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Awareness and Coordination: A Calendar for Families

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ABSTRACT

In this paper, we describe the AwareCo calendar visualization, designed to provide a means for awareness and coordination between family members with diverse schedules. The AwareCo calendar system does this by supporting the three major domestic calendar uses: *Coordination and Negotiation* of schedules, *Review and Reminders* of what is to come, and *Awareness* of the locations and activities of others. We first present the calendar's persona based design process. We then describe the visualization and interaction, and discuss how it supports family calendar qualities and uses.

General Terms

Design, Human Factors.

Keywords

Domestic Environments, Calendars, Families, Awareness and Coordination.

1. INTRODUCTION

Calendars are one of the most ubiquitous technology applications, and one of the best accepted to date [1]. Almost every commercially available office software package or email client includes some kind of calendaring program. Portable devices – including PDAs, cell phones, even mp3 players like the popular iPod – also usually have some kind of scheduling program as an expected feature. It has long been recognized that calendars are important to people, and that they play a major role in how people organize their work lives [1].

While the home is not the office, domestic life does require organization and management as well [9]. Especially in the case of families with school aged children, daily scheduling of home life can be a very complex and demanding chore. After-school activities need to be remembered, rides and carpools must be coordinated, special events must be planned for, and errands, dinner, homework etc. must all be fit into what rapidly becomes a complicated plan.

Calendars are an important part of the routine of family scheduling [1]. Families often have shared paper calendars that are used for planning out the day, week and month. These calendars are often covered in cryptic scribbles and notes, indicating trips, social events, special activities and day to day to do lists and reminders. They are frequently referred to and consulted over the course of a day, and are one of the major means by which families organize their combined schedules.

However, there are many problems families face in using calendars to do this shared scheduling work. Paper calendars do

not provide adequate space to indicate all the activities that often take place in a day. These calendars are not accessible outside the home, leaving household members without a reference to family events when planning at work or other locations. These calendars also do not allow the schedules of all family members to be viewed simultaneously – it is hard to tell who is where when, and how these events line up – making the planning of rides and dinner for example, much more difficult. These problems are only a small subset of the difficulties families routinely deal with when trying to organize their daily lives.

Technology holds a great deal of potential to help families with these difficulties. Since electronic calendars are one of the most accepted technologies in the office, it might mean that they could also be quickly adopted in the home as well, especially with the lowered cost of display technology and the ease of wireless networking. Many people will be familiar with electronic calendars from work, so the idea of a calendar that is managed this way will not be new to them. Networking could make the calendar available from anywhere. Notification systems could keep track of online versions of kids' activity and school schedules and automatically update the family calendar with changes. The same system could copy Mom and Dad's work schedules or PDA calendars over to the shared system. Recurring events could be entered once and copied by the system, saving time and effort. The flexibility of electronic information means that not only would changes be easier, but multiple levels of detail could be stored and quickly retrieved.

However, such a system will not be valuable without a way for family members to see and interact with the information. In this paper, we present the AwareCo calendar – a visualization of scheduling information for families. This paper unfolds by first describing an exploratory study run to gain an understanding of communication information in the home. We then describe our findings and illustrate them through a persona-based example. We discuss the qualities and uses of family calendars as seen in our



Fig. 1: Three real family calendars.

results and in related work. We then present our visualization and discuss how it supports the qualities and uses shown. Finally, we conclude by indicating improvements and future work.

2. METHODOLOGY

In order to gain a better understanding of how households manage communication information, including scheduling information, we conducted an exploratory ethnographic study. We recruited and interviewed twenty-nine people from ten different households. We intentionally selected diverse household types, including married parents with young children, retired parents with adult children, roommates, divorced couples with shared custody, common-law partners, blended families, and working couples with teenage children. Participants were from a wide variety of backgrounds, including students, retirees, programmers and office administrators. Most participants were at least moderately technically inclined. Of our ten households, five included at least one parent and school aged child living there at least part-time. We focus on these family households here, as their calendaring practices were the most interesting and complex.

Using semi-structured contextual interviews, we looked to gain an understanding of how households and individuals manage communication information. Calendars were a big part of this, as they are involved in many household jobs and routines. So although we were not looking specifically at calendars or schedules, we were struck by how often they were used in the day to day management of the household, especially in the portion of our participants that included parents and children who needed to coordinate their schedules for rides, carpools, dinner plans etc. Figure 1 shows three example family calendars from our study.

We analyzed our interviews and observations using an open coding technique which was intended to reveal similarities and differences between participant households. In general, we found that in spite of the diversity of our participant demographics and household compositions, there were many commonalities, including many ways in which calendars were used, and many problems frequently mentioned in association with them.

Rather than discussing our results in detail, we instead present them, along with related work, through an illustration. We will discuss the patterns we saw by presenting a persona family - an example imaginary family with real problems and desires, created for the purpose of grounding and inspiring design solutions. Following this, we will present a more general set of calendar qualities and uses. Finally, we will present our initial design, intended to support these characteristics, and to begin to address these problems.

