

Informing the Development of Calendar Systems for Domestic Use

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Abstract. This paper contributes to the design of Groupware Calendar Systems (GCSs) for use in domestic life. We consider a number of ethnographic studies of calendar use in domestic circumstances to illuminate the design space and inform design reasoning. GCSs have been employed in the workplace for sometime and have been informed by studies of ‘calendar work’. As design moves out of the workplace and into the home, the unique demands of domestic use now need to be considered. Existing insights into calendar work are restricted to the workplace however, and are constrained by analytic taxonomies. In the absence of first-hand knowledge of calendar use in domestic settings, we suspend the use of taxonomies and describe the ‘interpretive work’ implicated in calendar work in order to explicate real world practices of calendar use in domestic life. These novel studies draw attention to a corpus of accountable work-practices that impact directly on design. In particular, they emphasize the need for design to consider how the physical and the digital may be merged to support collaboration ‘anywhere, anytime’; the necessity of devising negotiation protocols supporting computer-mediated communication; and the development of collaborative access models and interaction techniques to support data sharing.

The Social Character of Calendars

Electronic versions of the mundane calendar are one of the most successful kinds of collaboration technology to be adopted by end-users to date (Palen and Grudin 2002). Calendars are ubiquitous tools in office work, where it has long been recognised that they play an important role in the coordination of organizational affairs (Kincaid and Dupont 1985). Calendars are also prominent coordinational devices in the domestic environment - a setting not characterised by the organization of action for purposes of production and efficiency, but an organized setting nonetheless (Venkatesh 1996). The manufacturers of integrated office systems have included electronic versions of the calendar in almost every system they offer. As the computer moves out of the workplace and into the home we might expect to see the continued development of electronic calendars and other Personal Information Management technologies for home use. This is not simply a matter of technology transfer, however. The home is a distinct environment and it has already been recognised that there is a need for design to be sensitive and responsive to the unique demands of domestic life (Gaver 2001).

The development of calendars supporting office work was initially informed by empirical studies of paper-based calendar use (Kelly and Chapanis 1982) and the same strategy might be usefully employed as design moves into the domestic space. Empirical studies of calendar use in the workplace have identified a wide range of properties implicated in calendar use. In addition to their ubiquity, it is noted that calendars are both personal and social objects, providing a means for individuals to organize their affairs and a visible resource making others aware of the individual's schedule. This observation has led to the development of open, restricted, and closed models of calendar use in design, where the availability of personal information may be constrained by users according to the social circumstances of use (Palen 1999). Recognition that calendars are information-management tools (Bellotti and Smith 2000) complements the observation that calendars are also communication devices that provide for awareness in their visibility (Ehrlich 1987). To this we may add that the visible character of calendars gives them a mnemonic function in 'marking out' and so reminding users of important events that they must attend to (Zerubavel 1981).

The various complementary properties of calendars (information management, communication and mnemonic functions) coupled with that essential property - time - provides a rationalized representation of the user's actual schedule of real time activities (Lauer 1981). This is not to say that the calendar actually matches the user's activities but rather, to draw attention to the planful character of calendars in their real world employment. Calendars are temporal plans of coordinate action situated in social space and may be characterised as temporal maps constructed by users to coordinate events with others. In the *in vivo* course of their construction, calendars come to assume the character of workspaces

consisting of a discrete body of ‘calendar work’ (Palen 1998). This work has been accounted for in terms of a taxonomy that is intended to “identify the basic components of calendar work and illustrate the richness of calendar interaction” (ibid.). Accordingly, the taxonomy highlights how calendar work 1) ‘orients’ users to the temporal order of events, and enables users to 2) ‘record’, 3) ‘remind’, 4) ‘schedule’, 5) ‘track’, and 6) ‘recall’ events within and over that temporal order. Coupled with appropriate access and privacy protocols, it is suggested that awareness of these essential features of calendar work may inform the continued development of shared workspaces – i.e., Groupware Calendar Systems (GCSs) that may be shared either synchronously or asynchronously and in either a co-located or distributed manner by more than one party.

