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"The Calendar is Crucial": Coordination and Awareness through the Family Calendar

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Everyday family life involves a myriad of mundane activities that need to be planned and coordinated. We describe findings from studies of 44 different families' coordination routines to understand how to best design technology to support them. We outline how a *typology of calendars* containing family activities is used by three different types of families—*Monocentric*, *Pericentric*, and *Polycentric*—which vary in the level of family involvement in the calendaring process. We describe these family types, the content of family calendars, the ways in which they are extended through annotations and augmentations, and the implications from these findings for design.

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1. INTRODUCTION

Family life involves the continual organization and coordination of various activities on an everyday basis, including school events, extracurricular activities, family outings, and appointments [Beech *et al.*, 2004, Sellen *et al.*, 2004, Neustaedter *et al.*, 2005, Taylor and Swan, 2005]. Coordination routines are intermixed amidst everyday life and extend beyond the home to include scheduling while at work or mobile [Crabtree *et al.*, 2003b, Beech *et al.*, 2004, Sellen *et al.*, 2004]. They also involve the use of a variety of "tools": from calendars [Brush and Turner, 2005, Neustaedter and Brush, 2006], to notes and lists [Swan and Taylor, 2005], to a myriad of technologies including telephones, mobile phones, email, and even instant messaging [Beech *et al.*, 2004, Neustaedter *et al.*, 2005, Brush and Turner, 2005]. Through these tools, families develop their own organization routine [Swan and Taylor, 2005].

Despite this diversity, our focus in this article is on understanding *family calendaring* as a part of everyday family coordination. A natural question is: why study family calendars as opposed to the many other domestic artifacts and tools that families use? The fact is that family calendars are almost always the central family coordination artifact (Zimmerman *et al.*, 2001 and our results reveal this) rendering family calendars "crucial."

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A sample of quotes from our participants illustrates this:

> *"The calendar is crucial; it'd be a disaster without it. Anyone can look at it." – Samantha (P14), Mom and Administrative Assistant*

> *"[The family calendar] is extremely important, we are involved in so many different events I have to be able to map it out or we would forget places, dates, times." – Mona (P20), Mom and Teacher*

> *"When you have kids in school you HAVE to have a schedule…there's just too much…You can't plan anything without looking at the calendar because if you do you're out of luck, something will come up…when you have kids it's not something you can just miss." – Doug (P9), Dad and Construction Manager*

One of our participants even faced the trauma of losing her family calendar in a house fire with no backup or record of when or where the family's activities took place:

> *"I couldn't live without [the family calendar]…at the hotel I didn't have my calendar up for a month and a half…I was taking two university courses…so I just went with the flow, I went on autopilot…It just puts everything into perspective…it's like my brain, you know." – Kayla (P19), Mom and Homemaker*

We are not saying that other coordination tools are any less valuable than the family calendar or not as worthy of study. Naturally other artifacts are used in conjunction with the family calendar for coordination and are often very important (for example, see Swan and Taylor, 2005 or Ludford *et al.*, 2006 for the role that lists play). Rather than provide breadth coverage of family coordination including analyses of *all* the tools and techniques that are used, we focus on family calendaring so that we may provide a detailed and thorough analysis of this specific facet of family coordination. While our own motivation is to design an effective digital family calendar, we purposely do *not* focus this paper on presenting a digital family calendar design, though we do briefly describe our design efforts at the article's conclusion. The article's focus is instead on detailing the core social practices that exist as part of current family calendaring routines where our analysis investigates the use of both paper and digital calendars.

To this end, we have studied the family calendaring routines of 44 different families. Our results show that families use one or more calendars to coordinate and stay aware of family activities. These calendars form a *typology of calendars* containing six different calendar types differentiated by their purpose and use within families' coordination routines. Families typically have one calendar that is thought of as the *primary family calendar* because it is central to the family's routine; other calendars we refer to as *secondary calendars.* Family calendaring involves a number of steps surrounding scheduling, checking the calendar, and coordinating, which we formalize. The *primary scheduler* is the family member who is most responsible for the family calendar: this person schedules events and frequently checks the calendar. *Secondary schedulers* are other family members who have a varied but lesser level of involvement with the calendar. *Monocentric families* have the least amount of involvement by secondary schedulers where the primary scheduler is the only person to schedule activities and tells other family members of relevant events. *Pericentric families* have more involvement by secondary schedulers where they begin to engage in the coordination routine by either scheduling or checking the calendar infrequently or asking about calendar contents. *Polycentric families* have the most involvement by secondary schedulers where they are frequently checking or adding to the calendar.

We have also performed content analysis to investigate what information is being placed on the family calendar and the ways in which calendars are extended and

appropriated by families. We found the family calendar is used to record *events that affect the family,* where the amount and type of events do not differ based on family type. Rather, families have a range of idiosyncratic needs and styles when it comes to recording events on the calendar. Calendars, like many tools in life, do not always get used as may originally be intended by designers. We found five different ways in which family calendars are extended through *annotations and augmentations* in order to meet the needs of families. Here families leave an imprint of changes as the calendar is updated, abbreviate content like names or locations, use color for important events or particular family members, write in the margins or attach extra information, and draw pictures or symbols. These techniques are used not only to circumvent space limitations, but to also make calendar information available at-a-glance.

It is vital to realize that the processes and routines we present are by no means static and have evolved, in many cases, over years of trial and error, repetition, and iteration. Family routines do not simply happen; rather, they come about as a result of households trying to organize their daily activities [Hughes *et al.*, 2000]. Our goal then is to first understand them and then suggest ways to design family calendars that allows them to naturally fit in and extend domestic routines. This knowledge immediately forms a requirements analysis for designers and practitioners of family calendar designs. It also provides a common vocabulary for discussing family calendars, and gives a better understanding of the context [Dourish, 2006] in which digital family calendars will eventually reside.

We begin by highlighting the existing knowledge that has been obtained about workplace and family calendaring. Next, we detail our methodology by describing our participants and study process. Following this, we step through the key themes we have uncovered about family calendaring. We conclude by discussing the implications from our findings for the design of digital family calendars that fit within the social fabric of the home, and that can be appropriated by families as needed.

2. RELATED WORK

We ground our research by highlighting the main findings from past studies of workplace calendaring as well as studies of coordination in the home. The former helps illustrate the differences between work calendaring and family calendaring, while the latter forms the basis for the way we think about family calendaring.

2.1 Workplace Calendars

In the workplace, calendars are in widespread use where they act as personal support artifacts providing a *temporal map* for people to ease the burden of one's mental map of activities [Payne, 1993, Palen, 1998, 1999]. People use workplace calendars in a range of different ways depending on the nature of one's work, their experience, and their personality. Typical individual calendaring tasks include orienting oneself temporally, scheduling events, tracking events for later reference, reminding oneself, recording and archiving notes, and retrieving and recall [Palen, 1998, 1999]. Many people use more than one calendar to schedule activities (70% of 23 paper calendar users studied by Kelley and Chapanis, 1982), to have the information in more than one location or in a different format, or for different purposes (e.g., business *vs*. personal) [Kelley and Chapanis, 1982]. However, this brings challenges in synchronizing multiple calendars, causing events to be missed and times overbooked [Kelley and Chapanis, 1982, Kincaid *et al.*, 1985]. People also commonly record both work and home activities in the same calendar (98% of 30 respondents by Kincaid *et al.*, 1985). Work calendars contain events ranging from meetings, appointments, and travel, to reminders and tasks [Kincaid *et al.*, 1985] for both short and long term planning [Payne, 1993]. Early calendar studies show people had an average of seven events per week on their work calendar [Kincaid *et al.*, 1985] though this number has likely increased (we did not find any more recent analyses

of this). To-do lists often accompany calendars as coordination artifacts, but are more for recording tasks [Payne, 1993]. Many people keep archives of their calendars, but referencing old calendars is an infrequent task [Kincaid *et al.*, 1985].

Work calendars are also social artifacts. When shared, they can enable groups to coordinate activities [Palen, 1998]. Here, users must balance the needs of easing coordination with privacy concerns [Palen 1998, 1999]. The model most prevalent in the workplace is one where individuals each maintain their own calendar and then provide some level of sharing or access to others [Palen, 1998]. This can range from showing no calendar information to others, sharing only free-busy times, sharing all calendar information, or even the extreme case of allowing others to modify one's calendar [Palen, 1998]. Using the knowledge of what is on another's calendar, co-workers can suggest meeting times and then accept, decline, or suggest an alternative time. A variety of research projects have also looked at next-generation workplace calendar designs focused on easing group scheduling [Mynatt and Tullio, 2001, Tullio *et al.*, 2002, Brzozowski *et al.*, 2006] or error correction for event scheduling [Mueller, 2000].

Within this context, our results will show that family calendaring is quite different from workplace calendaring when it comes to coordinating activities. We will illustrate differences in how and why *families* use multiple calendars and what events they include on their calendar. One implication is that the various types of workplace calendar solutions are a poor match to the practices and expectations of family calendaring.

2.2 Family Calendars

We now turn to what is known about family calendars. By their very nature, family calendars are collaborative objects, often situated in locations that help enable collaboration like the kitchen [Crabtree *et al.*, 2003a, Elliot *et al.*, 2005], where they move from 'dead objects' to 'social objects' as family members (more than just an individual) use them to produce meaning, purpose, and utility [Crabtree *et al.*, 2003b]. Despite being an artifact for the entire family, family calendars are often maintained by one person, typically a woman because she is most often the household communicator [Hindus *et al.*, 2001] and responsible for scheduling children's activities [Leslie *et al.*, 1991, Zimmerman *et al.*, 2001, Beech *et al.*, 2004]. In an online survey of 400 people, Hutchinson *et al.* [2002] found that family calendars were maintained by one person 44% of the time and 56% of the time by multiple maintainers. For single maintainer families, 90% were maintained by women. Brush and Turner [2005] surveyed 621 Microsoft employees and found similar findings: 72% of families had a single maintainer who was more likely to be a woman.

Like work calendaring, both paper and digital calendars are being used in the home for family coordination. Beech *et al.* [2004] argue that one of the most important aspects of family calendars is their ability to be a shared artifact viewable at-a-glance. Brush and Turner [2005] found that 59% of respondents (admittedly Microsoft employees likely biased to digital products) used a digital calendar as their primary family calendar because it was always accessible, easy to view and edit, and easy to synchronize with their work calendar (often it *was* the work calendar). Despite this, respondents noted that digital calendars were at times hard to share with others. Those choosing to use paper calendars did so because they too were thought to be easy to use. They also found that paper calendars are easily visible by other family members in the home, easy to archive, and people enjoy personalizing them with colors and pictures. Yet respondents still found paper calendars to be messy, hard to access remotely, and difficult to synchronize with other calendars (requiring manually copying of events). Beech *et al.* [2004] found families used an average of four calendars with seven being the most used by one family. Hutchinson *et al.* [2002] also found that the main problems people had with their family calendar were synchronization with other calendars, accessing the calendar remotely, and limitations in space to add events. In studies of mobile calendars, Starner *et al.* [2004]

found that people abandon digital devices when mobile and use alternatives like memory or paper because of their simplicity.

The prior work sets the canvas for our own research. In particular, our work extends these findings to show and formalize the many nuances in family calendar use. This includes the role and pattern of activity with family calendars by *primary* and *secondary schedulers,* a broad categorization of the interplay between primary and secondary schedulers into three different types of families, and a *typology of calendars* showing the varying styles of use of both paper and digital calendars.

3. METHODOLOGY

Our article reports on the usage of family calendars from 44 different middle class families using semi-structured interviews that probe into the social culture of the home. We do not consider this to be an exploration using traditional ethnography [Spradley, 1980] though we do uncover cultural processes and meaning. In this section, we describe our participants, interview method, and analysis.

3.1 Family Participants

Our study was comprised of 60 individuals from 44 different middle class families residing either in Seattle, U.S.A., or Calgary, Canada:

a) twenty families (from Seattle) are from design work by Neustaedter and Brush [2006];

b) four families (two from Seattle and two from Calgary) are from a field study of digital calendar use in Neustaedter, Brush, and Greenberg [2006]; and,

c) twenty families (from Calgary) are from a study looking exclusively at existing family calendar routines.

Interviews with the initial twenty-four participants (a and b) formed the basis of our thinking and the follow-up twenty (c) were used to narrow our focus and uncover additional detail about family coordination routines. All Seattle participants were recruited using a study recruitment agency which collects a database of people interested in user studies and contacts them to check for availability and appropriateness for a given study. All Calgary participants were recruited using a snowball sampling technique where emails were sent to colleagues and friends and forwarded on to their contacts, and so on and so forth. Participants in groups (a) and (b) were remunerated with computer software and participants in group (c) received $20 CDN.

All households were middle class families with children varying in age from three months to 20 years; the number of children ranged from one to six (median 2). Parents ranged in age from their late 20's to 50's. We had 29 dual income families and 15 single income families (the mother was a homemaker). Those working had a large variety of occupations, e.g., teacher, executive assistant, programmer, attorney, accountant, dentist, therapist, child care worker, firefighter. A large majority of families, 42 of 44, consisted of heterosexual married couples. Only two of the families contained single parents. Despite this, we did not notice any major differences in the results between the single parents and the married couples and do not suspect the main findings of this study would differ greatly with a larger number of single parents.

3.2 Interview Method

We interviewed one or more individuals from all 44 families about their existing family coordination routines. Interviews of family members varied: 31 of the 44 involved only the mother (primary scheduler), six involved both the mother and father (primary and secondary scheduler), two involved just the father (secondary scheduler), 1 involved an adult child living at home (secondary scheduler), and four involved all family members

(excluding young children). Interviews occurred either in the participants' homes (23 of the 44 households), our research lab (20 of 44), or in a neutral location chosen by the participant (1 of 44).

A natural critique of interviews is that people aren't able to easily describe their routines retrospectively. We avoided this pitfall by grounding our interviews in real domestic coordination artifacts. That is, we asked participants to bring, show and share with us their calendars and any other items they use to help coordinate family activities. We then asked participants to discuss these artifacts and how they were used. We also had a series of predetermined questions that were used throughout this process in case certain things we were interested in did not come up naturally. This technique of situating interviews with real world artifacts is borrowed from contextual inquiry [Holtzblatt and Jones, 1995, Beyer and Holtzblatt, 1998]. Interviews typically lasted about an hour. Audio was recorded for all interviews, while observations and interview responses were handwritten or typed by the interviewer during the interview. With participants' permission, we also photographed all calendars and items used by the families for coordination purposes.