3. PERSONAS

In order to ground our design of a household calendar, we used a persona-based design approach. This involved creating an

imaginary set of end users, each with their own personality, complex back story, desires and skill set. These personas are very specific: they have names, characteristics, wants and needs. Once personas are created and fleshed out, they are used to inform design decisions. e.g. “Will Aunt Tilly be able to find this button with her near sightedness?” “Will Jimmy still be able to get to his favorite website quickly?” etc.

Our personas were based on families and problems we saw during our study, [4, 6] combined with examples drawn from previous work, including [1, 2, 7]. In this way, while we were designing for one very specific family, the choices made should generalize to a larger set of users and problems.

3.1 The Alphabet family

Meet Anne, Bob, Catie and Dave Alphabet. The Alphabet family leads very busy lives, so managing their combined schedule is important to them.

Anne and Bob, the parents, both work. Anne is a part-time kindergarten teacher. She alternates teaching mornings and afternoons at two different schools. She also substitute teaches and tutors kids with learning disabilities out of her home. She is taking golf lessons and is a member of a monthly book club. Anne is the schedule boss of the household: she makes sure everyone gets where they need to go.

Bob is a full time architect for a small, but successful firm. He travels to building sites at least one week out of every six. When not traveling, he plays cards with a group of college buddies every second week, and also coaches soccer. Bob is very absent-minded, and relies on Anne to keep him organized.

Catie and Dave, the kids, are both very active. Catie, the youngest, is twelve and in grade six. She is a ballerina, and also plays soccer on the team that her dad coaches. She has many friends from her various activities, and always wants to go over to someone’s house to play.

Dave is fourteen and in grade eight. He loves music – he plays the trombone in both concert and jazz bands, and also take private lessons.

Between two different school schedules, Dave’s rehearsals and concerts, Catie’s practices and recitals, the never-ending volunteer requests that go along with such activities, and their own work and social schedules, the Alphabets have their hands full.

Every evening, Bob and Anne sit down at the kitchen table and talk about the upcoming day. They figure out which activities the kids need to get to, and try to fit these events around their own schedules. This is a sometimes a really long process, involving both their personal daytimers, printed schedules from the kids’ activities, scribbled carpool plans, etc. It often requires a lot of negotiation – who will leave work early to get Catie to ballet, who will drop Dave off at his early morning rehearsal, etc. It also includes fitting shared events into the day, for example, when dinner will be, since Anne likes everyone to eat together.

In the morning, Anne and Bob will review the schedule created the night before, reminding themselves and each other of what they need to do, in what order, and at what times. Anne in particular will make sure that Bob remembers what the plan is, since he’s prone to forgetting. She and Bob also talk through the

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day's plans with the kids as they eat breakfast, letting them know what is happening. e.g.

Anne: "Catie, today after school you need to come right home on the bus so Dad can take you to ballet, okay? Sarah's mom will bring you home."

Catie: "Do I need to bring my new shoes?"

Anne: "No, your teacher said you won't need those until next week."

During the day, Anne is often home, and likes to keep track of where everyone is. She will use the plan from the prior evening to know when her family members should be arriving home, or transitioning between activities. This awareness makes Anne feel more connected to her family [6], and also helps her make sure everything goes well. For example, Anne sews costumes for Catie's ballet, so sometimes she sends or picks up samples from the teacher. If Bob is driving Catie to ballet that day, she will try to call him just as he gets there to remind him to drop off the sample costume she has given him. Otherwise he will forget, and Anne will have to take it later. The kids also use the agreed upon schedule for awareness. They like knowing when Mom and Dad will be home, or when dinner will be. e.g.

Dave: "Mom will be home late tonight, she has her golf game. We should eat a big snack or we'll be hungry."

Currently the Alphabet family uses a paper calendar hung on their kitchen wall to manage this scheduling. They use coloured highlighters and pens, along with symbols and notations to mark different kinds of events so they stand out. For instance, Bob's work trips are always marked with big arrows and a blue line so Anne and the kids can clearly see when he'll be away.

However, this paper calendar is not a great system. Bob in particular, is really bad about writing things on the calendar. e.g.

Bob: "I can't take Dave to his rehearsal that day, I'm out of town."

Anne: "Bob, you didn't put it on the schedule, how am I supposed to know? Now I need to reschedule my golf game with Linda."

Bob: "Sorry, I always forget!"

They are constantly combining this calendar with a myriad of others: work calendars, activity schedules, post-its for carpools... these issues often lead to problems. It is very difficult to fit all the events into the spaces provided. This makes it hard to mentally combine everyone's schedules and figure out where the free spaces are, or what is the best way to manage rides, for example.

The family would like a way to look at everyone's schedule at once to easily see when people are free and where conflicts exist. They would like to be able to use this calendar for their evening planning sessions, the morning review and reminders, and finally, for maintaining awareness throughout the day of the schedule of the rest of the family.

4. QUALITIES

The calendars we saw had many qualities in common. These qualities are inherent to the calendar's usefulness, and should be supported in any technological substitute.