Moving from the Workplace to the Domestic

As noted above, moving design into the domestic is not simply a matter of technology transfer. GCSs will need to be responsive to the unique organizational demands placed on calendars and other personal information tools in the home. In the first instance, it might be noted that domestic calendars – and by that is meant calendars that are situated in the physical environment of the home - are not employed to support groupwork as they are in the workplace. Domestic calendars are not shared as they are at work to coordinate meetings with members of the organizational team or to schedule resources, for example. Nor are they open or closed but, as a result of their physical placement in the home (often in the kitchen), they are ‘proximally’ available to co-located members of the household. Further contrasts could be made, but the point to appreciate here is that the assumptions and insights developed in the design of GCSs for the workplace are not readily or straightforwardly transportable to the domestic. The workplace and the home are different and while it might reasonably be expected that the essential character of ‘calendar work’ will persist, this too is problematic.

The problem is not that household members do not use calendars to ‘orient’ themselves to the temporal order of events, and to ‘record’, ‘remind’, ‘schedule’, ‘track’, and ‘recall’ events within and over that temporal order. Rather, calendar work is problematic because it has not yet been explicated and described. To provide a taxonomy of calendar work – i.e., a scheme of classification – is not to make that work visible and available to design reasoning, it is only to classify a discrete ensemble of real world activities. What do those activities look like? What does ‘orienting’ to the temporal order of events consist of as a recognizable calendar-based activity? How is that activity and the other basic components of calendar work put together or constructed in interaction? Taxonomies don’t answer questions like these because they do not show the work involved in the real world, real time accomplishment of discrete activities. Taxonomies make reference to real world activities – they talk *about* them – but they do not display the activities referenced in actual details *of* their accomplishment. The taxonomy

is offered as a proxy for the work, then, and so stands as a gloss that remains to be explicated (Garfinkel 1967). This is not to criticise taxonomies in general – obviously they have important uses, especially in the natural sciences – but to draw attention to their limitations when used to describe and represent human interaction. It is, however, to recognise that as we do not know what calendar work consists of as an accomplished ensemble or corpus of real world activities in the home – do not know what the ‘basic components’ look like as it were – then it is difficult for us to determine what appropriate design solutions might consist of concretely.

One solution to the problem is to complement taxonomies of interaction with a consideration of the ‘interpretive work’ that is observably and reportably implicated in calendar work (Dourish et al. 1993). The notion of interpretive work draws our attention to the ways in which members make sense of calendars in the actual course of using them. As Dourish et al. put it, “interpretation is guided by a context which many electronic systems do not acknowledge ... [but which is important] for the design, deployment and evaluation of shared information systems” (ibid.). While there are many notions of ‘context’ at work in computer science today, Dourish employs the following when invoking the word: “context is managed moment-by-moment, achieved by those carrying out some activity together, and relative to that activity and the forms of action and engagement [with artefacts] that it entails” (Dourish 2002). This notion of context provides us with a firm orientation to the interpretative work implicated in calendar work in the home and elsewhere, drawing our attention to the moment-by-moment nature of that work and, more specifically, to the observable forms of collaborative action and engagement-with-artefacts made visible in and across an unfolding series of moments that make up the work. Studying the interpretative work of calendar work will consist, then, of making the embodied arrangements of interaction and collaboration implicated in domestic calendar use visible and available to design reasoning (Dourish 2001).