3.3 Observation and Analysis Methods

All interview notes were reviewed and if clarification was needed we returned to our audio recordings. We categorized all interview notes and observations and used open coding [Strauss and Corbin, 1998] to draw out the similarities and differences between households. That is, for each unique observation we coded it with a descriptive stylized label. We then compared subsequent observations with our coded ones, where we marked recurring similar observations with the best matching code. Observations that did not fit were given a new code. For example, when going through our interview notes looking for the locations of the family calendar, we came across the 'fridge' as one location. We created a label [F] to represent this location. Each time we came across the 'fridge' as the calendar's location we flagged the data with the same code, [F]. If a different location was seen, we created a new code for it, e.g., [P] for 'near the phone'. We then used our coding and categorizations along with affinity diagramming [Holtzblatt and Jones, 1995, Holtzblatt *et al.*, 2005] to reveal key themes within the data.

4. A TYPOLOGY OF CALENDARS USED BY FAMILIES

We found families use a variety of items for coordination including to-do lists, notices or handouts, random pieces of paper, and appointment cards. However, the most prominent and central of the coordination artifacts that we saw used by families were one or more calendars, and this is why it is the focus of this paper.

Figure 1 gives a broad overview, where it summarizes the number and types of calendars used by each family. Each column represents one family labeled by participant number (e.g., P1, P3 and so on) for easy comparison with other results. Families are further grouped across these columns by their coordination routine: Monocentric (first 17 columns), Pericentric (next 12 columns), and Polycentric families (final 15 columns); these groupings will be discussed in Section 5. Families are sorted by participant number within the groups, again for easy comparison with other findings.

Colored squares in each column show the type of calendars used by families, e.g., a paper wall calendar, a digital PC calendar, and so on. Black squares indicate which calendar is the *primary family calendar*: the main calendar used by a family for coordination. The grey squares show *secondary calendars*: the calendars that also contain family events but are not the central calendar used by the family. White squares are calendar types not used by that family. Regardless of the type, all calendars we saw used the fairly ubiquitous Gregorian format. Rows are further grouped into six grids based on the calendar's main purpose, e.g., calendars for public awareness *vs*. calendars for personal work; we discuss these groupings momentarily. Some families had two of the same type of calendar within

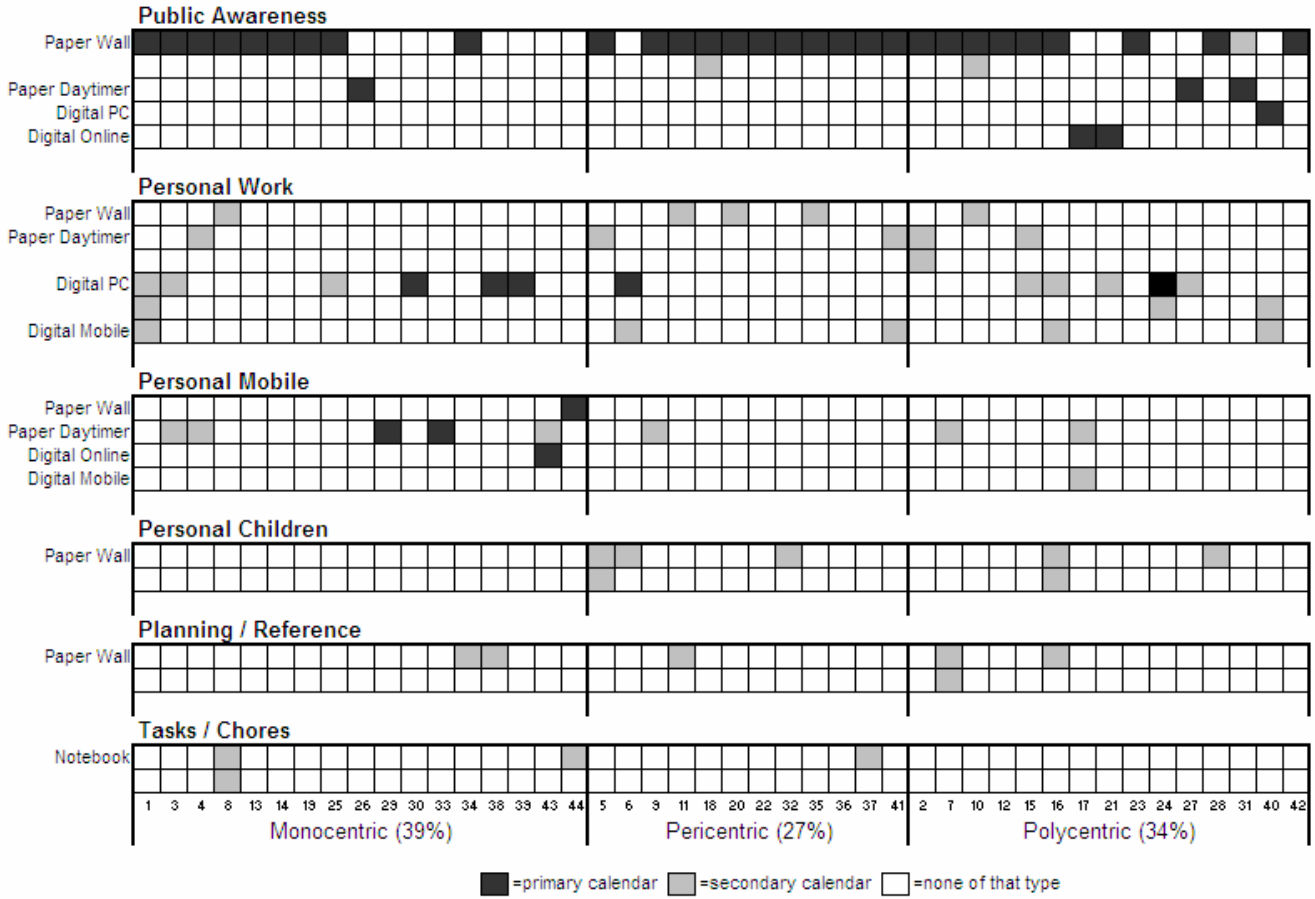


Fig. 1. Each column shows the number and type of calendars (e.g., paper wall, paper daytimer) used by a participant family (P1 through P44). These are grouped by the purpose of the calendar (e.g., public awareness *vs.* personal work). Black squares represent primary calendars and grey squares represent secondary calendars.

a grid so these types have multiple rows. For example, the top two rows both contain paper wall calendars (though only the first row is labeled as Paper Wall).

Taken together, each column can now be read as representing one family and the types of calendars they use for family events. For example, we see that the leftmost family (P1) uses four calendars: one paper wall calendar primarily for maintaining public awareness, two digital PC calendars (e.g., Microsoft Outlook) primarily for maintaining personal work, and one digital mobile calendar (e.g., a PDA) also for maintaining personal work. For this family, like many, the primary family calendar (marked in black) is the paper wall calendar. The three other calendars (marked in grey) are secondary calendars for this family.

The table illustrates many statistics. While 13 families (29.5%) used only one calendar for family coordination, a large majority of families, 31 (70.5%), used more than one calendar. The median number of calendars used for family coordination per household was two (mean 2.2 ± 1.1) with a range from one to six: 17 families (38.6%) had two, 8 (18.2%) had three, 4 (9.1%) had four, 1 (2.3%) had five and 1 (2.3%) had six. For each family, one of their calendars was considered the main calendar and often dubbed "the family calendar." For our 44 families, 35 (79.5%) used a paper calendar as the primary calendar while 9 (20.5%) used a digital calendar.

Over all of the calendars families used, we saw six different types of calendars emerge based on the *purpose* or *reason* for using the calendar as part of the family coordination routine (Figure 1 has six grids that group the rows by these types). These types span both paper and digital calendars:

1. ***Public Awareness*** calendars (most often used as the primary family calendar) are placed in a publicly viewable location so that other family members can gather an awareness of what activities are occurring (Figure 1, Grid 1);
2. ***Personal Work*** calendars are primarily used to record work activities but they also store family events that affect the work schedule, most often they are stationary though some are mobile (Figure 1, Grid 2);
3. ***Personal Mobile*** calendars move with the scheduler and are used to check the calendar and schedule while not at work or home (e.g., a daytimer or PDA that is not primarily used for work) (Figure 1, Grid 3);
4. ***Personal Children's*** calendars are designed for a child to become aware of his or her own activities and also how they relate to the family's activities (Figure 1, Grid 4);
5. ***Planning and Reference*** calendars allow people to plan out their family activities either by recording them or checking dates, though they are not typically for public viewing (Figure 1, Grid 5); and,
6. ***Tasks and Chores*** calendars are specialized for delegating or reminding family members of household tasks (Figure 1, Grid 6).

We stress that this calendar typology is specific to *family* coordination. Even though it contains some calendars geared towards work, they are included because they overlap with family coordination needs. Indeed, we left out other calendar types that people use for work activities if they were not used for family coordination. For example, a person may report using a shared workgroup calendar to plan weekly business meetings, but it is not normally used to coordinate family activities. Thus it is excluded from our typology. We also saw that some families use milestone calendars to record children's events as they grow (e.g., first step, walking, talking). While these do contain *family* activities, they were used more for *reflection* and not *coordination* so we do not include them in our typology.

The following subsections detail each calendar within this typology and the reason for its usage.

4.1 Public Awareness Calendars

Families often have a calendar that acts as a *shared family information resource* where the calendar is visible for all family members (whether they check it or not). The *awareness* provided by the calendar is used by family members to coordinate activities (the details of which are described in Section 5). We call these ***Public Awareness calendars*** because of their role and visibility. The large volume of grey and black squares in the top grid in Figure 1 shows that Public Awareness calendars were the most widely used type of calendar for family coordination. In fact, 80% of families (35 of 44) used a Public Awareness calendar as their primary family calendar.

Most often a *paper wall calendar* was used as a Public Awareness calendar (Figure 1, Grid 1, Rows 1 and 2): 29 times as a primary calendar (black squares). It also appeared 3 times in a more secondary role (grey squares), where it complemented other public awareness calendars located elsewhere in the home. While the paper wall calendar dominated, public awareness calendars were also used as primary family calendars in the form of *paper daytimers* three times (Row 3), a *digital PC calendar* once (Microsoft Outlook) (Row 4), and a *digital online calendar* twice (Planzo and MSN) (Row 5). Despite these calendars being slightly different in form, style, and presentation, they were all used in the same manner: all were placed in publicly accessible locations for the purpose of providing family members with awareness of their activities.

Because Public Awareness calendars are intended for public viewing by the family, they are placed in locations that family members can easily access for viewing and updating. Mona (P20) comments:

> *"[With a family] I found that [the calendar] needed to become more visible so that everyone had access to the information. I could carry a calendar in my briefcase but the communication wouldn't be there for the rest of the family."*
> *– Mona (P20), Mom and Teacher*

The location of Public Awareness calendars varied slightly across families. For all but one family (37 of 38), this translated into a *frequently visited* location of the *home*. A large majority of calendars in home locations, 29 of 37 (78.3%), were hanging on the fridge or wall of the kitchen; four (10.8%) were hanging on a shelf near computers in a home office; two (5.4%) were located in drawers in the kitchen; and two (5.4%) were online calendars accessible on a PC in the living room or home office. The remaining calendar was contained in Outlook and made public by printing and distributing it to family members. Figure 2 shows a sample of locations used by families.

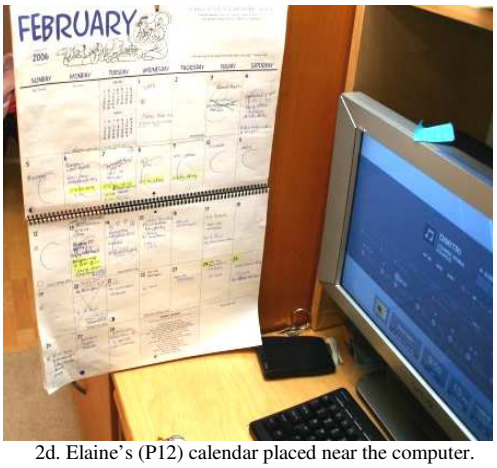
Unlike PC-based calendars, paper calendars naturally lend themselves to be placed in a variety of publicly accessible locations. One family referred to this type of location as the "hub of the home." For example, Linda's (P3) family calendar is on the wall in the kitchen next to its entrance (Figure 2a):

> *"Can't really miss it there…[what works best is] the fact that it's convenient, it's right there. I don't have to go far to write something. I don't have to dig it out. If it was in another room you wouldn't check it as often. The kitchen is where I spend most of my time, especially in the morning."*
> *– Linda (P3), Mom and Administrator*

2a. Linda's (P3) calendar on the wall beside the kitchen entry.

2b. Kayla's (P19) calendar magnetized to the fridge.

2c. Anita's (P9) calendar on the kitchen wall near the phone.



2d. Elaine's (P12) calendar placed near the computer.

Fig, 2. Public Awareness calendars located in easily visible places, which are sometimes near other resources.

Samantha (P14) told us that while it was very important to have her paper family calendar in a public location at home, she didn't think it was very aesthetically pleasing and it would even embarrass her if guests saw it. Similarly, Kayla (P19) says one of her least favorite things about the family calendar is how cluttered the area around it can become. Kayla's calendar is magnetized to the fridge door (Figure 2b, top right) along with a variety of other items. While family calendars can certainly become a "mess," it is this mess that becomes very useful, as we elaborate in subsequent sections.

Some families balance the need for the calendar to be public with the ability to easily update it. For this reason, the Public Awareness calendar will not only be in a high traffic area, but it will also be situated near other important scheduling resources, like the phone or computer where a phone call or new email may trigger adding an event to the calendar. For example, Anita and Doug (P9) comment on their placement of the family calendar in the kitchen right above the phone (Figure 2c):

> *"Usually if someone is calling, you can answer questions about the calendar, whether you can do stuff on [a day], and if they're calling about something on the calendar you can write it down." – Anita (P9), Mom and Accountant*

Somewhat similarly, Elaine (P12) keeps her family calendar by the main computer in the den (Figure 2d): Elaine accesses the Internet there, and considers its information an important scheduling resource. She often receives emails from neighbors about events such as birthday parties, and then copies the details from her computer onto her family's paper calendar.