4.1 Shared Public Artifact

First of all, family calendars are shared artifacts. While each household member may have one or more personal calendars (e.g., daytimer, PDA, electronic work calendar, personal wall calendar etc.) the family calendar is for everyone. Anyone may add appointments or events, and in fact are usually encouraged to.

As a shared artifact, this calendar is publicly located in the home. In our study, most family calendars were in the kitchen, as it was usually the main hub of the home: a place where every family member would spend at least a portion of their day, and would likely pass through in the morning and evening – two of the crucial times for scheduling. In one home, the calendar was above the computer desk because it was the same kind of place for that family.

The shared public nature of these calendars means that any technological substitute needs to have the same qualities. This is also one of the reasons why office email applications such as Microsoft Outlook are unable to support family calendaring practices. A calendar on a PC or a PDA is not easy to share, nor is it publicly accessible. For an electronic calendar to work in the home, it would need to be able to be displayed in the same public, shared areas (e.g. the kitchen) that paper calendars are.

4.2 Calendar Manager

These calendars often have a manager – that is a single person in the household who takes on the responsibility of trying to keep the calendar up to date [1, 7] This person, like Anne in our persona family, is the primary family organizer, the one who makes sure everything gets done. While anyone may contribute to the calendar, this person is usually the only one who will remove or edit events placed onto the calendar by other people. They do this in order to better organize the schedule as a whole.

This person, like Anne, will encourage other people to put all their appointments up on the family calendar so that everyone is aware of them, and so that problems and conflicts don't occur. In one of our study households, the manager had a rule that "if it's not on the calendar, it's not happening", meaning that all events had to make it onto the shared calendar in order to be integrated into the family's planning. Our participant, however, reported that this didn't really work – her two kids were constantly forgetting to put their events on the calendar, and the family was often scrambling to get organized at the last minute as a result.

This means that the designed calendar needs to be able to be primarily managed by one person, and yet should be able to accept changes from anyone. It would also suggest that showing some kind of trace of changes made would be beneficial, so that the manager can easily see, and if needed, edit, any changes or additions made by other members of the household.

4.3 Shared and Personal Events

Family Calendars will contain both shared events, such as family trips or parties, and personal events, such as a work trip or

dentist's appointment, since such personal events affect the tightly woven family scheduling process. Therefore any appointment on the calendar could belong to everyone in the family, to one individual only, or to a combination of people.

This means that an electronic calendar would need to be able to show not only events belonging to one person, as an office calendar does, but events belonging to any combination of people in the family, and would need to be able to show these connections clearly. This includes peripheral involvement, such as rides, as this is very important, and very hard to show on a traditional paper calendar, and almost impossible in most electronic ones.

4.4 Rich Annotations and Cues

Events on the calendar are usually marked with a rich set of annotations and cues developed to maximize the small space available on typical wall calendars and to help readability at a glance. Highlighting, circling, arrows, horizontal and vertical bars and lines, marking appointments with stars and using different coloured inks were only some of the techniques we saw.

These annotations allow people to put personal meaning and detail onto their calendars. For instance, in one of our study families, Mom would mark with a blue highlighter the days when she had custody of her teenage son, so she could glance at the calendar and see when he would be with her. Other typical examples include surrounding special events, such as birthdays, with stars to make them stand out, or writing tentative dates in pencil so they can be changed more easily. These personalisations are valuable to families in that they have meaning to them, and help them imbue their calendaring practices with their own personalities and special information.

Since these annotations are so valued, it's important that an electronic replacement allow for them in some form. Electronic calendars don't typically allow for much personalization – there are simply text fields to fill out, or boxes to check. In the office, this is sufficient. However, in the home these personal touches are more valued and often more meaningful, giving the calendar a life of its own, and making it a record or archive of the year rather than simply a tool for planning.

5. USES

We believe that calendars are used in three specific ways within the routines of the home. These uses support the smooth functioning of the family. We will present each of these in turn, along with what each mean to the design of a family calendar.

5.1 Coordination and Negotiation

As with Anne and Bob's evening planning session, the first major calendar use is for coordination and negotiation of schedules within the family. The calendar is used as a reference point for planning, and often as a record of what has been decided [1]. This process involves seeing what has already been scheduled, adding or changing appointments and events, and negotiating errand, ride and other responsibilities as needed.

This process of coordination and negotiation needs to be supported in design. The calendar should be easily viewable by several people at once, and should be easy to gather around and

discuss over. Family members often gesture over appointments [1, 7] when discussing them, for example pointing or circling, and this natural negotiation technique should be retained.

This means that, for example, a small PDA based system would not be suitable, as it cannot be easily shared and talked over. A typical PC based system is also not suitable, as it is not easy to share a single small monitor. Plus, in both of these cases, access to change or add information, or even to simply adjust the view is not equal – only one person controls the stylus, mouse or scroll wheel, even if they are taking turns or agreeing upon the changes. It is much more natural to allow either party the ability to change or adjust the view, as is possible with paper calendars.