This paper provides a provisional explication of the interpretative work implicated in domestic calendar work in order to inform the design of GCSs that are responsive to the unique demands of domestic use. The study is provisional in the sense that it is not exhaustive – more will undoubtedly be uncovered through further inquiry and, as in the workplace, this course of inquiry is likely to take some time. Specifically, we present a number of concrete empirical instances of interpretive work gathered through ethnographic inquiry. These instances make family members of a corpus of work-practices visible and available to design reasoning. These practices show us that the domestic calendar is an accountable social object whose use is organized in terms of its availability to collaboration, through members compliance with discrete coordination protocols, through the making of distinct annotations and notations, and through practices governing collaborative access and control. This corpus of practices suggests that design

needs to consider how the digital and physical may be merged to support collaborative use ‘anywhere, anytime’, how the making of annotations and notations is organized so as make entries accountable to members who use electronic versions of the calendar, and how data sharing is managed through the development of collaborative access models enabling members to specify a variety of access, read, and write privileges.

Studying Interpretive Work (Methodology)

As design moves out from the workplace and into the home it is widely recognised that new methods are required to support the development of appropriate technologies. Ethnography has been of considerable utility to work-oriented design, providing rich insights into the social circumstances of systems usage, and has promised to do so in a domestic context for some time (Venkatesh 1985). When considering the potential role of ethnography in supporting design in domestic settings it needs to be appreciated that, strictly speaking, ethnography is not actually a method, but a gloss on various competing analytic frameworks. As Shapiro (1994) has had occasion to put it in the past,

While ‘ethnography’ as a term strikes a useful contrast to traditional methods of requirements capture, within sociology and anthropology themselves it denotes rather little. It marks a distinction between quantitative and qualitative approaches to social science and carries with it a commitment to a period and degree of immersion in the social setting being studied that is sufficient to reach a qualitative understanding of what happens there. These are important matters, but beyond this, ethnography can be put to the service of virtually any theoretical school: there are, for example, functionalist, structuralist, interactionist, Weberian and Marxist ethnographies.

As ethnography is not a method but a gloss on a veritable host of analytic perspectives on social life and social activity it does not need to be adapted to support design in a domestic context: ethnography is not a tool that needs reconfiguring, but an analytic sensibility and way of accounting for social action. Indeed, ethnography has already provided valuable insights into domestic life and the role of technology in the milieu of domestic activities (Mateas et al. 1996, O’Brien and Rodden 1997, Venkatesh et al. 2001).

One particular analytic perspective that has been widely employed in CSCW and workplace design more generally, and which continues to inform systems development as design moves into the domestic (O’Brien et al. 1999), has been that of the ethnomethodological mode of analysis (Crabtree et al. 2000). Ethnomethodology (Garfinkel 2002) replaces a concern to account for human interaction through the use of theories, models, taxonomies, and other formal analytic and representational devices for a concern with the ‘thick description’ (Sharrock and Button 1991, Ryle 1971) of the work manifest in members’ observable and reportable interactions. The ethnomethodological notion of ‘work’

does not refer to either paid or (as one might find in the home) unpaid labour. Rather, 'work' refers to the discrete courses of practical action whereby persons construct, organize and reflexively coordinate their mutual activities in their interactions together. Making these recurrent real world, real time courses of action or 'work-practices' visible and available to reflection in design is the primary concern of the ethnomethodological analytic (Button and Harper 1996). It is an analytic point of view that supports Dourish's notion of context, and indeed, a point of view from which that notion is derived. Thus, when accounting for the interpretive work of calendar work, the ethnomethodological analytic will do so in terms of the observable and reportable work-practices made visible by the embodied arrangements of interaction and collaboration whereby calendars come to be embedded in home-life.

Interpretive Work Implicated in Real World Calendar Use

This section presents and considers a number of concrete empirical instances of the interpretive work implicated in calendar work in the home, both as a means of elaborating ethnomethodological study and as a resource informing the development of future technologies supporting Personal Information Management within domestic settings. The empirical instances presented are not representative in a numerical sense, but are instead concerned to examine actual empirical events in details of their actual collaborative construction so that we may learn what we can of the ways in which calendars are used in the home and so inform the design of appropriate forms of Groupware Calendar Systems for domestic use. The instances were gathered as part of a wider, long-term and ongoing study of 22 homes in the UK covering a wide range of domestic media usages some findings of which have been published elsewhere (e.g. Crabtree et al. 2002a; Crabtree et al. 2002b; Crabtree et al. 2003a; Crabtree et al. 2003b; Crabtree 2003).