The challenge of paper-based Public Awareness calendars is that they are only accessible in one location, which means that family members have to resort to other strategies if they wish to 'see' the family's activities when away from this location. One strategy involves using multiple calendars each in a different location. This is why we see many families using more than one calendar in Figure 1. Another strategy involves using a digital calendar as a Public Awareness calendar.

Digital calendars have different affordances than paper. For example, they are certainly not as amenable to flexible placement on walls and doors, and typically have too large a footprint to be placed atop a kitchen counter. Yet people develop strategies that not only work around these limitations, but take advantages of abilities not possible on paper. Typically, we saw that the contents of digital calendars is made public through online sharing or printing, where others have their own copies or can access the calendar remotely. For example, Margo (P17) is a mother of children aged 18 and 22 (the 22 year old no longer lives at home) who uses a digital online calendar as a Public Awareness calendar. She placed her calendar online so her family can view and even add events to it rendering the calendar public from a variety of locations. Margo describes how she began using the calendar:

> *"I kept asking my kids what do I need to do today, where am I taking you. It drove my kids nuts. They hated to keep answering me. So [my son] is actually the one that found [the online calendar]...he was getting frustrated 'cause I would be working on something and I'd go, 'oh I can't get you right now or I can't take you right now'. I said if you would write it down for me, like write down your schedule when you are working… he found it easier to just write it in once and put a repeat on it. It was really for him to make my life easier and not be so frustrated with him. It was a way for them to let me know what their needs are for me." – Margo (P17), Mom and Executive Assistant*

Rebecca (P40) is a trial lawyer with six children (the most in our study). The primary family calendar is in Microsoft Outlook on her computer and laptop. While only Rebecca can access it, she makes it publicly available by printing out copies of the calendar at the beginning of each day and distributing one to each family member (and also the nanny). If events need to be updated, family members can notify Rebecca who will update the calendar and print new copies.

Public Awareness calendars also need to be for a specific time period to provide an awareness of family activities over an appropriate time period. Families like to gain *a perspective on the entire month* (or in some cases, multiple months) so they can schedule events and check the calendar weeks ahead of time. Two participants comment:

> *"I've tried [a calendar with a single day] and I can't get the big picture in my head. At work I use a day view for my job, but at home I like to look at what's coming up tomorrow, Thursday, Friday…" – Anita (P9), Mom and Accountant*

> *"For daytimers with a daily view, I didn't have enough stuff to write in the pages and it seemed a waste. But I like looking at the full month to get the big picture…I sorta like just having an overall view of the next four months to get a view of what we have planned, if we have a weekend free we can try to plan something." – Lana (P7), Mom and Dentist*

4.2 Personal Work Calendars

Family activities and work schedules have a tendency to affect and interact with one another. For example, a parent may need to leave work early or start late because of a child's doctor appointment. Parents may also need to know what activities are happening in the evening after work so they can mentally prepare for the evening before leaving the office. Others just like to have family activities that they are responsible for on their work calendar as a reminder or to aid coordination during the day. This is especially true if the family calendar is on paper and only accessible when at home. For these reasons, we found that 22 of 44 families (50%) also used ***Personal Work calendars*** in some capacity for family coordination, even though the primary purpose of these calendars was to schedule and coordinate *work* activities (see Figure 1, Grid 2). Fourteen families (31.8%) used one work calendar, seven (15.9%) used two (one by each parent) and one family (2.3%) even used three.

The location of Personal Work calendars varies. As expected, they are often located at work (10 of 31 work calendars, 32.2%), but in some cases they move between home and work as paper daytimers (6 of 31, 19.4%), or PDAs (5 of 31, 16.1%), or on laptops (3 of 31, 9.7%). For those parents who work out of their home, the Personal Work calendar is located in the home (2 of 31, 6.4%).

Five families (11.4%) used a Personal Work calendar (Microsoft Outlook) as their primary family calendar (the black squares in Figure 1, Grid 2). Each of these families had a fairly intertwined work and family life. In these situations, all activities for the family are recorded in the work calendar, yet the challenge is that the calendar is often inaccessible for family members other than the primary scheduler. One family we interviewed had a workaround that enabled both parents to see the family calendar: Joanne sends all family events as scheduled meetings from her Outlook calendar to her husband Jason's email, which he can then 'accept' and move into *his* Outlook work calendar. While this strategy worked for Joanne and Jason, this information was inaccessible for their children. Other families who used a Personal Work calendar as their primary calendar faired even worse than Joanne and Jason, for they were unable to easily share the family calendar's events.

The remaining 26 Personal Work calendars we saw (the grey squares in Figure 1, Grid 2) were all used as secondary calendars where they *do not typically contain all family activities*. Instead, these Personal Work calendars contain a subset of family events, usually those that affect the work schedule. Thus, these calendars were used to stay aware of certain family events when at work. For example, Ellen and Oreste (P10), parents of a 9-year old son, both write family activities in their work calendar to stay aware of family events when at work:

> *"If a family event that is related to my work or affects my work I will also put it on [my work calendar]. If I have a doctor's appointment and I have to leave I'll put it down. If we go to a party on Saturday it won't be on [my work calendar]." – Oreste (P10), Dad and Technical Sale Representative*

> *"If I have to leave early from work then I will put it on my [work calendar]." – Ellen (P10), Mom and Programmer*

The use of a work calendar to store family events when at work reflects an underlying challenge arising from the many paper-based primary family calendars located in the home. These calendars are inaccessible at work, which forces people to integrate portions of their family calendar into their work calendar.

4.3 Personal Mobile Calendars

Several families use ***Personal Mobile calendars*** for family coordination in order to schedule activities and see the family's plans. These calendars are used in a manner which makes them both personal and mobile: events are recorded by one person and the calendar is accessible by that family member in multiple locations both inside and outside of the home. Ten of 44 families (23%) used Personal Mobile calendars, two of which used more than one (Figure 1, Grid 3). The styles of calendar ranged from daytimers (8 of 11 personal mobile calendars) to digital calendars (2 of 11) and paper wall calendars (1 of 11). We have discussed these calendar styles previously, where they were used as Public Awareness or Personal Work calendars. The difference here is that the family is using these calendars in a manner which makes them both *personal* and *mobile* where the primary purpose of them is for family activities rather than work ones.

Four families (11.4%) used a Personal Mobile calendar as the primary family calendar (the black squares in Figure 1, Grid 3): one was a wall calendar, two were daytimers and one was a digital online calendar (AOL's). Each of these calendars was used by one family member, the primary scheduler, where it was either carried with the scheduler (e.g., in their purse if it was paper) or accessed at multiple computers in the case of the digital online calendar. The challenge with having a Personal Mobile calendar as the primary family calendar is that other family members can't see the family calendar, causing them to learn about the family's activities in other ways (discussed in detail in Section 5). For example, Gloria (P44), mother of two children aged 7 and 10, uses a paper wall calendar as the primary family calendar. Rather than hanging the calendar on a wall though, it is moved throughout the home by Gloria and even taken with her most times when she goes out. Because of the changing locations of the calendar, her family typically needs to ask her what activities are occurring.

Eight families (18.1%) used a Personal Mobile calendar in a more secondary role (the grey squares in Figure 1, Grid 3). Here most were daytimers that could be carried in the purse of the primary scheduler when out; its purpose was to have a version of the calendar handy in case something came up that they needed to schedule or check. For example, Linda (P3) carries a personal daytimer in her hand bag whenever she leaves home, and will use it to write down events when she is out. On returning home, she will sit down and transfer events from the daytimer back to her primary family calendar.

Some people don't use Personal Mobile calendars, yet they have workarounds that achieve a similar effect. We saw people carry a to-do list or piece of paper that contains a list of things that need to get done that day. Rather than have a full calendar, events are copied down from the calendar to the to-do list and augmented with additional tasks that the family member wants to accomplish.

4.4 Personal Children's Calendars

Some families have special, dedicated ***Personal Children's calendars,*** where their purpose is to make children more aware of the family's activities and teach them about organization. These types of calendars were seen less frequently. Five families (11%) used Personal Children's calendars as secondary calendars (the grey squares in Figure 1, Grid 4), where two of these families had a calendar for each of two children. These calendars were placed either in a child's room or a public area of the home like the kitchen or living room. They are *personal* because the calendar is designed specifically for an individual, in this case, a child.

For example, Charity (P16) created a special calendar for her 5 year old daughter (Figure 3). The calendar is made of dry erase board and has a small piece of Velcro attached to each day. When a day occurs, the daughter attaches the large numbered day to that day's Velcro strip so she can learn the days of the month and her activities. Instead of

Fig. 3. Charity's (P16) calendar made specifically for her daughter.

writing out activities, Charity draws little symbols (discussed more in Section 7). Once Charity's son, currently aged three, was old enough, the children would argue over who put on the number for the current day. As a result, Charity created an almost identical calendar for her son. Each calendar now resides in a child's room.

4.5 Planning and Reference Calendars

Some families use certain calendars specifically for short or long term planning. We call these ***Planning and Reference calendars***, and 5 families (11%) used them as secondary calendars (grey squares in Figure 1, Grid 5)**.** These calendars serve one of two purposes. First, they can provide a draft space where family activities are planned out before being written on a more finalized calendar like a Public Awareness calendar. Second, they can simply be used as a reference for calendars dates, and in this situation they may not necessarily contain family events. Here the important aspect is that they can provide a long term view of the weeks and months ahead to see when holidays occur and when certain days are (e.g., what day of the week is August 18th?). Of course, Public Awareness calendars could be used as Planning and Reference calendars, and we did see some families use their Public Awareness calendar in a manner similar to a Planning and Reference calendar. However, some families like to have separate specialized calendars for this purpose. This calendar can be even placed in a different location than the Public Awareness calendar, where the location is more conducive to the task of planning or referencing dates rather than being publicly visible.

For example, Charity (P16) maintains her own paper month calendar as a draft calendar. Charity will plan out events on this calendar, writing in a pencil to represent its draft nature. Once events are finalized, Charity will copy the events onto the more permanent family calendar that the other family members can see. Cathy (P11) prints out a Chinese calendar containing all the months of the year as well as Chinese holidays to serve as her reference calendar (Figure 4). This 'year at a glance' view lets her use this calendar to look ahead in the year to see if certain weeks and days are good times to plan

Fig. 4. Cathy's (P11) calendar specifically used for long term planning.

family events like vacations. The calendar doesn't actually contain any family events, but sometimes Cathy circles certain dates because an important event occurs on it. Similarly, Greg and Lana (P7) also have a calendar specifically for looking up dates. It is located in their home office near the phone, so they can check a date if someone calls and asks about planning an event. As with Cathy's, this calendar doesn't contain any events.

4.6 Tasks and Chores Calendars

Three families (6.8%) kept specialized household ***Tasks and Chores calendars*** (grey squares in Figure 1, Grid 6). All were hand drawn in a paper notebook (e.g., Figure 5), and were considered secondary calendars. These families either did not want to forget about these tasks or chores, or they wanted to keep a record of them. In contrast, most other families simply remembered tasks and who is responsible for them, or sometimes placed them on the primary family calendar (discussed further in Section 6). Task and Chore calendars are usually placed in a high traffic area of the home close to the location used to plan the tasks, such as a kitchen. Thus this calendar serves as a visual reminder about the tasks that need to be accomplished.

For example, Muriel (P8) keeps two different calendars for household chores. The first is her meal calendar, which she creates at the beginning of each month. The calendar contains each week from Monday to Friday, and Muriel uses it to plan and record what meals they will have. Muriel buys all groceries for the week on the weekend, and she uses this calendar to help her so she knows that she will have the required ingredients for the planned meal. Muriel also maintains a second calendar containing a biweekly housework schedule of chores that need to be done around the house (Figure 5). Muriel places both the housework and meal schedule on the fridge, because this is where she plans out the tasks and cooks meals.

Fig. 5. Muriel's (P8) biweekly household tasks and chores calendar.

5. WHY COORDINATING FAMILY ACTIVITIES ISN'T SO SIMPLE

Family calendars provide a place to store and retrieve family activity information, where this knowledge is used to coordinate activities. While this may appear simple on the surface, families actually follow a more complicated multi-step process that has evolved over time through trial and error, repetition, and iteration. We formalize these steps here. The first three steps involve the actual scheduling of events:

1. ***Batch Updating the Calendar****:* at the beginning of a certain time period (e.g., month, school year) a large group of events are scheduled in the calendar.
2. ***Continuous Updating of the Calendar:*** calendar events are added, updated, and removed on a daily basis as needed, either at home or while mobile.
3. ***Synchronizing Multiple Calendars:*** events are transferred between the family's calendars to ensure each calendar contains the relevant information.

The next steps involve checking the calendar or becoming aware of its contents, and then using this knowledge to coordinate the family's day-to-day activities:

4. ***Awareness Acquisition****:* checking the calendar directly or indirectly to see what events are scheduled.
5. ***Coordination:*** using awareness of calendar activities to coordinate responsibilities.

We present these steps as being distinct, yet in actual fact they are often intermixed and certainly not always as systematic as we describe them. What is important is that each family generally employs these techniques and steps in some form or another as part of their calendaring routine.

Another factor is *who* in the family performs these steps. As we will shortly see, almost all families have a *primary scheduler* that takes charge of many of these steps. Yet beyond that, family types vary in how *secondary schedulers* update and/or check the calendar. Some families have no secondary schedulers. Others have members who use the family calendar, albeit some use it only infrequently while others use it frequently.