5.2 Reminder and Review

Family calendars are also used for review of the upcoming day, week or month. Family members look at the order of events to sort out their own personal schedule in relation to everyone else's and to their family responsibilities. In our persona family, Anne and Bob review the daily plan with each other and the kids as everyone is getting ready to leave for work or school.

The calendar also serves as a reminder and to-do list system. Seeing what events are on that day, while still in the context of the home, reminds people of things they may have forgotten related to the schedule. This could include permission slips to return, items or clothing to take along, or errands to run. Seeing what events are on the horizon serves as a kind of to-do list of things that need to be done before certain events or activities take place. For example, if a family road trip is upcoming, the car may need a tune-up before leaving, an errand that needs to be incorporated into the calendar at some time between now and departure.

These uses indicate that a family calendar needs to support both a detailed view for review of the day, and an overview to see events on the horizon. The detailed view should contain not only times and places, but also any little reminders of things to take, or information to remember in association with that appointment. The overview needs to show what is upcoming, and how soon it is, and to allow for smooth movement into the details of and associated reminders for that appointment.

5.3 Awareness

The third major calendar use we found was for awareness. Awareness of the rest of the household is important to people in several ways, including scheduling, but also including intangibles like comfort and feeling connected to loved ones [6]. Family members like to know where the others are, what they are up to, and when they will be coming home.

Calendars are used to support this awareness throughout the day. A teenager getting a snack out of the fridge after school may glance at the calendar to see what activities his parents have that evening, so he can guess when dinner might be. A worried mother might check the calendar to see if her son had any after school activities scheduled that would explain why he's not home from school at the usual time. This awareness also helps family members contact each other at appropriate times, such as Anne's reminder calls to Bob just as he is getting to Catie's ballet class.

It is also important that the calendar be either portable, or that it be placed in a common location within the home. Not all

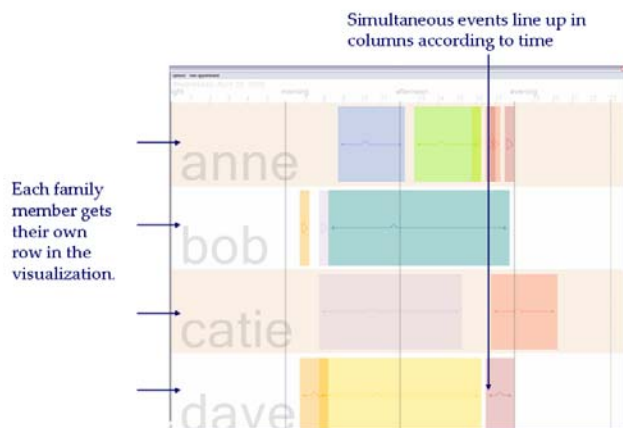


Fig. 2: The AwareCo calendar shows multiple schedules simultaneously

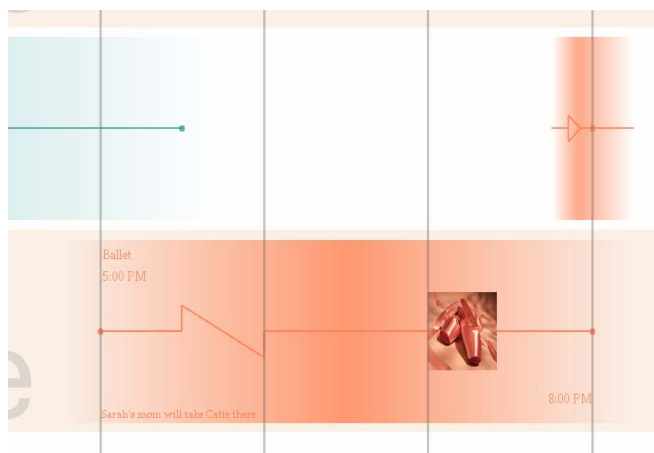


Fig. 3: Rides and carpool plans are shown on the AwareCo calendar.

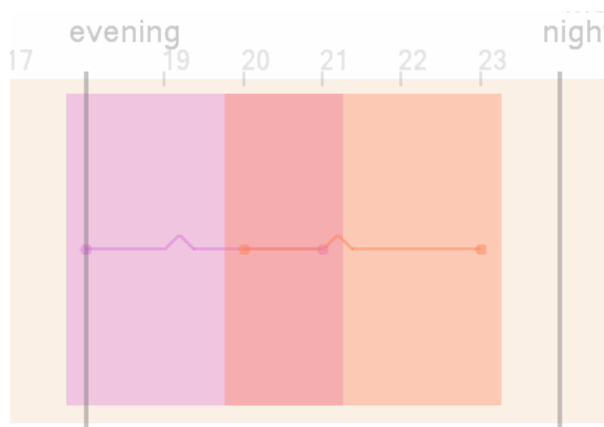


Fig. 4: Conflicts and overlapping appointments are easy to spot

scheduling tasks take place in one room. Ideally, a calendar should be able to be carried from room to room, as people can do with a paper one, so that it can be easily compared to online

schedules in the computer room, exam schedules in the kids' rooms, and activity schedules on the fridge. If this mobility is not possible or practical, it is important to place the calendar in the best possible location for sharing and discussing it, which is usually the most frequently trafficked and used room in the house. In North America, this is often the kitchen, so the calendar should be designed to work in this kind of environment.

