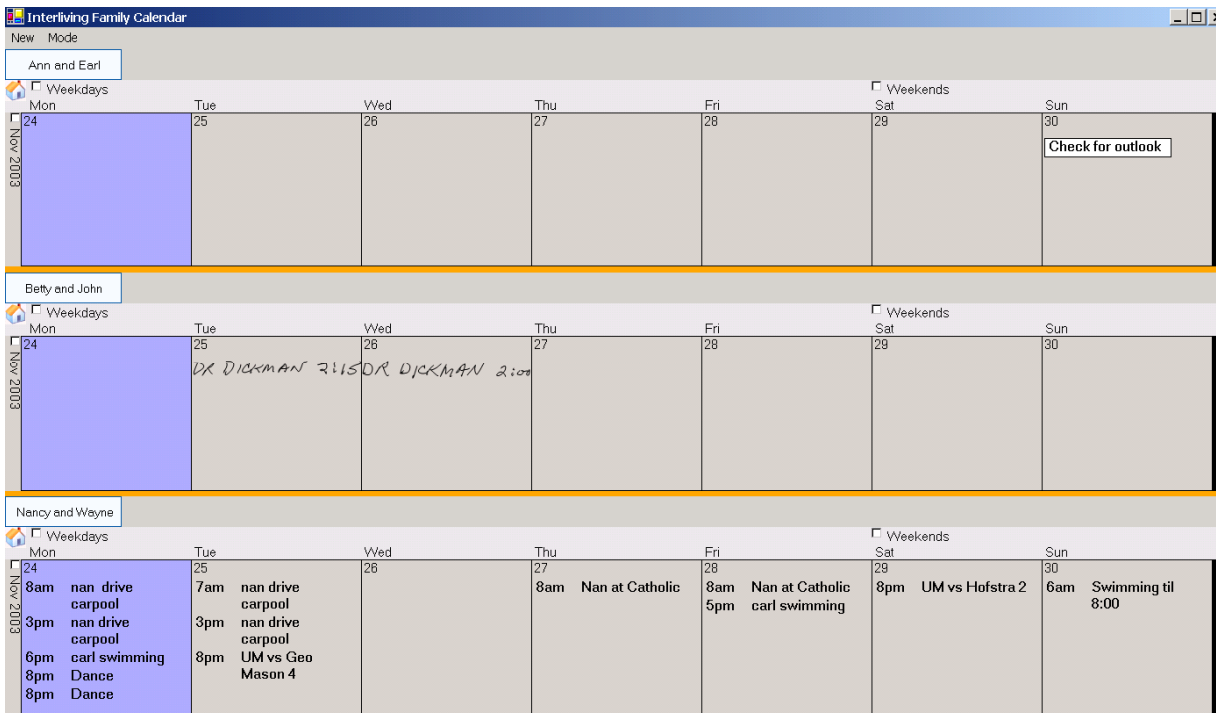
First Period – Week 1: the study run only in two households. Some events became duplicated later on.



First Period – Week 3: The Maternal grandparents join in. A close friend is ill and the Paternal grandparents become somewhat unavailable.



First Period – Week 4: The Paternal grandparents are more active. Normal use. Still some duplicate events.



First Period – Start of week 5: The Maternal grandparents switch to keyboard entry.

Interliving Family Calendar							
Ann and Earl							
Weekdays				Weekends			
Mon	Tue	Wed	Thu	Fri	Sat	Sun	
1 8am Go to Annapolis			4 7pm Choir practice		6 8am Carl's swimming meet	7 12am Carl's swimming meet	
Betty and John							
Mon	Tue	Wed	Thu	Fri	Sat	Sun	
		3 DR KATZ 10:150					
Nancy and Wayne							
Mon	Tue	Wed	Thu	Fri	Sat	Sun	
1 8am nan drive carpool 3pm nan drive carpool 6pm carl swimming 8pm Dance 8pm Dance	2 7am nan drive carpool 8am email Catherine 3pm nan drive carpool 5pm test 5pm test 2 9am LIM vs Wisc 2	3 9am Nan at Catholic 9am Nan at Catholic	4 8am Nan at Catholic	5 8am Nan at Catholic 5pm carl swimming 7pm lyrical ballet	6 8am Swim Meet at Fairland 10am math review at UPES	7 6am Swimming til 8:00 8am Swim Meet at Fairland 2pm dance til 3:00	

First Period – Week 6: More typing. Limited use by Maternal grandparents.