Instance 1) The Calendar is an Accountable Social Object

The following sequence of interaction takes place between Alex and Sam in the kitchen, where their calendar is situated on the door. Alex and Sam both have jobs which often require them to travel to different places across the country. They have recently had their first child, Jake, and need to coordinate their busy schedules so as to ensure that one of them is available to pick Jake up from the nursery at the end of each working day. Alex has decided to use a calendar as a solution to the problem of coordination, which provides an economical way of displaying their schedules to one another 'at-a-glance' (Kincaid and Dupont 1985). The sequence of interaction emerges in the course of their evening routine: Jake has been fed and put to bed and Alex and Sam are preparing their evening meal; they are having a glass of wine and discussing the day's events and what's

on tomorrow's agenda; Alex reminds Sam of tomorrow's work commitments, which means that Sam will have to pick Jake up. At this point in the conversation Sam also remembers a work commitment, one that has not been recorded on the calendar because it only arose two days ago as a result of a conversation with Sam's boss, Jane:

Alex: It's always the bloody same - you leave it to the last minute every time!

Sam: No I don't. Sometimes I don't get enough notice to

Alex: Doesn't Jane understand about Jake?

Sam: It's not her problem is it.

Alex: Oh come on, she's not that bad - and besides, you could have phoned me at work.

Sam: I was busy, then I forgot all about it. It was only when you said what you were doing tomorrow that it reminded me of

Alex: You, you can see - *look* (Alex points to the row of arrows on the calendar)

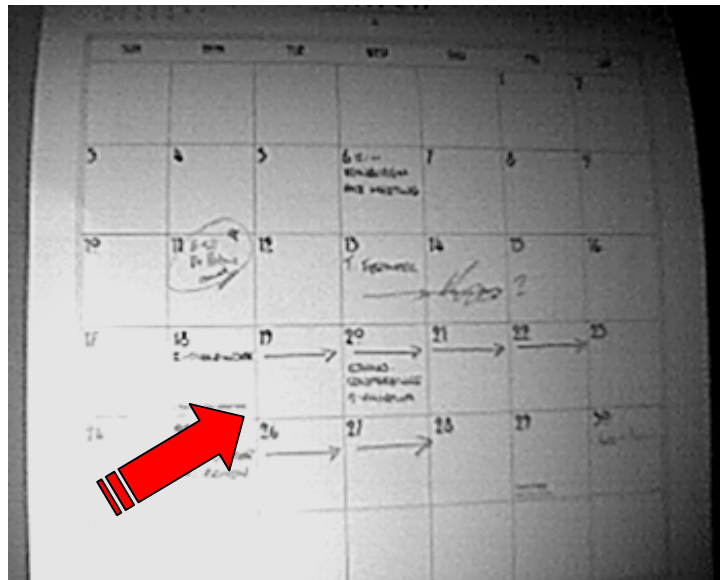


Figure 1. The arrows → → → indicate and display Alex's schedule.

Alex: I'm really pushed and Stuart [Alex's boss] will expect

Sam: I know and "Kinda Like" [a nickname for one of Alex's colleagues] can't drive yet, so it's down to you again. And *that* [causing a conflict in their schedule's] is my fault, *again!* It's my Alzheimer's coming on.

Alex: That's not f***ing funny anymore!

Sam: It's not that I do it on purpose. You're more organized. I just don't always remember until it's too late.

The outcome of this conversation was that Alex had to reorganize the following day's work so as to be able to pick Jake up. It is a grossly observable feature of Alex and Sam's conversation that, in details of real world, real time human praxis, the calendar is an 'accountable' social object – i.e., a discourseable object oriented to and employed to negotiate schedules and to coordinate practical action. 'Negotiate' is a gloss on an unfolding course of interpretive work in which the calendar is recurrently implicated. Over its unfolding course, that work is

observably and reportably concerned to elicit reasonable grounds for the negotiation in hand: for Sam failing to notifying Alex of recent contingencies that effect Alex's schedule.