6. THE AwareCo CALENDAR

These uses and qualities, combined with our persona-based design approach, lead us to create the AwareCo calendar. This is a visualization designed specifically for awareness and coordination between family members with diverse schedules. The AwareCo calendar is shown in Figure 12.

Shared and Public

The AwareCo calendar is designed to be displayed on a large public display in the kitchen or other common, high traffic area in the home. The public display should be touch sensitive, since using a mouse and a keyboard in such a setting is not practical. Such a set up would allow family members to easily share and talk over the calendar, using gestures over the display to elaborate on their discussion. A touch screen means that any family member can walk up to the calendar and start interacting with it. The Calendar is therefore a *Shared Public Artifact*.

Multiple Schedules at a glance

The AwareCo calendar's primary goal was to display the schedules of everyone in the family at once. It accomplishes this, as we can see in Figure 2, by assigning each family member a horizontal row on the y axis. Time is shown on the x axis, creating columns of appointments. Each coloured rectangle overlaid on the rows is an appointment or event. The length of the rectangle corresponds to the duration of the appointment, so short rectangles mean short appointments, while long term events such as trips may have blocks that extend over many screens. Events that involve multiple people are copied in all the corresponding rows. Rides or carpools are shown as smaller squares with triangles in the middle, and are lined up vertically with the start or end of the appointment they are connected to, as shown in Figure 3. In this way, the calendar shows *Shared and Personal Events*.

Lining events up over time makes it very easy to see who is where when and to immediately identify conflicts, since they will cause overlapping squares, as seen in Figure 4. This is a huge benefit over traditional paper calendars, where the squares are too small to provide this level of detail and synchronicity.

This ability to see everyone's schedules at once is very helpful for one of our major calendar uses: *Coordination and Negotiation*. The process of planning out the details of the next day is made much easier when all the conflicts and free spaces are shown. This visualisation also allows for *Reminders and Review* since it is possible for any one person to read along a row and easily see their own schedule for the time period shown, and to examine details for any upcoming event. It also supports *Awareness* by displaying where the entire family is at any given moment, and when the appointments or events they are involved in will start or end.

View Levels

The AwareCo calendar supports many different view levels, in terms of what times are shown. In Figure 5, we can see that the

The week view (Fig. 5d) provides an overview. It will support both *Coordination and Negotiation* and *Reminders and Review* tasks. It allows families to coordinate their schedules over more



Fig. 5: The different view levels available in the AwareCo calendar.

calendar can display several hours at once, an entire section of a day (e.g. morning, afternoon or evening), an entire day or a week. These different levels of view all work off of the same layout principles so they are easy to understand.

The hour view (Fig. 5a) provides the most detail. It shows where each family member is, when their current appointment ends, and when their next one begins. The AwareCo calendar also provides an ambient version of the hour view (see Figure 6), which will turn on when no one is interacting with the calendar. This ambient view shows very clearly where “now” is by a thicker dotted line, and will gradually change over time to reflect the current situation. This view in particular is good for *Awareness*, as family members can see at a glance where everyone is, and when they should be home, simply by when the boxes end, and their colour.

The section view (Fig. 5b) shows part of a day at a time – a morning, afternoon, evening or night. It gives slightly less detail than in the hour view, while also providing a broader view of the day. This view is especially useful for *Reminders and Review* since it has several hours at once, but also has a lot of detail available.

The day view (Fig. 5c) shows 24 full hours at once. It is designed to support the *Coordination and Negotiation* calendar uses. Family members can see the entire current or upcoming day at once, and decide how to best schedule rides, errands, and common events such as dinner, which can all then be added to the calendar.

than just a day at a time, helping with negotiation. It also provides a review of how busy the week is, and a reminder of what is coming up in the next few days.

Visual Representation

The characteristics of each appointment rectangle represent important information about the event itself. The line and the dots at either end show the declared time for the event. As shown in Figure 7, if line is solid, the appointment is marked as confirmed. A dotted line means the appointment is tentative – it has been “penciled in”.

Each line is broken by a symbol. A triangle, as mentioned above, means that the rectangle represents a ride or carpool time connected to another event. A sharp wave indicates a one time only or special event, such as a trip to visit Grandma, Bob’s work picnic, or Dave’s jazz concert. A curved wave represents a more routine or recurring event, such as work or school, Catie’s ballet practices, or Anne’s golf lessons. These are shown in Figure 8.

The faded edges of the rectangles, evident in the section and hour views, indicate the uncertainty inherent in appointments. (Figure 9) For example, a ballet practice may officially start at 4:00, but Bob may drop Catie off any time between 3:45 and 4:15 depending on how traffic is, if she was late at school, or if he got off work early.