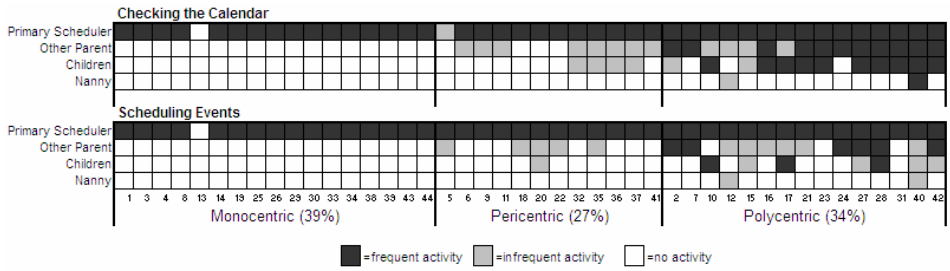


Fig. 6. Three different family types—Monocentric, Pericentric, and Polycentric—and how each family's members schedule and check the calendar.

We begin this section by discussing three different family types, and how they vary in the mix of primary and secondary schedulers. Following this, we go through each of the five calendaring steps described above, and highlight when and how this process varies for the different family types.

5.1 Family Types

Primary schedulers are engaged in all family calendaring steps, yet the involvement of *secondary schedulers* varies amongst families. This is summarized in Figure 6: each column shows which family members participate in scheduling (bottom grid), and which family members actually checked the calendar (top grid). Black squares indicate frequent activity, grey indicates infrequent activity, and white indicates no activity. While almost all families have a primary scheduler, the involvement of other family members differs considerably. This range is evident in Figure 6 by the differing number of shaded squares between families. The family in the leftmost section, P13, that does not have any schedulers (no shaded squares) does not use a family calendar; we discuss this outlier in Section 5.6.

To more easily compare calendaring routines, we have clustered families into one of three main types. In general, all types are centered on the primary scheduler, but vary based on the involvement in the calendaring routine by secondary schedulers.

1. ***Monocentric Families****:* only the primary scheduler adds to and checks the calendar, while others learn about relevant activities by having the primary scheduler tell them (Figure 6, left section, 39% of our 44 families);
2. ***Pericentric Families****:* the primary scheduler adds to and checks the calendar, and one or more secondary schedulers *infrequently* add to the calendar or ask the primary scheduler about its contents (Figure 6, middle section, 27% of 44 families); and,
3. ***Polycentric Families***: the primary scheduler adds to and checks the calendar, and one or more secondary schedulers *frequently* add and/or update (Figure 6, right section, 34% of 44 families).

In 41 of our 44 families (93%), the mother was the primary family scheduler. Parents in two of the other families said they shared the role of primary scheduler (4.5%); and, in the remaining family (2.2%), the father was the primary scheduler because he was at home most often due to his shift work as a firefighter.

We caution that these are general groupings, and family routines vary within each group as Figure 6 illustrates. The groupings are at best a general means to compare and understand the differing routines that families undertake when it comes to calendaring.

In Section 4, we presented many types of both primary and secondary calendars used by families, and it is tempting to try to correlate the type of calendar with the three types of coordination routines. Yet this correlation is at best weak. We did not find that a certain family type arises from the use of a particular calendar type. Instead, we believe that family routines are fairly idiosyncratic, where patterns emerge within families for a large number of reasons. Still, a particular mix of calendars used by a family could make high family involvement more challenging. For example, our findings show that only Monocentric families use Personal Mobile calendars as the primary family calendar (Figure 1, Grid 3 has only black squares for Monocentric families); this makes sense, for secondary users cannot use the calendar if it is absent. Thus, it is more likely that a family's routine somewhat influences how they select calendars, rather than the other way around.

5.2 Batch Updating the Calendar

The *primary scheduler* typically spends a significant portion of time placing a large amount of events on the family calendar all at once (though other household activities may occur intermittently throughout this process). The point at which this *batch update* takes place varies between families, but the existence of the batch update is fairly widespread. Batch updates do not differ based on the family type (Monocentric, Pericentric, and Polycentric); in all cases, batch updates are performed by just the primary scheduler.

Some families perform a batch update at the beginning of each month and place all known events for that month on the calendar. Other updates are triggered by a school notice at the beginning of the school year. Some families even do this type of batch update for the entire calendar year (e.g., adding all birthdays). For a number of families, this batch update is not as demanding as it sounds, because they specifically select and use a calendar that already pre-fills relevant information. For example, a number of our Seattle families reported that they used the local school district calendar as their primary family calendar because it already contained the school holidays.

A primary scheduler describes her process for batch calendar updates:

> *"Before my month begins I will write down things that generally happen…My daughter has Brownies every Monday night so I write down Brownies for every Monday night. Tuesday night I have my course from 4:45 to 6:45, so I write that down… I used to be the main person for the kids' program at the church, so I'd write that down. And then I'd add things like dentist, things from the month before." – Kayla (P19), Mom and Homemaker*

When adding events to the calendar, most families just write events on the days in the calendar where they can find the space, while a smaller number will actually try to write the events chronologically within the date. The amount of information that is written down for an event depends on the event and the family's routine. Some will write who the event is for, its time, and its location, while others omit particular details if they are part of the family's tacit knowledge.

5.3 Continuous Updating of the Calendar at Home and while Mobile

Throughout the month, families must update events on the family calendar as they find out about them or plans change. One may imagine a simple process of just writing or changing the event on the calendar, but in actual practice updating the calendar is much more challenging. Family members find out about needed calendar changes throughout the day and people are not necessarily at the calendar to update it when they find out.

The bottom grid in Figure 6 shows who adds events to the calendar for families in each family type. In Monocentric families, the primary scheduler is the only person who

performs continuous updates of the calendar. For example, in Kayla's (P19) family nobody else adds events to the calendar, yet this low level of involvement in scheduling is actually desired by Kayla. In fact, she told us, *"I won't let [my husband] write on it, he's too messy."* Kayla's children are aged 8 and 10 and also don't add to the calendar. She told us that, for her, updating the calendar is a spontaneous process that happens throughout the day. She tries to keep the calendar neat but may have to add an event quickly or at any point, *"If someone calls me up. If I'm on the phone, I'll write it at the bottom [of the calendar] and then later add it in to the day so it's not messy."*

In Pericentric families, the primary scheduler still updates the calendar regularly, yet secondary schedulers are also somewhat engaged in adding events to it, albeit infrequently and/or in a restricted way. For example, Carrie (P35), mother of one child aged 9, told us when asked who adds to the calendar, *"Oh, no no no, I only put things on."* The calendar was *hers* for modifying, though it was still placed in a publicly viewable location for the rest of the family. Still, Carrie *would* let her family members write on sticky notes which they could stick on the calendar for her to transcribe later.

In Polycentric families, all family members update the calendar, although the primary scheduler performs the majority of updates. Here families are less restrictive in who updates the calendar. For example, Elaine (P12) told us that her husband would normally write something on the family calendar about once a month. Her nanny also added information, usually weekly, though it was typically to show which days she would be unable to work. In Brad and Jennifer's family (P2), all family members including both parents and their two teenage children add events to the calendar weekly.

What happens when people are mobile? Events that should be recorded sometime arise while family members are out and about. This poses a particularly challenging situation, because most do not actually have their calendar with them to update, or to check when they are free. As a result, family members either use additional calendars, or have strategies that help them remember or record the activities while remote, and then transfer these activities to the family calendar when they get home.

Like many people, Ellen and Oreste (P10) receive appointment cards for future appointments for themselves or their son during the current visit to the doctor. Once home they can then copy this information on to the family calendar. For other types of events that do not come 'pre-recorded' on a card, they will just try to remember the event and then write it on the calendar when they get home.

Kayla (P19) uses a similar "hit or miss" strategy:

> *"I won't know, usually I just schedule and then when I go home if I see there is a conflict I will call back and reschedule. I know this is awful. So I'd like to have a PDA so I can synchronize then I don't have to... it would be good if I could have it incorporated into my cell because I carry my cell phone. I try not to carry anymore than that." – Kayla (P19), Mom and Homemaker*

While this strategy often works, it is certainly error prone. Yet Mona (P20), like some others, prefers not to guess when she is free. Instead of scheduling something while on the move, she will phone back once she checks her calendar at home.

Some families use people or technology as resources for scheduling when not near their family calendar. When Samantha (P14) needs to add something to the calendar while she is out, she phones her kids and (if they are at home) has them add it to the family calendar. Jack and Sherry (P5) email themselves with the information, where they add it to the calendar later. Paul (P42), father of two teenage sons (and coincidentally the only male primary scheduler we found in our study), phones home when he is out and leaves a message on the answering machine with event details for the family calendar. Once home, he'll copy the details on to the calendar. If one of his sons answers the phone

when he is trying to do this, he'll tell them to hang up and not answer the phone, and then he'll call back and leave the message.

5.4 The Pain of Synchronizing Multiple Calendars

Over 70% of families use multiple calendars (discussed in Section 4) to record family events. This comes with a need to synchronize these calendars. Good synchronization ensures each calendar has the appropriate events on it, so that double booking does not occur and events are not missed.

This process can be painful: events must be manually copied multiple times when the calendars are paper-based. Many families reported this as being one of the key challenges faced in their coordination routine. Indeed, synchronization is a challenge faced by all Monocentric, Pericentric, and Polycentric families that used multiple calendars. The only difference between these families is who is involved in the synchronization, and this depends on whose calendar needs to be synchronized.

Wanda and Dale (P15), parents of children aged 10 and 15, both have a Personal Work calendar. Dale uses a paper daytimer and Wanda uses Outlook. Dale transfers events when at home from the family calendar to his work calendar if they affect his work schedule. Wanda doesn't have the luxury of being able to copy these events at home because she uses Outlook on her work computer. As a result, once a month, Wanda takes the family calendar in to work along with any other sheets of paper containing schedule information. She then types them in to her Outlook calendar. Throughout the month, Wanda occasionally calls her work voice mail to leave a message for herself to add an event to Outlook. Dale and Wanda also email each other regularly to tell the other to add something to their work calendar.

While paper calendars are clearly hard to synchronize, we would suspect that digital calendars would alleviate this problem because synchronization can be automated (if the technology supports it). Yet we found some people still find this process not to match their needs: the detail in one person's calendar is not necessarily appropriate for the family calendar. Synchronization can also be risky, confusing or even scary. For example, Sidney (P6) finds it a challenge to synchronize Work calendars (one of which is the primary family calendar). Both Sidney and her husband use Outlook but are fearful of trying to synchronize these calendars in order for her husband to see family events:

> *"[My husband and I] could probably have a shared calendar…it isn't something we've done yet. Neither one of us want our calendar screwed up. I don't want all his meetings for work in my calendar, he doesn't care who my clients are. He just cares when I have them. So there is detail on here that he doesn't want and I'm sure there are details on his calendar that I don't want." – Sidney (P6), Mom and Therapist*

This concludes how calendars are updated. In the next sections, we describe how families stay aware of what is on the family calendar and use the information to coordinate everyday activities.

5.5 Direct or Indirect Awareness Acquisition

The family calendar provides family members with an awareness of what activities are occurring. The first way in which this knowledge can be gathered is by directly checking the calendar. The way this is done depends on the calendar. For example, digital calendars have automated reminder features: people can be notified of key events, but this only works if the person is at a computer. While such notifications are reasonable in a workplace for those who spend most of their time in front of the computer, this is less than ideal in the home setting where computer use tends to be much more occasional (unless one is telecommuting). Paper calendars do not have active reminders; for this

reason, family members must actively monitor the family calendar and check its contents on a regular basis or when adding events. For some, this involves checking multiple calendars.

The top grid in Figure 6 shows who checks the calendar in each family for the three different family types. Primary schedulers dominate, regardless of family type. We found that primary schedulers in all families regardless of the family type have a fairly common pattern when it comes to checking the family calendar. They check the calendar daily, in the morning or evening, in order to plan out events, and then also when they schedule events. This is evident by a solid black square appearing next to each primary scheduler in Figure 6. The two exceptions are P3 where the family doesn't use a calendar and P5 where the primary scheduler checks the calendar infrequently because she usually remembers activities after writing them down. For all other primary schedulers, checking the calendar usually becomes a habit, or occurs simply because the calendar is in a noticeable location. Two primary schedulers comment on their calendar checking routine, with the second contrasting active looking to automated reminders:

> *"I check in the morning…what do I need to pack for the day, I need to have this and that, do I need dance shoes, music, do I need my ghetto blaster, music bag, do we need this, do we need that, do I have to get that soccer uniform washed. There is that whole other schedule going on in your head." – Anita (P9), Mom and Accountant*

> *"[The wall calendar] doesn't remind me, I have to check it. That's why I like the electronic calendar at work because it sends me an email as well to remind me… I check [the family calendar] if not every day at least every other day, it's kind of a habit to glance at it every morning to make sure I'm not missing anything." – Linda (P3), Mom and Administrator*

The second way that people stay aware of calendar contents is through intermediaries. In Monocentric families, secondary schedulers find out what activities are occurring by having the primary scheduler *remind them* of activities pertinent to them. While some families view this as problematic, others find it beneficial. For example, Mike (P1), father of two children aged 8 and 12, is in just this situation. Mike doesn't check the family calendar because he and his wife have a fairly clear delineation of family responsibilities. Mike's wife is in charge of ensuring the children make it to their activities, and if necessary, she will let Mike know if there are activities that he needs to be responsible for. Other Monocentric families feel their family members should check the calendar more often. For example, Linda (P3) comments "*My family members don't check [the calendar] often enough. I suppose I would tell [other family members] but again it's up to them to check the calendar."*

In Pericentric families, secondary schedulers gather an awareness of family activities through several means: the primary scheduler reminds them about activities, they ask the primary scheduler, or they infrequently check the calendar. Unlike Monocentric families, secondary schedulers are moderately engaged in finding out what activities are occurring. For example, Anita's (P9) two teenaged sons are involved in a variety of extra curricular activities, though they check the calendar infrequently. She comments, *"[My family] usually comes to me and asks what the schedule is during the day."* The timing of this is fairly opportunistic. Her husband, Doug, will often phone her during the day while he is at work to ask what is on the calendar for the evening. The difference between this Pericentric family and the Monocentric families is that secondary schedulers are *asking* about the calendar, rather than just being reminded.