What makes the calendar an accountable object, one that is employed, invoked, appealed to, and in other ways skillfully and artfully implicated in the co-construction of a reasoned and reasonable familial discourse providing for the reorganization of scheduled commitments and the coordination of practical action (picking Jake up from nursery), is an ensemble of accountable work-practices that provide the calendar with its recognizable and discourseable features and give it life and meaning. By 'life and meaning' we wish to draw attention to the fact that although calendars consist of certain abstract and generalisable attributes such as various representations of time which lend calendars their planful character, such attributes are meaningless in themselves. Naturally, regardless of whatever attributes calendars may be said to possess, calendars are dead objects in the absence of use. Use transforms the object into a living thing that has meaning, purpose, utility, and demonstrable sense and reference. Use breathes life into the object and that life consists of everything that the accountable work-practices comprising its use could be. We do not claim to identify all the members of the discrete corpus or family of work-practices implicated in calendar use in the home. We do offer the following observations, however.

The accountable character of calendars - and with that, their real world, real time collaborative uses - relies on their availability to collaboration. This issue is currently addressed by household members in practice by placing the calendar in a location where it can be shared, such as on the kitchen door. Shared use relies on members' compliance with coordination protocols. The protocols state, in this case, that members should update the calendar to reflect their schedules and to 'articulate' (i.e., identify, avoid, point out, negotiate their way around, etc.) potential conflicts. Coordination protocols are embodied and expressed in terms of visibly distinct annotations. In Figure 1, for example, Alex indicates and displays her schedule by making visibly distinct annotations to those made by Sam: Sam employs arrows \rightarrow to mark out and make visible his schedule, whereas Alex employs circles \circ . Visibly distinct annotations are accompanied where necessary with explicatory notations. These textual notations 'tell' members who use the calendar what some particular annotation is about, what event it refers to and marks out. Notations do not necessarily accompany annotations and may stand on their own. Visibly distinct annotations and explicatory notations provide for the at-a-glance intelligibility of the calendar for the members who use it. They provide for the accountable character of the calendar, giving it life and meaning, and merit consideration in their own right.

Instance 2) Calendar Use Relies On Essential Accountable Work-Practices

The at-a-glance intelligibility of the calendar for members who use it is demonstrably provided through the annotations and notations that give it sense and reference. Annotations and notations are essential features in the negotiation of schedules and coordination of practical action. We have already seen how annotations and notations are implicated in Alex and Sam's occasioned use of the calendar. Figure 2 shows a range of annotations employed by Veronica and Julian to coordinate and organize their actions around important events in their lives. Here the calendar shows us that Veronica and Julian employ annotations and notations for a variety of purposes.

- Vertical lines on the margin of the calendar are used to mark out holidays;
- Capped lines inside the calendar mark out particular holiday arrangements (such as going to a friend's for a couple of days);
- Notations in the margins mark out the unfolding order of Veronica's work schedule;
- Red notations accompanied by a name mark out birthdays;
- Red notations elsewhere mark important events (like going to the doctor's);
- And a plethora of contingent notations otherwise populate the calendar.