Each appointment also has a picture and colour associated with it. These are chosen by the family, and are intended to provide them with a lightweight way of personalizing their calendar markings, as this is an important quality as presented earlier.

“Now” is always shown on the calendar as a thicker dotted line, like in the ambient view, in order to help people orient themselves, and quickly find the current week, day, hour etc.



Fig. 6: The ambient view provides constant, at a glance awareness.

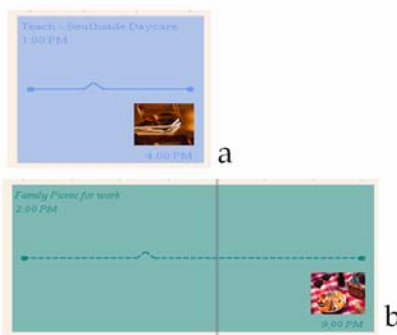


Fig. 7: Tentative events are indicated using a dotted line and italics (b), while confirmed events are shown using a solid line (a).

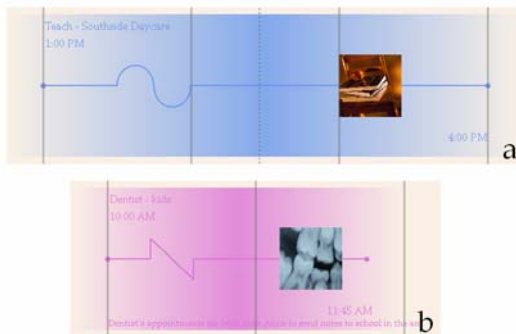


Fig. 8: Routine events are indicated with a curved wave (a), while one time or special events are marked with a pointed wave (b).

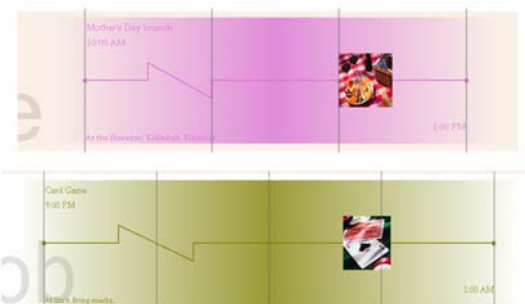


Fig. 9: The natural uncertainty in event start and end times is shown by a gradual fade

Since all these symbols are relatively easy to understand and read once they are known, they will provide the family with personalization, detail and a better understanding of their schedules. These visual characteristics support *Rich Annotations and Cues*.

Gestural Interaction

Since the calendar is designed for use in the home, on a large touch sensitive screen, it would make very little sense to require a mouse and keyboard, or to use typical interaction techniques. In order to make it as easy as possible to move between the views and to move in time, all interaction with the AwareCo calendar is designed to be gestural. Dragging a finger a short way from right to left on the display moves the displayed time forward one small section. A longer drag moves it forward an entire screen, or slice in time. The same gestures in the opposite direction move backwards in time a little bit, or a full slice. How much time the gestures move depends on the view. For instance, in the hour view, a short gesture moves time forwards or backwards by half an hour, while a long pull moves an entire hour. In the day view, a short pull moves forwards six hours, or a single section of a day (morning, afternoon etc.) while a longer gesture will move time by an entire day. All moves within time are animated, in order to provide context and a connection between screens.

To move between view levels a vertical gesture is used. Dragging a finger vertically downwards over a specific appointment or time period zooms in on it by one level. Dragging vertically upwards over a square moves out one level over that appointment or time period. So it is easy to zoom out to the week view, quickly scan to find the appointment or time period of interest, and then rapidly dive back down to working with it in detail. This kind of quick, simple interaction is designed to make the process of working with the calendar as easy as possible, so that the real work of scheduling events can take place.

Appropriate and Available Detail

To see more detail on any appointment or event, the family member simply needs to touch it once. The detail is displayed directly on the appointment rectangle, and is suitable for the view level (Figure 10). For instance in the week view (Fig. 10c), the detail shown is a picture representing the appointment, along with lines connecting the appointment to the ride triangles associated with it. At the day level (Fig. 10a), the event name, start and end times, and picture are displayed, and all associated events are darkened to show the connection. At the section or hour level (Fig. 10b), comments are added, which could contain reminders or simply more detail about the event. It is possible to zoom in or out over a selected event without losing the detail view. Tapping the item once more will hide the extra details.

So why not show all the detail all the time? First of all, this would result in a cluttered display, where everything is competing for attention. Secondly, since the AwareCo calendar will be large and publicly displayed in the home, privacy becomes a bit of an issue. Many families do not want their guests seeing all the details of their lives. By reducing appointments to coloured blocks, guest see little more than a pretty overall picture, rather than seeing, for example, that Anne has a doctor's appointment tomorrow morning. The colours are still meaningful and helpful to the family, but since they are personally assigned, they have little or no meaning to outsiders.