In Polycentric families, reminding by the primary scheduler still occurs, but secondary schedulers also check the family calendar fairly frequently. For example, Charity (P16) has actively tried to involve her children in the family's calendaring process as a teaching tool by making special children's calendars (Figure 6). Charity's husband Bruno describes how their daughter, aged 5, checks the family calendar:

> *"We have a breakfast nook. [My daughter] sits at one end of the table and the calendar is at the other end of the table. She'll look at it while we're eating dinner and say,' oh on Saturday we're doing that' so she definitely looks in at the calendar." – Bruno (P16), Dad and Systems Administrator*

In some cases, rather than checking all events, secondary schedulers in Polycentric families are more selective in what they check. Bruno comments on his pattern for checking the family calendar:

> *"I'm pretty used to our schedule so I don't need to check it that often. As sad as it is, I work full time so a lot of activities don't pertain to me. But Fridays change because I may be home. I may also glance at it because the activities end at regular periods. I look for the ends of things because I'll try to make it to the last class so I can make it to at least one of their classes during that activity. And I'll glance at it to see if anything is out of the ordinary." – Bruno (P16), Dad and Systems Administrator*

The third way that family members stay aware of activities is through an archive or record of past calendars. Some families will store calendars from year to year and then return to them to look up past events. Elaine (P12) keeps all of her past calendars on a shelf near the computer, which is also near to her current family calendar. Elaine keeps the calendars mostly for tax purposes because her husband travels frequently as part of his work as a surgeon.

5.6 Coordinating Activities through Awareness

Once family members have some semblance of awareness of activities, they use this knowledge to coordinate who is responsible for what. Unlike workplace calendaring, the people attending the event (other than possibly the person whose event it is), are not necessarily decided at the time of scheduling the event. This is the act of *family coordination* that occurs much closer to the scheduled event. Monocentric, Pericentric, and Polycentric families are all fairly similar in this activity. In all cases, the primary scheduler coordinates with those family members involved or affected by the activity. Children are not normally involved unless they are teenagers. Coordination involves discussing activities face-to-face if all parties are at home, or using technologies like the phone, email, or instant messenger when they are not at home. Sometimes the calendar is used as a discussion artifact where it may be moved from its normal location, while other times the knowledge people acquire and retain from the calendar suffices.

For example, Brad and Jennifer (P2) coordinate their family's activities (such as rides to activities for their children) each evening for the next day by talking at home. If things come up during the day, Brad and Jennifer will discuss the activities on the phone:

> *"In the evening we'd be checking it to make sure we're coordinated for tomorrow. We have to coordinate for early morning ice times, we'll switch vehicles, then I'd have to get up early and drive all the boys to practice and then work. It's a coordination that way. Then the odd time I might have to pick them up." – Brad (P2) Dad and Architectural Technician*

> *"We can't coordinate the morning of the day because I'm at work before they're even up so we have to know before…Sometimes [coordinating] is two or three*

conversations, figuring out maybe we can do it this way or maybe this other way...we're good at working on the fly." – Jennifer (P2), Mom and Government Clerk

Certain activities don't need to be coordinated because family members simply know who will be responsible for an event through tacit knowledge. For example, Brad and Jennifer both know when the other person is routinely finished work and in some situations there is only one person available to drive the children anyhow.

Many families try to avoid scheduling conflicts or overlapping events, but sometimes they do arise. In cases where events do overlap, plans must be rearranged. If an event needs to be cancelled, usually an implicit priority system is used. Anita and Doug (P9) check to see which event is most important. Sports games are considered more important than practices, but if the practice involves Doug as the coach, then he must attend. For Lana (P7), this involves seeing how many people the change will affect, where she tries to reduce the number. Sometimes changes will affect just her, but other times they may affect both her and her husband as well as her babysitter.

As we saw with Lana and her babysitter, resolving scheduling conflicts also involves more than just family members. For Sidney (P6), resolving conflicts often involves her friend and child share, Rebecca. Each regularly watches the other's children at least one day per week. Coordination also sometimes involves parents splitting the activities that the family is involved in. For Mona (P20), if their children have events at the same time, her husband will take one child and she will take the other child.

We did find one family of five children who have a Public Awareness calendar yet do not really use it. Instead, Fiona and Orlando's (P13) family relies heavily on communication between family members to remember, plan, and coordinate activities. We stress that this was the only case out of 44 families where the family calendar was not crucial to the family's coordination routine. In this situation, we feel that the lack of family calendar use reflects the cultural background of the family, originally from Central America. In many regions of the world, particularly Central America, notions of time are much less structured and the tempo of life is not as fast paced as highly industrialized nations [Levine, 1997]. In these regions, the importance of a calendar may be much less.

6. INFORMATION PLACED ON AND LEFT OFF THE CALENDAR

When you ask someone what events they write on their family calendar, a typical response is "everything under the sun." And, to families, it most certainly feels that way. While there are certainly idiosyncrasies to specific calendar contents, this section shows that strong and consistent patterns emerge.

To better understand what families are *actually* putting on their primary family calendar and how much they are adding, we performed a content analysis of one month from the primary calendars of 17 families from our final group of 20 families (Section 3.1, group c). The three omitted families happened because we did not have a satisfactory photo of a complete month: some days were covered or only partially shown. All 17 families from this content analysis used a Public Awareness calendar as the primary family calendar. The months we analyzed were either January or February 2006, depending on the time of the interviews, though we discuss potential month variations with them. We would have preferred to analyze more than this single month (for example, to see seasonal events), but this was impractical as many families had discarded their past calendars. Future studies run at the end of a calendar year rather than its beginning could overcome this issue.

Still, the single month suffices to show strong patterns. We first look at how many events families are placing on their calendar and the different types of events they record.

We then discuss the reasoning for having these events on the calendar by describing: events that affect the family, routine events, and household tasks and reminders.

6.1 Number of Events on the Family Calendar

We counted the number of events on each family's month, not including events already printed on the calendar. Multi-day events were counted for each day the event transpired. We counted 562 events on all of the 17 calendar months we analyzed, which included a total of 491 calendar days. Of the 491 days, 35.6% had zero events, 31.4% had only one event, 20% had two events, 10.2% had three events, 2.2% had four events, and 0.6% had five events. Figure 7 shows the median number of events placed on a day grouped by family type (sorted within each group by the median). The circles represent the median per day; shaded rectangles (boxes) show the interquartile range (about half of the days have this many events on them); lines coming out from the rectangles (whiskers) show the overall range; and, stars show outlier days (containing an unordinary number of events). For example, the rightmost family, P12, has a median of two events per day; half of the days on their calendar month have between one and three events; the least number of events per day is zero and the most is five; and, no days are considered to be outliers.

As visible from this graph, the number of events per day has little correlation to family type. The family with the lowest median and range of events is Fiona and Orlando's (P13) who really don't use the family calendar (Figure 7, far left). The highest median was found to be two events for seven different families. These families varied in family type: two were Monocentric families, three were Pericentric, and two were Polycentric. The range for most families is between zero and three events per day with four families showing exceptions: P11, P9, P14, and P12. These families all had a maximum of five events on a calendar day. Again, we did not find any similarities between these families in terms of the family type: one is Monocentric, two are Pericentric, and one is Polycentric.

What is the number of events intended for adults *vs.* children? Figure 8 shows the number of events we counted for each family during one month, split by the number of events specifically for children *vs.* adults. Family activities were included under adult.

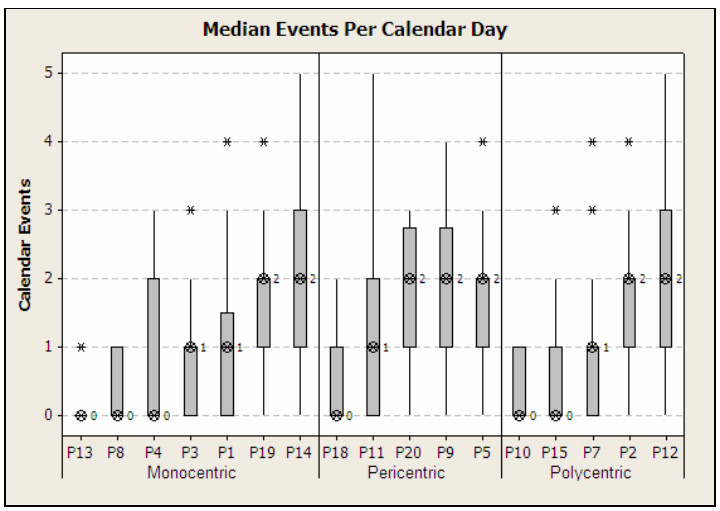


Fig. 7. The median number of events on the primary family calendar. Circles show the median; boxes show the interquartile range; lines extending from the boxes show the complete range; and, stars show outliers.

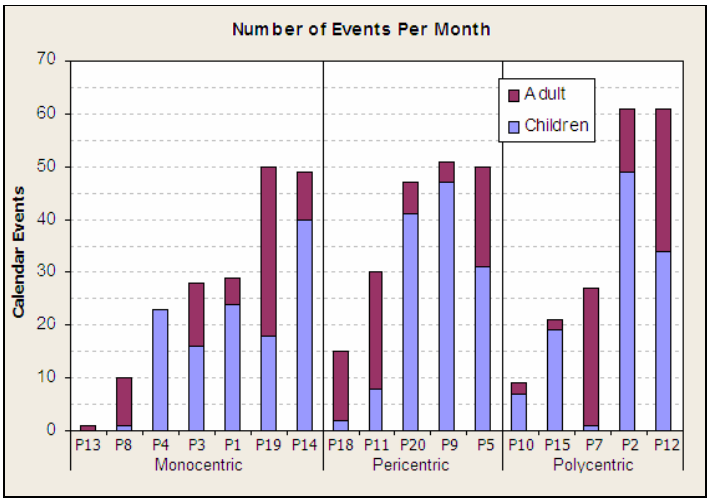


Fig. 8. The number of children events *vs*. adult events on one month of each family's calendar.

Visually we can see there is a large variation in the number of events between families and also family types. We can also see that families use the calendar differently in terms of the number of events for adults when compared to children. Families with only infants, P7 and P8, had nearly all adult activities. Taken together, the results show that there is little correlation between the number of events on the calendar, the type of family, and the number of children in a family. Rather, the number of events on the calendar is idiosyncratic to the family, their routines, and their actual need to add information to the calendar.

These results also show that the number of events placed on the family calendar per day is usually fairly small: often three or fewer, and in many cases only one event is on a calendar day. However, there are occasional times where four or five events are recorded; it would clearly be a mistake to assume that providing space for up to three events only will always suffice. In fact, our results do *not* show that families *want* to place only a few daily events on their calendar. In our interviews, many families said they find the squares for each calendar day to be small, and they claimed they would put more information down if the calendar days were larger. In contrast, others told us that there is only so much they want to write on the calendar. Whether these perceptions by families would remain if in fact their writing space for each calendar day was much larger is hard to say.

In spite of this uncertainty, we do know that families *are* able to manage their coordination routines with the tools they are currently using and the amount of events they write down. These numbers provide a nice approximation of the level of content currently being added to family calendars.

6.2 Types of Events on the Family Calendar

Next, we counted the different types of events that were contained on the calendar months. Figure 9 shows the median number found on the months we analyzed across all families. We found the following event categorizations, as derived through our open coding method (the percent shows how many of that event type we found out of all 562 events counted):

- ***Sports and Outdoors***: extra curricular activities involving a sport or the outdoors, e.g., soccer, hockey, swimming, wilderness training (30.8%).

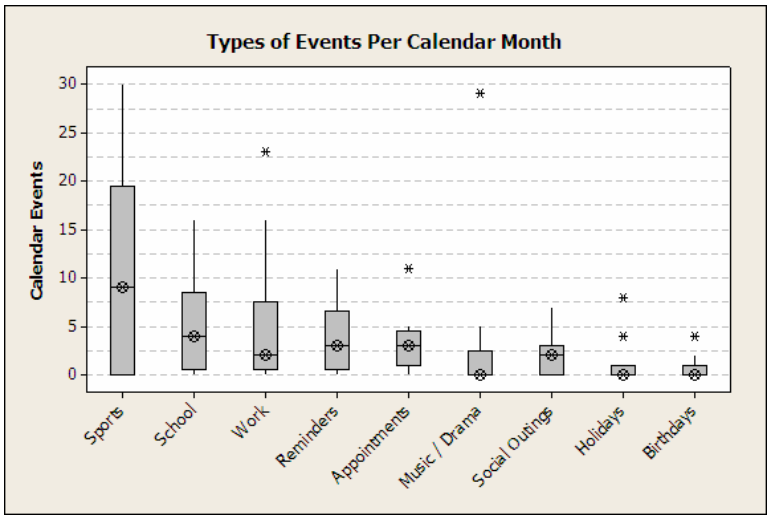


Fig. 9. The median number of different types of events on the primary family calendar for all families.

- ***School:*** events relating to or happening at school (15.7%).
- ***Work:*** events happening at work, work schedules, or changes to work schedules (including volunteer work) (14.4%).
- ***Reminders:*** events to trigger memory recall usually about a task that needs to be performed (10.3%).
- ***Appointments:*** events where you are meeting someone for a specific purpose at a specific time, e.g., doctor's appointments, non-work meetings, picking someone up at the airport (9.1%).
- ***Drama and Music:*** extra curricular activities that teach about the arts, e.g., music lessons, drama performances (8.5%).
- ***Social Outings:*** events which are social in nature, e.g., family dinner at friends, sleepovers, going to a movie, date night, church (5.9%).
- ***Holidays and Vacations:*** trips not involving work (3.2%).
- ***Birthdays / Anniversaries:*** birth notices, birthdays, wedding anniversaries (2.1%).

Figure 9 shows that sports events are the most commonly occurring activity on family calendars, with the amount of events for other categories diminishing from left to right. Of all of these events, 98.5% were single day events and only 1.5% were multi-day events. Again, we did not find any major differences between family types or the number of children in a family for the types of events on the calendar. The importance of these event types is the realization that families put many different types of events on the calendar; indeed, as some of these events are quite seasonal, their frequency would fluctuate over the year (e.g., activities whose occurrence is dependant on school terms, summer vacations, courses, team membership, and so on).

To explore this further, we asked families if the month we analyzed was a fairly common month in terms of the content. Sidney (P6) commented, *"March break there may be less [events]. There's nothing at school, but we'll go do something else like the zoo."* Other families talked about their calendar having different cycles throughout the year. For Jack and Sherry (P5), their family calendar generally goes on a four-month

cycle to coincide with university semesters (Jack is a professor and Sherry is a graduate student). They say the number of events they have on the calendar is fairly consistent, but the type of events will change depending on the semester. Mona (P20) finds that her family calendar is less busy between mid-December and mid-January because the children are on holidays from school. She also feels that November is busier because her children are involved in practices for Christmas performances.