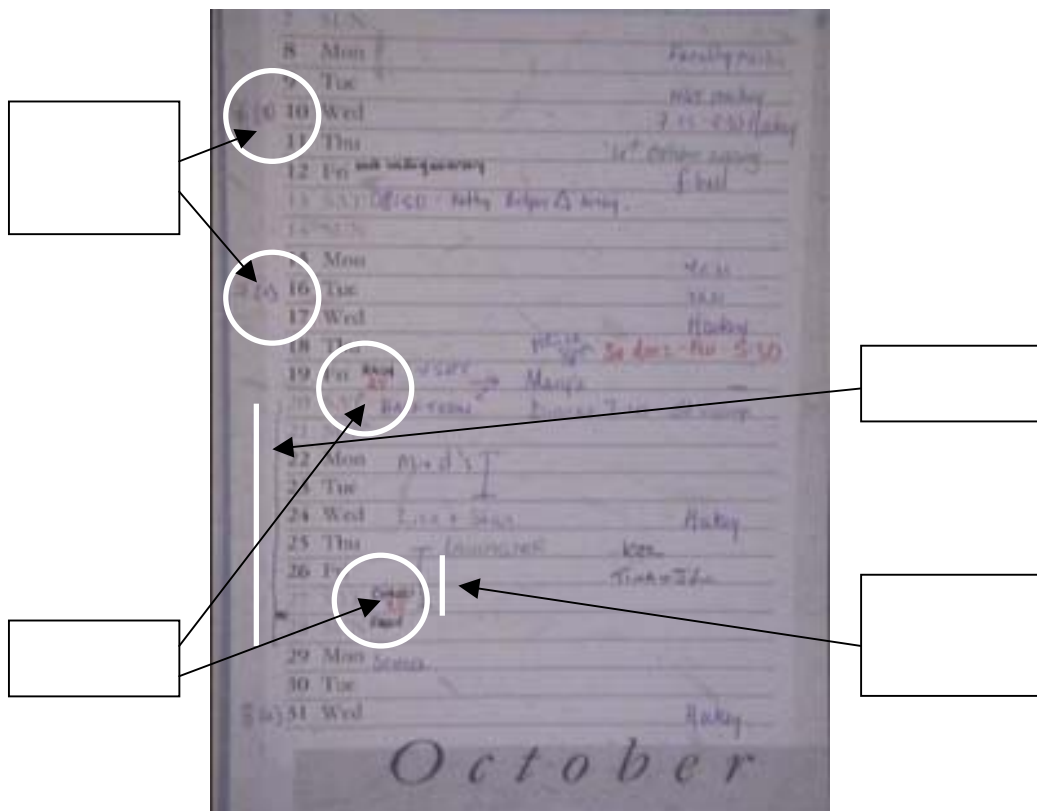


Figure 2. Making schedules visible and available to account

Annotations and notations on paper calendars may be thought of as idiosyncratic, marking the calendar out as a 'private' and 'personal' object and, if

supported in design, as limiting the collaborative value of moving calendars online (Palen and Grudin 2002). As Palen (1999) puts it,

Conventional paper calendars support people in idiosyncratic, personally customised ways. GCSs replace conventional calendars, requiring that they be used both for personal and social coordination.

As noted above, the home is a very different environment to the workplace. For one thing it is not characterised by a large working division of labour or the need to use calendars to coordinate activities on an hourly basis. This, in turn, means that the intelligibility of the calendar does not rely on standardised arrangements of use. Any array of annotations and notations will do for members as long as that array allows them to mark out and display the things they need to mark out and display for one another. In the home, the personal and the social are, already and through local agreement, thoroughly intertwined. Rather than ignore the idiosyncratic, design will need to appreciate its importance when it comes to the domestic and support ‘personal customisation’ because that is what calendar use in homes is all about and that is the great utility of existing calendars: that they can be easily and readily appropriated to support the very personal coordinational needs of household members. Demonstrably, Veronica and Julian’s use of lines and coloured notations along with Alex’s circles ○ and Sam’s arrows → show us that the personal and idiosyncratic does not exclude or inhibit or limit coordination but provides for it, and provides for it at-a-glance (even where just what it provides is the re-negotiation of coordinate action). Providing members with means of making visibly distinct annotations and explicatory notations is not all that the negotiation of schedules consists of as work-practice, however, as the following instance shows.