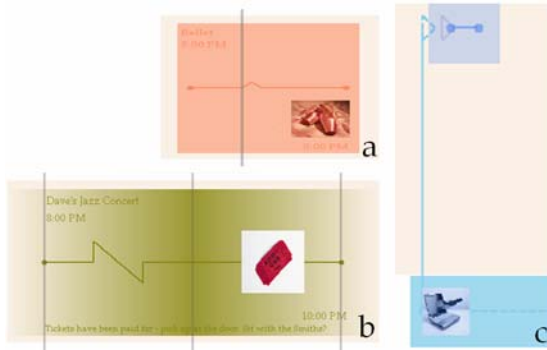


Fig. 10: Detail is always available at an appropriate level.

Quick Editing

A quick double-tap on any appointment will open it for editing in a separate window, as shown in Figure 11. With the exception of the event name and comments, all changes and additions can be made with a simple touch. For example, adding a family member to an event involves tapping on the white square containing their name once. Tap again and they are added as the driver there. Tap twice to add as driving back, three times to add as driving both ways, and finally the fourth tap removes them from the appointment all together. To switch between a tentative event (penciled in) to a confirmed one or vice versa takes nothing more than tapping on either the pen or pencil icon. Selecting a picture or colour is done by touching the appropriate squares. Times can be moved easily using the arrows.

While we definitely do not believe this is the best appointment editing or adding system possible, it was merely intended as an initial prototype to show how much could be done with simple touch and gestures, and to allow for appointments to be entered for testing. Ideally, the AwareCo calendar would integrate other calendars. However, it is important to include the ability to quickly add to or edit the calendar. While valuable for all family members, this especially supports the *Calendar Manager* as they are the one who will most often work with the calendar.

7. FUTURE WORK

Although the AwareCo calendar is a good beginning, there are still many improvements to be made. First of all, the calendar should be networked so that it can be viewed and edited over the web from work, or even possibly on a PDA or cell phone. This will allow for family members to be more aware of each other and to be more coordinated even when not at home. The calendar should also use this networking ability to connect to online calendars from school, work, kids' activities etc. and automatically update the main family calendar with changes. This is the major improvement that needs to be made, and will greatly increase the usability and value of the AwareCo calendar system.

Beyond this, there are some visual and interaction improvements that would enhance the visualisation. First of all, it would be great to be able to use gestures not only to move about the space, but also to edit or time shift an appointment. An overview layout is also needed – whether this takes the form of a more typical month view, or a small overview layout incorporated into the main view. This would allow for better movement between dates that are far

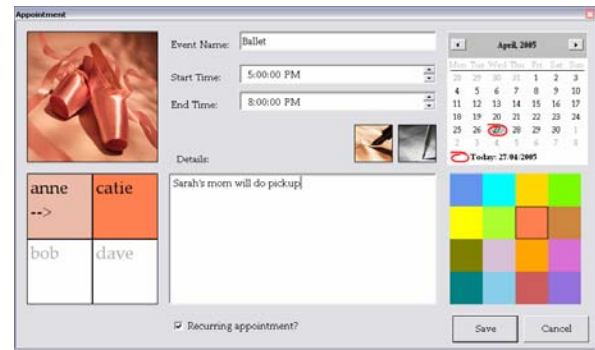


Fig. 11: Adding new events and editing

apart, and would let the family, especially the main calendar manager, have a better sense of upcoming appointments. It would also be good to provide a visual trace of recent changes or additions, so that family members can easily see what is new, and the manager can monitor changes and edits.

Finally, adding additional personalization options would be beneficial. For instance being able to modify the amount of uncertainty in the start and end times of an appointment could be very useful – e.g. to indicate how long the drive is to a certain event. Being able to choose which depth of view is the default ambient view (e.g. day view rather than hour) would also be helpful so that households can choose the one that best meets their needs.

Our next steps include incorporating this calendar into two demonstration home spaces, both in our lab and a neighboring one, and using feedback received from this experience to improve the AwareCo visualization. After a second design iteration, we would like to deploy the AwareCo calendar to an actual family and see if it is able to support their natural calendaring practices.

In conclusion, technology has a great deal of potential for use in family calendaring. Further work still needs to be done to understand exactly how best to use technology and visualization techniques to support domestic practices. The AwareCo calendar visualization is a first step towards providing awareness and coordination for families managing diverse schedules.

8. REFERENCES

- [1] Crabtree, A., Hemming, T., and Mariani, J. (2003) *Informing the Development of Calendar Systems for Domestic Use*. In *Proceedings of ECSCW '03*. Kluwer Academic Publishers, pp. 119-138.
- [2] Crabtree, A. and Rodden, T. (2004) *Domestic Routines and Design for the Home*. In the *Journal for CSCW*, Vol. 13. Kluwer Academic Publishers, pp.191-220.
- [3] Edwards, W.K., Grinter, R.E. (2001) *At Home with Ubiquitous Computing: Seven Challenges*. In *Proceedings of Ubicomp '01*. Springer-Verlag, pp. 256-272.
- [4] Elliot, K., Neustaedter, C. and Greenberg, S. (2004) *Time, Meaning and Ownership: The Value of Location in the Home*. Technical Report 2004-761-26, Department of Computer Science, University of Calgary.
- [5] Hindus, D., Mainwaring, S., Leduc, N., Hagstrom, A and Bayley, O. (2001) *Casablanca: Designing Social*

Communication Devices for the Home. In *Proceedings of CHI '01*. ACM Press, pp. 325-332.