In summary, we believe the months we analyzed are fairly typical of what one would find by looking at months throughout the year, though the content may vary slightly.

6.3 It Affects the Family

Next, we explore why particular events are placed on the family calendar and why other events are left off. In essence, the main reason why events are placed on the family calendar is because they are *activities that affect the family*. We found these activities fall into two main categories: those that actually *involve* more than one family member, and those that family members should *know about* because they may affect the family's routine. These events can be single day events, span multiple days, or be tentative.

The first type of event, *activities that involve more than one family member*, are usually ones where a parent is responsible for ensuring a child is at a certain place or doing an activity. Typical examples involving children's activities include sports, music, school, and appointments. Each of these generally requires a parent driving the child to or from the activity, or being at the activity to observe. These events may even involve a parent coordinating with someone else to drive the child (a friend or carpool) or may involve a parent telling the child to pack something extra when they leave for school because of the day's event. Other activities affecting the family are those where the entire family participates, such as family outings.

For example, Linda's (P3) family calendar will include band practices and performances for her daughter along with times when her daughter is taking a babysitting class because she has to drive her. Her calendar will also include multi-day family trips to a nearby tourist town, because everyone in the family usually goes.

The second type of event, *activities that others should know about*, usually includes activities that change ordinary routines. For example, non-routine work hours (e.g., irregularly scheduled shift work, or a change in hours), and work trips out of town. These are all deviations from the normal schedule, where the calendar indicates a family member is not available for normal duties.

For Cathy (P11), like many parents, her husband watches the children at certain times during the day or on particular days. As a result, any time that her husband's work schedule will be out of the ordinary or that he is out of town needs to be on the family calendar. Similarly, Greg and Lana (P7) each watch their three year old son when the other isn't working. If both are working, they have a regular babysitter to watch him. Recently, Greg went out of town on the weekend for his friend's bachelor party; this event had to be on the calendar to remind Lana that she had to arrange alternate child care for their son.

Events that do not affect multiple family members or events that family members do not need to be aware of are *not* generally placed on the family calendar. This includes detailed school activities like class times and one's routine work schedule during the day. As well, some families won't put tentative or not fully planned events on the calendar even if they do involve other family members, although others do include them as placeholders.

6.4 Routine Events: Next Week, Same Time, Same Channel

We have already described that events which affect the *family* generally appear on the family calendar; however, *routine events* present an interesting special case. Routine or

recurring events are those that typically appear on the same time and day each week over a series of weeks. The general trend for family calendaring is to write routine events on the calendar only during the initial weeks of their existence. When the events become ingrained as part of the family's knowledge, they no longer need to write them on the calendar. Even so, some families do prefer to note these events so they don't accidentally double book themselves.

For example, Jack and Sherry (P5) find they usually write routine events on their calendar for the first few weeks of their occurrence until the family easily remembers when and where the events are. However, Sherry still writes routine events on the children's calendars to help teach them organization skills.

Cathy (P11) also doesn't write routine activities on the family calendar once they become known. If a routine event is cancelled though, she will write this down because it is out of the ordinary. Yet sometimes the omission of routine events on the calendar causes Cathy problems: her son's routine tennis practice is on Mondays but she often forgets about it because the family is involved in so many tennis events.

For Muriel (P8), there are certain routine events that just don't get placed on the calendar because they are easy to remember even from their onset:

> *"The kids used to go to [a church group] every Wednesday night. That was a routine habitual thing and I didn't write it down. I only tend to write stuff that doesn't happen all of the time. If it happens once a month then I'll write it in. If it's a weekly thing I just kinda remember." – Muriel (P8), Mom and Day Home Organizer*

In Linda's (P3) family, routine events are normally *always* written on the calendar if they affect other family members, even when they are part of the family's tacit knowledge. For her, they are important placeholders:

> *"I know that [my daughter] goes to band every Wednesday night, generally I'll put that in. I think it's just a placeholder as much as anything. I mean I know she goes to band every Wednesday and I don't need to worry about that, but it's a placeholder because sometimes it would be easy to look at that one week and think that night's free and scribble something in and not realize that it was a Wednesday night, whereas if its in there you definitely go, oh that's a Wednesday." – Linda (P3), Mom and Administrator*

Sometimes, routine events that appear on the calendar week after week will be written in a different style than other events. This reflects the fact that they comprise tacit knowledge, yet are still important as placeholders. For example, Samantha (P14) just writes a keyword like "Guitar" for a weekly guitar lesson and doesn't write the location or time. Elaine (P12) just writes a number to represent each week her children have swimming lessons, '1' for the first week, '2' for the second, etc. This helps Elaine know how many lessons she has to pay for and when the lessons end.

6.5 Reminders for Household Tasks

Many families will include reminders for household tasks on their primary family calendar, although as previously mentioned some families use to-do lists or Task and Chore calendars, or simply remember the information without writing it down. These household task activities aren't necessarily tied to a particular date, but even when they are, they may not have a specific time. They are also different than activities affecting the entire family because they are usually specific to one family member.

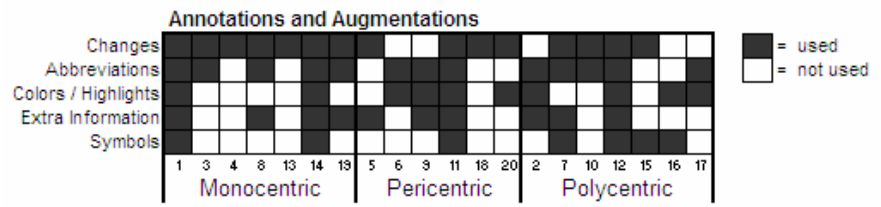


Fig. 10. The five types of annotations and augmentations used by families.

For example, Elaine (P12) commonly places tasks on her calendar to reminder herself that a certain activity needs to be done. She writes these tasks on a day when she thinks it may be appropriate to do the task. For example, she wrote a note on her calendar to remind herself to get a birth certificate for her one month old baby. Cathy (P11) will write reminders on her family calendar like paying for her children's music classes or maintenance reminders like servicing their treadmill. Lucy (P18) writes reminders like when she needs to return library books, while Linda (P3) writes down household chores like cleaning out the freezer.

7. ANNOTATIONS AND AUGMENTATIONS

Family calendars do not come "out of the box" with all the features that people need. As a result, the calendar as an artifact is appropriated as needed by families to overcome their idiosyncratic challenges. These include but are not limited to: a lack of space on calendar days, easily seeing the important information on the calendar, and seeing what has changed on the calendar.

In spite of apparent differences between families, content analysis of twenty family calendars (Section 3.1: all 20 group (c) participant families) uncovered five main types of annotations and augmentations used by them:

1. ***Changes****:* markings left when a calendar is edited leaves a history of changes;
2. ***Abbreviations:*** limited space and time cause people to shorten or abbreviate portions of an event's description on the calendar;
3. ***Colors and Highlights:*** events are written with specific colors, highlighted, or days are crossed out to help draw attention to events and times;
4. ***Extra Information:*** the unassigned space on the calendar (outside of the month's days) is used to add additional information, or the information is just attached to the calendar; and,
5. ***Symbols:*** visual representations like drawings or stickers are used in place of words to provide more detail or to represent an event.

Figure 10 summarizes our analysis, where it shows which families used each type of annotation and augmentation. While families are grouped as mono/peri/polycentric, we did not see any relationship between the different annotation and augmentation styles and the family types or the event content. That is, each family is just as likely as the next to use a particular annotation, although their usage will vary depending on the family's current context. We now detail each of the annotations and augmentations to show how and why they are used.

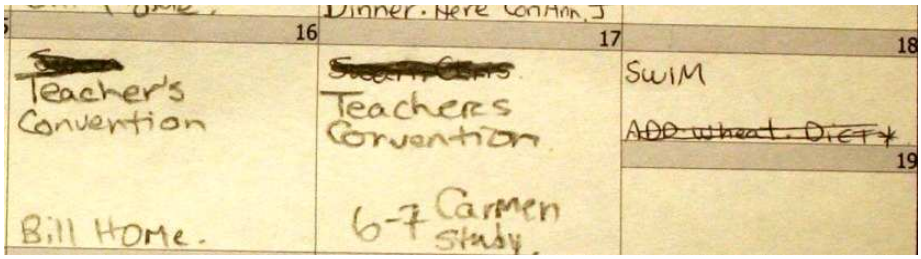


Fig. 11. Kayla (P19) crosses out events on her calendar to remove them or change the date.

7.1 Changes: Imprinting the Calendar with Change History

Family members routinely tell each other about changes made to the family calendar that affect them. Yet for many families, the calendar also provides its own change history [Tam and Greenberg, 2006], where family members can gain some sense of what has changed on the calendar just by looking at it. We found that 75% of families (15 of 20) leave visual marks on the calendar when moving or removing events, usually because they simply cross out these events or write words like 'cancelled' next to them (Figure 10, Row 1).

For example, Kayla (P19) removes events from the family calendar by crossing them out. Changing the date of an event is done similarly by crossing it out and then writing it on a new date. Figure 11 shows a portion of Kayla's family calendar: on the 16th, 17th, and 18th we see events that have been removed. Kayla finds it quick and easy to remove events this way, though she does find it to be a bit messy. Mona (P20) also normally crosses out events but sometimes she will draw an arrow between the event's old location and its new one on the calendar, as an explicit marker to herself and others that the date has changed.

The remaining 25% of families (5 of 20) remove or move events by erasing or using white-out, where the visual indications of the change are mostly lost. Here family members must rely solely on the person making the change to notify others. Change history is also non-existent for *all* families when the change is the addition of an event, unless family members are able to recall what events used to be on the calendar compared to what is currently there.

Unlike paper calendars where editing naturally produces a change history, the editing capabilities of current digital calendars means that changes are often invisible. Although this is an apparent disadvantage, the families using a digital calendar as their primary family calendar did not find this problematic. This is likely because the responsibility of modifying the digital calendar was still mainly that of the primary scheduler, who could easily keep track of changes by memory. As well, families are fairly good about keeping each other aware of what has changed on the calendar simply by communicating.

7.2 Abbreviations for Locations, Names, and Repetition

People often *abbreviate* information on the calendar. They do this because the space within most calendar's days is limited, and because of the high effort required to write repeating events and long location names. We found 65% of families (13 of 20) abbreviate information about an event on the calendar (Figure 10, Row 2). Not included in this count are 'radical abbreviations,' where the scheduler simply leaves out information; nearly all families do this.

Typically, the scheduler shortens the location or the name of the person associated with the event. If understood, terse abbreviations are an economical way for people to quickly look at the calendar to acquire an at-a-glance awareness of upcoming events. Yet

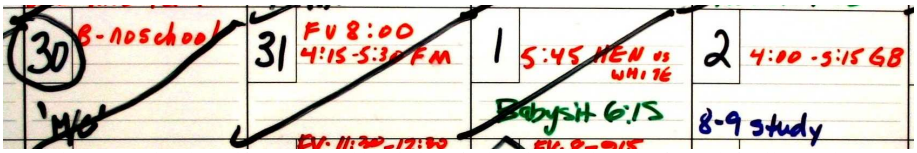


Fig. 12. Brad and Jennifer (P2) use abbreviations for locations and a color for each family member.

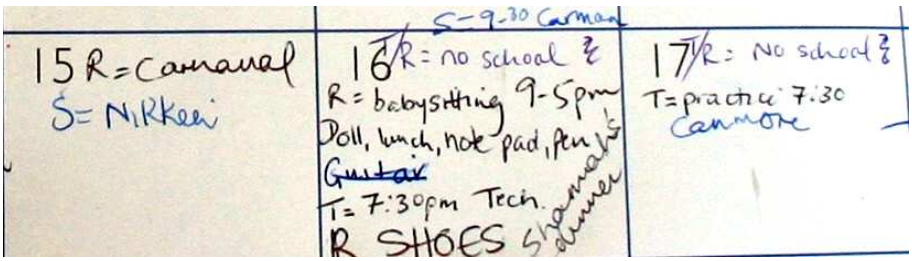


Fig. 13. Samantha (P14) abbreviates who an event is for on her calendar with initials.

those individuals not as familiar with the abbreviations get only a limited understanding of the calendar's contents.

For example, Brad and Jennifer's (P2) family is very busy with extra curricular sports activities. Figure 12 shows how the family calendar contains abbreviations for the location of hockey practices and games. They do this because of the lack of space on the calendar and the long length of location names (usually schools or community arenas). On the 31st, 'FV' is an abbreviation for a practice's location, while 'FM' abbreviates a game's location. For the same reasons, Samantha (P14) also abbreviates locations and the names of family members. Figure 13 shows a portion of her calendar where events labeled with an S (for Samantha) are for her, T are for her son Timothy, and R are for her other son, Randal.

Many families also abbreviate multi-day events that span contiguous days by drawing an arrow to show the duration of the event, rather than writing it on each day that it occurs.

7.3 Colors and Highlighting to Make Events Stand Out

While people often use the closest pen at hand to write events, we found that 50% of our families (10 of 20) go out of their way to use specific colors (Figure 10, Row 3). These families said they use colors to make particular events stand out, be it for the type of activity or the person involved in it. The benefit is that colors make the calendar more readable, where they can quickly look at the calendar to gain an at-a-glance awareness of the family's events.

For example, Brad and Jennifer (P2) use different colored dry erase pens on their family calendar (Figure 12): red is for their son, blue is for their daughter, green is for Jennifer, and black is for Brad. They explain that these colors let them easily see at a glance who has activities on a given day. Both parents find the colors to be one of the best things about their family calendar:

> *"I like the color coding. It's a quick at-a-glance [our son] has something." – Jennifer (P2), Mom and Government Clerk*

> *"When [our daughter] had soccer and [our son] had hockey you knew which one of the two of them you had to worry about. And one of the better things about that is you knew what time of day depending on which [child]… The color is the best part, that's why we do the color." – Brad (P2), Dad and Architectural Technician*

Fig. 14. Greg and Lana (P14) use highlighters to make important events stand out on their calendar.