Interliving Family Calendar							
Ann and Earl							
Last entry was on: 1/26/2004 12:03:29 PM							
Weekdays				Weekends			
Mon	Tue	Wed	Thu	Fri	Sat	Sun	
8 JERAM'S APPT W/ DR. P. P. 11:30	9 CARL + BETH'S MUSICAL REHEARSAL 3:00 PM TIME?	10 HOME ALL DAY CATHERINE 10 AM	11 CHRISTMAS SWIMMING NO SWIM TUESDAY NIGHT	12 WORK ON CHRISTMAS CARDS (ANY 2 ALL DAY)	13 LOOK FOR CHRISTMAS	14 GO TO RAY'S CHURCH 6 PM - CHRISTMAS	
Betty and John							
Mon	Tue	Wed	Thu	Fri	Sat	Sun	
8	9 7 PM ERHS BAND	10 TEST - HAPPY NEW YEAR!	11 9:00 CP UPGRADE VISIT	12 IF YOU CAN READ THIS GIVE ME A CALL - MOM			
Nancy and Wayne							
Mon	Tue	Wed	Thu	Fri	Sat	Sun	
8 8am nan drive carpool 3pm nan drive carpool 6pm carl swimming 8pm Dance	9 7am nan drive carpool 3pm nan drive carpool	10	11 8am Nan at Catholic 3pm wayne drive carpool	12 8am Nan at Catholic	13 1pm party at greenbelt gym present for jaimie	14 6am Swimming til 8:00 5pm UM vs Pepperdine 4	

First period - Week 6. More handwriting but some of the Junior family events do not appear...

Interliving Family Calendar						
New Mode						
Ann and Earl						
Last entry was on: 1/26/2004 12:03:29 PM						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Dec 8 2003 JEDAN'S BAPT WIT DR. (P) 11:30	9 CARL + BETH'S MORN R. PAPER - 14 School TIME ?	10 HOME ALL DAY CATHERINE 10 AM	11 NO CHRISTMAS SWEEPING NO SWEEPING W/TH	12 WORK ON SWEEPING CAROL (MAYBE ALL DAY)	13 LOOK FOR CHRISTMAS C	14 MADON TO RAY'S CHURCH P.M. CHRISTMAS P...
Betty and John						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Dec 8 2003	9 JPM ERHS BAND	10 TEST - HAPPY NEW YEAR	11 PTOO CP UPGRADE VISIT	12 IF YOU CAN READ THIS GIVE ME A CALL - MGS		
Nancy and Wayne						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Dec 8 2003 8am nan drive carpool 3pm nan drive carpool 6pm carl swimming 8pm Dance	9 7am nan drive carpool 3pm nan drive carpool	10	11 8am Nan at Catholic 3pm wayne drive carpool	12 8am Nan at Catholic	13 1pm party at greenbelt gym present for jaimie 3pm	14 6am Swimming til 8:00 5pm UM vs Pepperdine 4

First Period – Week 7: This is the final week included in the paper calendars. Grandparents requested new calendars.

SECOND PERIOD

Interliving Family Calendar						
New Mode						
Ann and Earl						
Last entry was on: 1/26/2004 12:03:29 PM						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mar 22 2004 9am Pick up handicap tag for Jean	23 12pm Bill and Mary, Lunch here	24 9am Lumcheon date with Mary & Billy changed to Wednesday	25	26	27 9am Pot Luck Dinner at Church 6:00	28 9am Meet Jean Adams and family after church on Sunday
Betty and John						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mar 22 2004 CALL SAM ADKINS RE NEW DOORS	23 PKK OUT NEW DOORS	24	25 GASOLAN STORE FOR BBL BDAY ER HAIR APPOINT	26 ASTORIAN STORE FOR BBL B-DAY	27	28
Nancy and Wayne						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mar 22 2004 8am nan drive carpool 9am book fair nan drive carpool 3pm nan drive carpool 6pm carl swimming 6pm carl swimming 8pm Dance 8pm Dance	23 7am nan drive carpool 8am sprig picture day, free dress 4pm HCIL 7pm Dance	24 9am Nan at Catholic 9am nan at cua swim Carl 6pm Swim lesson w/ c smith	25 8am Nan at Catholic 3pm wayne drive carpool 3pm Carpool 4pm HCIL	26 8am Remit CC sales to Bookkeeping office 8am Nan at Catholic 5pm carl swim	27 9am orientation at ERHS	28 6am Swimming til 8:00