- [6] Neustaedter, C., Elliot, K., Tang, A. and Greenberg, S. (2004) *Where are you and when are you coming home?: Foundations of Interpersonal Awareness*. Technical Report 2004-760-25, Department of Computer Science, University of Calgary.
- [7] Taylor, A.S., and Swan, L. (2005) *Artful Systems in the Home*. In *Proceedings of CHI '05*. ACM Press, pp. 641-650.

- [8] Tullio, J., Goecks, J., Mynatt, E. and Nguyen, D.H. (2002) *Augmenting Shared Personal Calendars*. In *Proceedings of UIST '02*. ACM Press, pp 11-20.

- [9] Venkatesh, A. (1996) *Computers and Other Interactive Technologies for the Home*. In *Communications of the ACM*, Vol. 39, No. 12. ACM Press, pp.47-54.

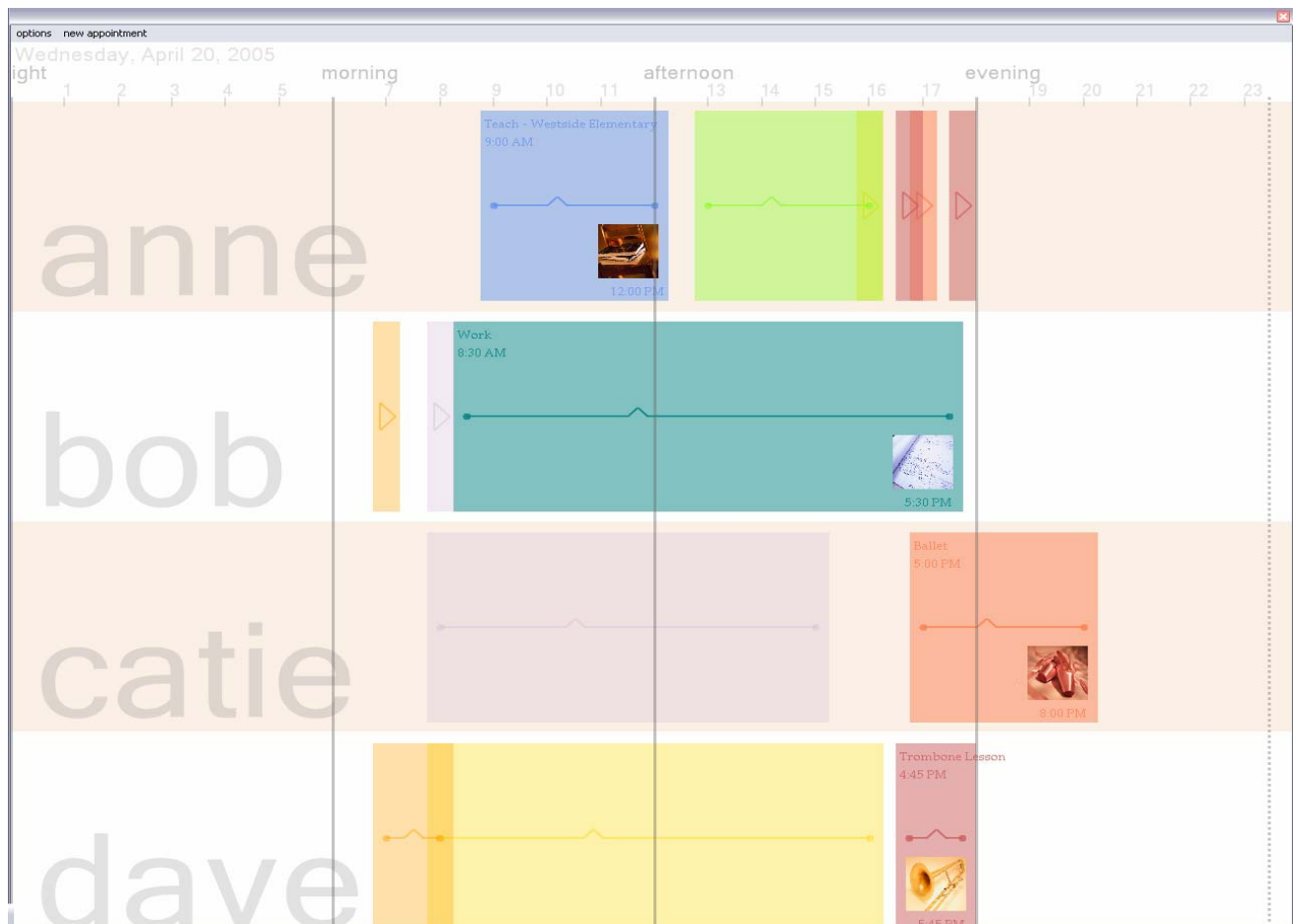


Fig. 12: The AwareCo Calendar Visualisation