Mona (P2), a teacher, uses colors to highlight the types of activities on her calendar rather than who has activities. Pink events are birthdays and births, blue is for education and teaching, and bright blue is for school holidays. Figure 14 shows Greg and Lana's (P7) calendar where important events are highlighted. For other families, there is sometimes the extreme case where color and nothing else is used to show that an event is taking place. For example, the number on a calendar day may be highlighted to represent an event on that day.

Despite really enjoying the use of colors, families who do color events often end up stopping after time. We interviewed several people who used to use colors but who did not currently. This is not to say people don't continue to use colors, but many who do use colors at some point end up finding it to be cumbersome. Colored pens can be easy to lose or hard to find and it is often much easier just to grab whatever pen is available. For example, Anita (P9) used to use color on her calendar: a color per person and a highlighter for birthdays. Anita finds she just doesn't have the time to be this meticulous with adding events to her calendar now that her children are involved in more activities. Cathy (P11) goes out of her way to use colors for important events on her calendar that she can't miss and tries to sidestep the problem of losing pens by tying a 4-color pen to her calendar with a string.

7.4 The 'Extra Information'

Family calendaring is about more than just the actual events written on the calendar. There is often an abundance of other information that must be kept along with the events, or information that is not necessarily associated with a particular calendar day like additional schedules, maps, phone numbers, and tasks. This information is important but people often struggle with where to put it because it often doesn't nicely fit on the calendar. Sometimes it even needs to travel with people because it describes the details of how to use the event on the calendar, for example, how to get to a particular location. We found that 50% of families (10 of 20) either write this information in the margins of the calendar, or augment the calendar by attaching information directly to the calendar (Figure 10, Row 4). This keeps the information close at hand to the calendar, and provides quick access to it.

For example, Anita (P9) slides pieces of paper into her calendar (Figure 15) to store handouts for the various extracurricular activities her children are involved in. When mobile, she will then take the extra information that is needed and place it in her purse. Anita describes the challenges of the 'extra information':

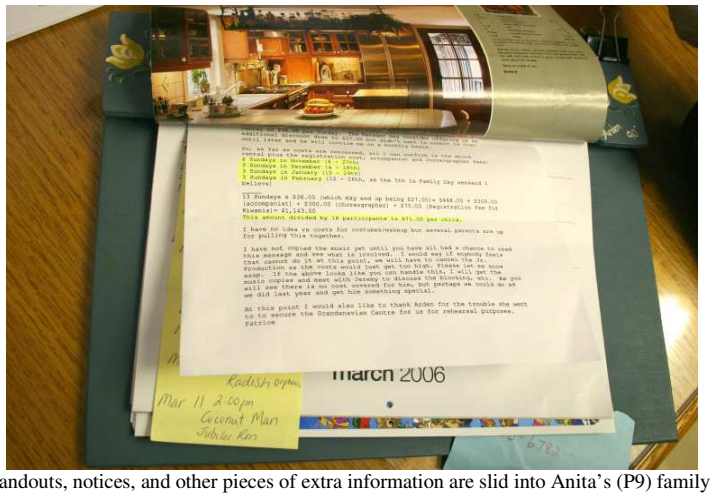


Fig. 15. Handouts, notices, and other pieces of extra information are slid into Anita's (P9) family calendar.

Fig. 16. The pocket in Samantha's (P14) family calendar holds extra information.

"The only thing that is missing is all the other details that I have like how do you get to this place, where is that, all the extra stuff. It'd be nice with all the extra stuff if you had it in one place then I wouldn't need my purse file. I used to have extra things stuck to the fridge, now they're stuck in the calendar. We used to have their soccer schedules on the fridge. I think it's trying to get it all in one place." – Anita (P9), Mom and Accountant

Samantha (P14), mother of two children aged 12 and 14, has specifically selected her calendar to help with the problem of storing the extra calendar information. Samantha orders a Block Parent calendar every year over the phone for the simple reason that there

is a *pocket* behind each month (Figure 16) which she uses to place the extra stuff that goes with her family's calendar events.

Familes who do *not* augment their calendar to hold the 'extra information' will often find nearby locations for it. Brad and Jennifer's family (Figure 17) ends up with this information stuck on the fridge next to the calendar; thus, the fridge becomes an ecology containing both scheduling and associated information. Susan's (P23) family has developed yet another strategy for handling this extra event information. The 'Book of Life' is a binder that contains all of the school notices, maps, phone number lists, etc. that the family needs to reference often when going about their everyday activities. The Book of Life resides in the kitchen in a drawer near the calendar and any family member can pull it out to check the information.

7.5 Symbols: Stickmen, Stickers, Etc.

Some families also place symbols on their calendars, like drawings or stickers, to serve as abbreviations, to highlight activities, to indicate the status of an event, and even to make calendaring more fun. Here the symbol either replaces text or augments it. We found 35% of families (7 of 20) used symbols on their calendar (Figure 10, Row 5), where these visual representations benefit families by again providing an at-a-glance view of what activities are on the calendar.

For example, Charity (P16) has developed a very rich symbol system for her family's calendar (Figure 18) so that her children, aged 3 and 5, can learn and understand what activities are on it. The upside-down stickmen (23rd and 2nd) represent gymnastics for her daughter, the books mean school, the dog means dogsitting, the smiling house (27th) means her son is going to grandma's house, the treble clef (27th) is for her son's music lessons, M is for a special lunch at Montana's, and the 'Mom' balloon (1st) is Mom's birthday. Even though the symbols were originally intended for the children, Charity's husband, Bruno, says they also provide him with an at-a-glance view of what activities the family is doing.

Mona (P20), like some other primary schedulers, tries to achieve a similar effect through the use of stickers. Mona's calendar comes with a set of generic stickers like "Important," "Birthday," and "Activity." Figure 19 shows stickers on a few days from her calendars. However, Mona finds the set of stickers to be quite limiting, both in terms of

Fig. 17. Brad and Jennifer's (P2) calendar on the fridge along with information relating to it.

Fig. 18. Charity (P16) uses symbols on her calendar for her children who can't read yet.

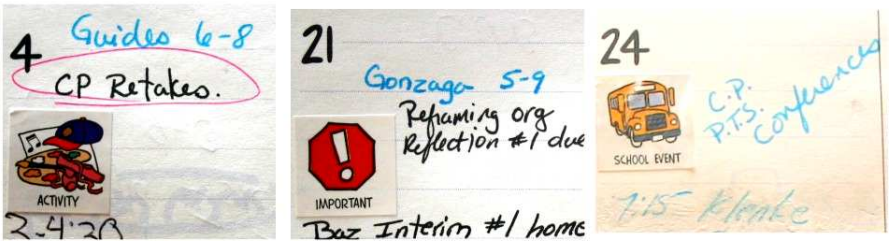


Fig. 19. Mona's (P20) uses stickers on the family calendar to highlight events for her children.

the quantity of stickers given with the calendar and the small range of types. She says that the idea of adding stickers to the calendar makes things a little more fun for her kids who like to place the stickers next to events.

Some families also use symbols like '?' marks to reflect the fact that some events are tentative, or they will put a large 'X' or line through days as they pass in order to easily see what day today is. Elaine (P12) also uses symbols to show which days have passed, but has found the use of an 'X' caused her confusion. As a result, she writes a large 'C' on days that have 'completed':

> *"C just means [the day] is done. I used to X them out but I used X's to mean there is no school…because I have to know what day the kids don't have school…it was kinda confusing, holidays were a highlighted X, but then I got lazy and didn't want to use the highlighter. I used to cross out the days with a squiggle but then I couldn't read what was under if I wanted to look back. I like to cross out the dates because then I know what day it is." – Elaine (P12), Mom and Homemaker*

8. DISCUSSION AND DESIGN IMPLICATIONS

As social science research, our study findings contribute an understanding of the everyday social routines of family calendaring. Focusing on human-computer interaction concerns, we can contribute even more value by using our findings to suggest empirically-based guidelines for the design of digital family calendars.

Other researchers have already suggested calendar guidelines, such as: allowing synchronization between multiple devices [Beech *et al.*, 2004] that are likely to be heterogeneous [Taylor and Swan, 2005], providing remote calendar accessibility [Crabtree *et al.*, 2003b, Beech *et al.*, 2004, Brush and Turner, 2005], and creating protocols for negotiating events [Crabtree *et al.*, 2003b]. We use our results to build on

these ideas, where we show what calendar devices are likely to need synchronizing, what locations are necessary for remote access, and how we can aid coordination by leveraging the techniques people already employ. As we have seen, families have developed their own routines within a family type (Mono/Peri/Polycentric). Rather than force people to change their routines or the nature of their family types, our goal is to enhance what they currently do. The main premise of our design guidelines is to *support family coordination by enhancing both scheduling and awareness acquisition through the use of calendaring devices in multiple locations*. We now list and discuss each guideline.

1. **Public and Accessible:** *A digital family calendar should have a publicly available client in high traffic areas of the home that is always-on and accessible.*

Many families use Public Awareness calendars because they are publicly available in high traffic areas of the home for updating and checking by both primary *and* secondary schedulers (regardless of whether all actually do check and update the calendar). To replicate this feature in digital family calendars, the form factor of the design must allow the placement of the calendar in a variety of locations that families would normally want to place Public Awareness calendars. Moreover, much like paper wall calendars, the calendar should be accessible with minimal interaction so one can simply glance at the calendar. Information appliances where the device is dedicated to a specific task like calendaring would be appropriate in this regard. However, placement of the calendar on a conventional computer would be less than optimal because of problems locating it (e.g., its footprint) and because it would be used for multi-tasking (the calendar would not be visible). Several (unprompted) participant quotes discussing digital family calendars allude to the points we make:

> *"I think a digital calendar is a good idea but you have to be sitting at the computer. If you're in the kitchen, you don't have the time to boot up the computer to see what time your meeting's at. If a digital calendar was on my wall attached to my computer now wouldn't that be easy!" - Linda (P3), Mom and Administrator*

> *"I don't have to pull something up and kick the kids off the computer…if you designed something that looked like [my paper calendar] and was inexpensive and there it was on the fridge and you had one of these pencil things [a stylus], then there you go…If [a digital calendar] was on the fridge and like [my paper calendar], it'd be an easy transition…it would have to be a small size because you don't have that much space [on the fridge]. And turning on the computer [sighs], a computer is way too slow." – Kayla (P19), Mom and Homemaker*

Beech *et al.* [2004] suggest a wall-mounted large display for the family calendar, though reflections on paper calendars suggest this type of digital calendar may be cumbersome to use. People routinely take wall calendars down to write on them, and sometimes move them to various locations in the home for discussion or planning. Alternative form factors like Tablet PCs (i.e., pen based, light, but of course much cheaper if they are to be considered for this dedicated use) may be more appropriate as they have affordances that more closely match people's existing behaviors. These location needs also mean that traditional interaction through a mouse and keyboard may not be easy. Imagine trying to use a keyboard and mouse on your kitchen counter amidst a variety of other forms of clutter. Instead, *digital family calendars should use pen-based interaction,* as pens are better suited for locations away from a desk like the kitchen wall

or counter. This type of interaction takes advantage of the actual physical and social context of which the user is present [Dourish, 2001].

Crabtree *et al.* [2003b] suggest digital family calendars should incorporate access rights for extended family or friends to view the family calendar. Yet nobody in our study suggested this feature. In fact several participants felt their calendar was not appropriate for public viewing outside the home because it was messy. While one could extract event information and provide it 'out of context' for others, we emphasize nobody from our study suggested this.

2. ***At-a-glance Awareness:*** *A digital family calendar should provide at-a-glance awareness of activities and calendar changes for easy awareness acquisition.*

In workplace calendaring, the norm is to explicitly list and invite meeting attendees [Palen, 1998, 1999], or to give people access control permission to 'log onto' one's calendar. This is not how coordination is done in family calendaring: none of our participant families kept records of who was needed to attend a family event. Instead awareness of calendar activities is used to coordinate who is attending or driving to events. This has serious implications for it suggests that importing explicit features that show who is supposed to attend an event from workplace calendars into digital family calendars will likely not be used by families. Instead, we have found that acquiring an awareness of family events directly or indirectly from the calendar is what aids coordination. Thus, it is important in any digital family calendar design to make the acquisition of this information easy and at-a-glance. While in most families it is the primary scheduler updating the calendar, visual cues on the calendar can help her understand if others have updated the calendar as well. Crabtree *et al.* [2003b] suggest providing negotiation facilities in digital family calendars to help family members plan events and decide who will attend, yet we argue these types of features would not be used by most families. As we saw, secondary schedulers in Monocentric and Pericentric families do not check the calendar frequently enough (if at all), rendering any form of negotiation protocol mostly useless. Plans are also changed too frequently in some families and, if used, negotiation protocols would simply increase the workload needed for coordination.

Families already employ specific social techniques with their family calendar to provide awareness at-a-glance, such as having the Public Awareness calendar publicly visible in the home. This practice can be leveraged by having the calendar accessible from multiple locations (discussed in subsequent guidelines), as it will help provide more opportunities for family members to be able to glance and see the calendar. Yet an *at-a-glance quality requires more than just the calendar being viewable from multiple locations*. It requires the *information within the calendar to be discernable quickly*. We saw that people already use various annotation techniques on their calendars to achieve this, and this should most certainly be provided in a digital family calendar. For example, people use color and highlights to indicate which events are important, or who has events on a particular day. They also use abbreviations in a similar respect, so less information must be read and processed to understand what activities are occurring. They may even use symbols or stickers to achieve awareness without having to read calendar entries. Paper calendars also often contain a visual history of what has changed, usually shown with pen markings. These types of visual features should be supported in a digital family calendar and would most certainly help individuals quickly understand what is on them and what has changed. Supporting rich annotations like these is also suggested by Crabtree *et al.* [2003b], though we identify the specific kinds of annotations designers should expect to support.