Second Period – Week 1: Active use

Interfving Family Calendar						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Ann and Earl 9:30 Take Jean Adams to Baltimore						
Betty and John						
Nancy and Wayne						
7am 7:30 meeting nan drive 8am carpool 8am send in snack for art show-finger food 2pm registration at ERHS. bring packet and papers required. see bulletin board 3pm nan drive carpool 3pm holy trinity art show 8pm Dance	7am nan drive carpool 10am Tim Armacost 3pm nan drive carpool 4pm HCIL 7pm Dance	8am Have John do Cash count 8am Cash Count 6pm swim Carl	8am Do Payroll cash in 160 hours for Gholam 8am Nan at Catholic 8am CLEAN FILTERS ON FURNACE UNIT 8am Mrs dove 3pm wayne drive carpool 3pm Carpool 4pm HCIL	8am half day out at 12:20 8am Nan at Catholic 8am Remit CC sales to Bookkeeping office 2pm coop 5pm carl swim 6pm lyrical	9am coop sale 9am beth and mom at kathleens 1pm clean up coop sale	

Second Period – Week 2: No data entry by Maternal grand parents. Some typed events overlap the handwritten one (but not found to be a problem as overlap disappears when the day is enlarged).

Interfving Family Calendar						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Betty and John						
Nancy and Wayne						
8am no school 8am denail appt bet and carl 6pm dance	8am no school 8am beth to wayne's work 8am Advance Geo Taylor 1 week 10am carl with Dr Economides at Wheaton. Get allergy shots 3pm Flute Lesson	8am bethany to orthodontis then to work - Wayne in late 8am no school 11am Call massanutten 12pm Take beth home, get her food 1pm Mats Meeting 4pm Call dad about pets 5pm Cut grass, movies w/ carl 7pm beth at concert	8am Philidelphia 8am no school	8am See David in Oklahoma 8am no school	8am Carl for allergy shots 3pm return from Philly	9am Easter

Second Period – Week 3

Interliving Family Calendar

New Mode

Ann and Earl

Last entry was on: 5/17/2004 9:05:35 AM

Mon	Tue	Wed	Thu	Fri	Sat	Sun
3 May 2004 LYNDIE & STEVE FOR LUNCH	4 PLACE ORDER FOR COMPUTER DESK HOTEL WITH DATE 4/26	5 TAKE JEAN TO THE STORE MID MORNING	6 11 AM. DR'S APT. (DR. CALLHAN)	7 YARD WORK DR APT - 2 PM D: VATE	8 SHOPPING FOR KITCHEN EQUIP	9 MOTHER'S DAY???

Betty and John

Nancy and Wayne

Mon	Tue	Wed	Thu	Fri	Sat	Sun
3 May 2004 8am Pay Luke and Bub 125 Each for 137744 8am DO PAYROLL 8am nan drive carpool 3pm nan drive carpool 6pm Carl to Swimming 7pm dance changed times from now until recital	4 7am nan drive carpool 8am Article in the Baltimore Sun re HCL 8am Tim and Jimmy 3pm nan drive carpool 7pm Dance	5 8am Before posting change invoice date to system date 8am carl orthodontist for spacers 9am Nan at Catholic 6pm Carl to Swimming	6 8am Nan at Catholic 3pm wayne drive carpool 8pm dance	7 8am Remit CC sales to Bookkeeping office 8am Nan at Catholic 5pm Beth at dance Special time 5pm Carl to Swimming	8 8am star quest in college park	9 8am star quest in college park

Second Period – Week 6: Data entry still active, but only in two households. End of the study.