What about the case where the calendar is not being checked enough? This happens for secondary schedulers in Monocentric families, and could also happen to family members from other family types when they neglect to check the calendar. In these cases, providing visual features within the calendar to make information stand out will not help. Instead, perhaps automated reminders may be appropriate, where the reminder is sent *to an individual*. We emphasize that reminders cannot simply appear on the calendar or they will still be missed; instead, they need to be sent to contextual locations [Beech *et al.*, 2004; Elliot *et al.*, 2005], where family members will actually see them. This is an example where location-based message systems could augment a digital family calendar by sending reminders or the calendar events themselves to an appropriate location, e.g., like an exit leaving the home, the fridge door, or a mobile phone of a family member [Kim *et al.*, 2004, Sellen *et al.*, 2006, Elliot *et al.*, 2006, Ludford et al, 2006].

We also need to recognize that primary schedulers are involved in most events directly or indirectly by having to remind others about them. Thus, most events could also have reminders sent to the primary scheduler so he or she can inform others, although some balancing would be needed to avoid interruptions. However, sending automated reminders to other family members is likely problematic, as people don't assign family members to events ahead of time. Thus, it would not be clear which events are relevant to which family members. While software could attempt to infer this information, it would be subject to errors. Alternatively, location-based reminder systems could provide features to allow the primary scheduler to forward appropriate reminders as needed. Such features could lessen the reminding burden on primary schedulers, especially in the case of Monocentric families that rely primarily on this person to tell others what is going on.

3. **Appropriate Information:** *A digital family calendar should support adding and viewing appropriate event information at different levels of detail.*

While families place a variety of types of events on the family calendar, the common theme is that they are events affecting the family. This contrasts heavily with the workplace calendar's focus on the 'individual' [Palen, 1998, 1999]. As well, families will sometimes record household tasks and reminders on the calendar to reduce their memory load. In spite of this diversity, the type of information and number of events does not differ per family type. Thus, *family calendar design for event content does not need to be tailored to particular family types*. While the types of items recorded on the calendar varies, so does what people actually write down for calendar entries. Families are idiosyncratic in style, rather than the patterns they follow. Thus, we suggest that *digital family calendars support free form event creation,* where the scheduler is able to choose what information is added for calendar entries to create their own meaning for calendar events. This type of flexibility is described by Taylor and Swan [2005], though not in the context of calendar entry.

The limited size of days on most calendars causes people to abbreviate information on the calendar, be it the name of the person, event, or its location. Particular events may not even be written because of a lack of space. Calendar events also have a variety of 'extra information' like paper notices that are associated with them where people are forced to write in the margins of their calendars, augment the calendar, or place this information in cluttered locations near the calendar. *Digital family calendars should be designed to provide more space for some calendar entries and the easy incorporation of 'extra information' associated with events.* Additional space to add more events or display event information could come from the use of visualization techniques like semantic zooming as suggested by Bederson *et al.* [2003]. However, other calendar visualization techniques

designed for work calendars [Mackinlay *et al.*, 1994] appear to limit the ability to gain an awareness at-a-glance, though this would require evaluation. Perhaps augmenting a digital family calendar with systems that allow the creation of lists [Elliot *et al.*, 2006, Ludford *et al.*, 2006, Sellen *et al.*, 2006] could help support the incorporation of 'extra information' for events. Events could also be linkable to emails and web URLs that may contain relevant information, like sports schedules or maps to locations. Of course, a problem is what to do with current paper-based information, for it is more difficult to link this to a digital calendar unless the information was scanned in.

4. **Work Access:** *A digital family calendar should be accessible for viewing and editing family events while at work.*

We also saw that family members use Personal Work calendars to store either all or some of the family's events, as this helps them stay aware of family activities and coordinate when at work. They may also think of events they need to add to the family calendar while at work. Digital family calendars should allow access to add and view family events either by offering *a client that runs on a work PC where family calendar content synchronizes between work and home clients*, or by having *family events available within the context of one's work calendar*. Some work-specific events also affect the family schedule and sometimes family members think of events to add to the work calendar when at home. Thus, *family calendar designs should offer access to certain work events from within the context of the home, and vice versa*. Beech *et al.* [2004] argue for seeing work and home activities together, yet the relevance of such events will come and go when at work or home. For this reason, we suggest that information should be selectable for display at work and home, which is also argued for by Brush and Turner [2005]. We also know that calendar interaction for work environments is well suited to a mouse and keyboard where PCs are situated on desks; therefore, family calendar clients for the office should also permit mouse and keyboard interaction.

5. **Mobile Access:** *A digital family calendar should provide a mobile interface for viewing and editing family events while not at home or work.*

We saw that family members need to be able to schedule and check the calendar while out and about. This was also found by other researchers, though design suggestions for a mobile calendar interface were out of the scope of their work [Crabtree *et al.*, 2003b, Beech *et al.*, 2004, Brush and Turner, 2005]. While mobile scheduling (and thus calendar checking) is clearly an important task, we did not find it to be a frequently occurring task. Nearly a quarter of families (23%) used a Personal Mobile calendar to support it. Those who did not have a Personal Mobile calendar had fairly practical workarounds while mobile like using appointment cards, one's memory, or phoning others at home. Of course, these strategies have their drawbacks, but more importantly they suggest the way in which a mobile family calendar interface should be designed. That is, they suggest families do not need their entire family calendar when mobile. Instead, they may need to query for particular time periods to see if they are available to schedule something, they may need to leave a message to add something to the calendar, or they may need to just find out the location of an event. Thus, *many families would benefit from lightweight mobile technologies that permit querying or leaving a message with the family calendar*. This suggests that small devices can serve an important role. Perhaps technologies that send lists of task information to mobile phones [Ludford *et al.*, 2006] could be augmented to send relevant calendar information when needed. Conversational input proposed by Lyons *et al.* [2005] may also be suitable. There will certainly be families who want full

calendar access while mobile, and in this situation it would also be necessary to have a mobile version of a family calendar that synchronizes with an in-home client. Space limitations on mobile devices naturally call for information visualization techniques like semantic zooming [Bederson *et al.*, 2003].

6. **Multiple Home Locations:** *A digital family calendar should be accessible from multiple locations within the home where the information displayed may vary.*

Families also place calendars in multiple locations in the home; 34% of our families had more than one calendar in the home either as a second Public Awareness calendar, or more specialized calendars in the form of Children's, Reference and Planning, or Task and Chore calendars. While this is less than half of families, it still outlines an important family need. In fact, we suspect that other families don't have multiple calendars in the home because synchronizing them would currently be tedious. Yet synchronization is easy with digital calendars (if a design adequately supports this feature in a useable fashion). This suggests the need to have multiple family calendar clients present within the home. Not all locations would need to display the same information however; *clients would need events to be selectable for information display*. For example, a Children's calendar displayed in a child's room could show only events relevant to the child. Events on a Planning calendar could be displayed on a Public Awareness calendar once they are finalized, or a Reference calendar could show a high level view of the entire year highlighting days with large amounts of activity. Reminders for tasks already appear on many Public Awareness calendars and again could easily move between dedicated Task and Chores calendars and a Public Awareness calendar.

9. DIGITAL FAMILY CALENDARS

Currently digital family calendar design is dominated by online calendars ostensibly designed for family or personal use (e.g., 30Boxes, Family Scheduler, Google Calendar, Our Family Wizard, Planzo, Trumba). Yet after analyzing a sample of these calendars, it is clear that *current digital online calendars offer a largely impoverished experience for families that does not match their natural routines*.

Digital online calendars are disadvantaged when it comes to providing a publicly available, always-on or accessible family calendar (Guideline 1). For example, explicitly going to the PC in a home office or spare room, launching a web browser, and logging in to the family calendar is certainly not as easy as passing by the paper calendar hanging on the wall in the kitchen and glancing at its contents. This inaccessibility could work for a Monocentric family, but would likely force other family types into monocentric behavior and probably prevent other family members from engaging with the calendar. Families could, of course, locate a PC in a high traffic home area, use one login account for all members, and leave its web page always-on. Yet interaction would still be a challenge, as these locations don't lend themselves naturally to mouse and keyboard interaction. While a tablet PC form factor does promote stylus interaction, existing web page interactions often make stylus use more, rather than less, cumbersome. Finally, while some families do have dedicated PCs in their kitchen or living room, they often use it in a task-switching "work" mode that would compromise the 'always on, always visible' requirement of a domestic calendar.

Digital online calendars also do not always match the needs of families to gather awareness at-a-glance in order to coordinate (Guideline 2). Instead, many provide explicit event negotiation, were individuals are invited and assigned to events (e.g., Family Scheduler, Our Family Wizard, Google Calendar, Trumba). We stress again that while this is reasonable for work scheduling, this is not how families coordinate. On the

positive side, many digital online calendars do provide a means to acquire awareness at-a-glance by explicitly assigning colors to events (e.g., 30Boxes, Family Scheduler, Google Calendar), though some do not (e.g., Our Family Wizard, Planzo, Trumba). Yet all of the online calendars we looked at restrict the information that people are able to add for an event. For example, most restrict people to typing; people cannot draw pictures, symbols, or include a visual image like a sticker to represent events. This detracts from a calendar's ability to provide at-a-glance awareness. Digital online calendars' use of automated reminders also does not match the needs of families. While many permit sending reminders to email or a mobile phone (e.g., 30Boxes, Family Scheduler, Google Calendar, Trumba) at a designated time, they are restricted to just one email address or mobile device, rather than a plethora of devices that would be needed for proper family-oriented location-based messaging.

Current digital online calendars do not allow appropriate event information (Guideline 3). While they do support adding any type of event, they restrict the actual information that one can enter by only allowing typed text. Some even automatically parse this information and extract out potentially relevant description details (e.g., 30Boxes, Google Calendar). These calendars are also most often designed specifically for individuals (Family Scheduler is a notable exception): the underlying assumption is that each person will have their own online calendar, while still being able to view the calendars of others overlaid on one's own. This idea is obviously imported for work calendars, and we believe it would create unnecessary authentication and sharing issues if one is to try and view all activities relevant to the family from a number of different calendar accounts.

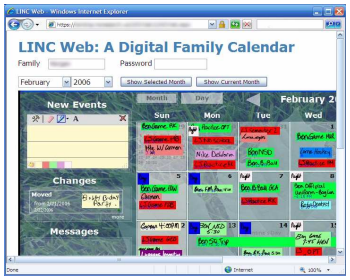
When it comes to ubiquitous calendar access from work (Guideline 3), while mobile (Guideline 4), or from multiple home locations (Guideline 5), digital online calendars are mixed. On one hand, they are well suited to provide access to family calendar events while at work; they are, after all, designed for traditional desktop PCs. Another nice feature is that no special software is needed because these calendars run in standard web browsers; this could alleviate potential security constraints that disallow installation of personal software at work. On the other hand, digital online calendars typically do not provide the mobile family member with a good calendar access experience. While one could navigate to a web page on a mobile device, these web pages are designed for a standard PC display *vs*. a small screen. Finally, and as previously mentioned, these calendars are designed to run on a standard mouse-based PC, which compromises how they can be positioned in multiple home locations.

Given this analysis as a whole, we clearly need an alternative calendar design that more adequately meets the needs of families. In parallel with our study-based understanding of family calendars, we iteratively developed LINC, a prototype digital family calendar (Figure 20). LINC is our first step at meeting our proposed guidelines; full details of its design and evaluation can be found in Neustaedter and Brush [2006] and Neustaedter, Brush, and Greenberg [2006].

To summarize, LINC is designed as a dedicated information appliance—prototyped using a Tablet PC (Figure 20d)—that makes the family calendar easily accessible and always available (Guideline 1). LINC can be placed in any home location that fits within a family's current routine. Using a stylus, family members create an event by writing a note (Figure 20a, top left) and then dragging it over the appropriate day (Figure 20a). Using the stylus, people can create their own free form representation of event entries (Guideline 3), where they can use various annotation styles including note and ink colors. This helps make the calendar's contents available at-a-glance (Guideline 2). The LINC client can also run on any desktop PC where all clients synchronize through a server. Thus, LINC can be running at work (Guideline 4) or from multiple home locations

20a. LINC showing a sample family's calendar.

20b. LINC Mobile



20c. LINC Web

20d. The main LINC client on a Tablet PC.

Fig. 20. The LINC digital family calendar, designed to augment existing family calendaring routines.

containing Tablets or other PCs (Guideline 6). If it is not possible to install the full LINC client, LINC Web (Figure 20c) can be accessed using a web browser which shows an image of the family calendar. LINC Mobile also displays an image of the family calendar, which can be panned and zoomed, making the family calendar available ubiquitously while mobile (Guideline 5).

LINC is not without its pitfalls, but that is the subject of other papers [Neustaedter and Brush, 2006; Neustaedter, Brush, and Greenberg, 2006]. For now, we are improving its interface to better match the study results and guidelines detailed in this paper. We also recognize that LINC is only one of many possible family calendar designs that can be developed from our guidelines. We have only begun to scratch the surface.

10. CONCLUSION

Family calendars play a pivotal role in the everyday coordination of family activities. We have presented, through the study of 44 different families' routines, the core attributes of

family calendaring. In this respect, we have shown how a typology of calendars is used by families to record events, to gain an awareness of activities, and to coordinate by using this knowledge. We have also uncovered the types of events placed on the family calendar and the annotations and augmentations that are used to appropriate calendars for everyday use. We believe that digital family calendars can and should be designed to fit within the existing routines of families that we have articulated; otherwise the calendar will simply not be adopted by families.

Our study looks specifically at the family calendaring routines of middle class families in Canada and the United States. We expect that our results generalize to middle class Western culture given the fact that social psychology studies have shown that most industrialized nations exhibiting strong economies have fairly similar tempos and notions of time [Levine, 1997]. However, there will naturally be exceptions based on one's location (e.g., rural vs. urban), personality (e.g., Type A vs. B personalities) [Levine, 1997] and context (e.g., living alone, or dysfunctional families). Thus, while the specific needs of families and individuals within middle class Western culture will differ, we believe the main principles we have uncovered will stay the same.

We leave the investigation of the calendar usage of other cultures to future studies rather than broadening our article's scope, although our work could be considered a precursor to this comparative study. Many cultures exhibit very different notions of time (e.g., third world nations) and as a result will use very different methods for coordinating activities, if activities need to be coordinated at all. While comparing these cultures to that which we have studied would be very interesting, this is not the focus of our current work.

Future work should also continue the exploration of family calendar design by applying the knowledge we have presented to the design and evaluation of digital family calendars.

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