Instance 3) Collaborative Access Underpins Negotiation

The following sequence of interaction takes place between Sarah and Helen in Helen’s living room. Sarah is the partner of Adrian, Helen’s son. Helen has asked Sarah and Adrian when they are going to visit her again? Having agreed that it will be sometime soon, “sometime in half-term”, Helen goes and gets her calendar off the kitchen door. She brings it back into the living room where Helen and Sarah orient themselves to the calendar to negotiate just when in half-term the visit might occur, which they then relay to Adrian.

Sarah: I’ve got two weeks, Ian [Helen’s grandson] has got six.

Helen: I’ve got Ian at half-term, the week before Sarah’s off (points to area marked out on the calendar; Sarah looks at area pointed out).

Sarah: Because we have different term dates in Derbyshire from what they do here.

Helen: So I’ll have Ian on the Monday and the Tuesday, all day I would think, and the half-day (points to a day on the calendar). But also, Lyn [Ian’s mother] has started on maternity cover so that means both he and Rachel [Ian’s sister] will be here (points to a day on the calendar) on *those* mornings [of the second week] I would think (points to first date then second date and re-emphasises by repeating the action)

Adrian: When’s Sarah, when do you want to come down?

Sarah: Next week, after Ian.

Helen: (Circles the date on the calendar that follows the two she has previously highlighted).

Helen: That's the day when you're coming.



Figure 3. Shared orientation provides for negotiation.

The sequence makes it visible and available to design reasoning that the negotiation of schedules is made possible by collaborative access situating the calendar between the negotiating parties and so enabling a shared orientation. It is worth noting that collaborative access is permitted by the calendar owner following provisional agreement to schedule an event and, for the practical purposes to hand, access is restricted to the time frame in question (which is to say that access to the entire calendar of events is not occasioned). Shared orientation to the calendar is not a given thing but an achieved phenomenon, which is to say that the users mutual orientation is worked up and maintained moment-by-moment over the unfolding course of the accompanying negotiation. Noticeably, the work is done through 'ostensive definition' – i.e., by pointing, gesturing, drawing imaginary lines across dates with a pen or finger and similar transient actions which provide specific reference, direction and emphasis to the conversationalist's talk. Through situated practices of ostensive definition, the negotiation proceeds. Thus, and for example, Helen points out that on these days marked here on the calendar her grand children are coming. Here, the work of negotiation employs previous annotations and notations to identify a possible date for scheduling the event to hand. This is achieved by highlighting those days that are ruled out of play. Reflexively, and in light of Sarah announcing the days on which she is free (the week after Ian breaks up for half-term), this action articulates these unmarked days as candidates. Over an unfolding course of ostensibly defined work appealing to and manipulating previous annotations and notations a definite date is mutually identified and fixed.

A Corpus of Accountable Work-Practices

The instances of calendar use we have presented allow us to identify a number of discrete real world, real time work-practices belonging to the corpus of practices implicated in calendar use in the home and which provide for negotiation and the coordination of practical action. The corpus includes:

- **Situating Calendars so that they are Available to Collaboration:** Negotiation and the coordination of practical action rely on situating the calendar in a location where it is readily available to household members and from where it may found, moved and accessed when needed.
- **Complying with Coordination Protocols:** Effective collaborative use requires compliance with discrete protocols for sharing personal information that affects the members' schedules. These protocols are characterised by updating the calendar with personal information that directly relates to schedules.
- **Making Visibly Distinct Annotations:** Compliance with collaboration protocols is embodied in a wide range of distinct annotations that display particular member's schedules and which serve as a resource articulating conflicts. Annotations take a wide variety of forms as they are used to express a range of different and contingent events.
- **Adding Explanatory Notations:** Annotations are often accompanied by textual notations that give particular annotations their sense and reference. Notations may stand alone however, they do not necessarily accompany annotations.
- **Accomplishing Collaborative Access:** Where calendars are shared with non-household members access is restricted to the time frame in question. Annotations and notations are available to collaborative action however, their use being embedded in situated practices of ostensive definition that enable members to establish a shared orientation and provide for negotiation and the coordination of practical action.

This is not an exhaustive listing of the essential practices implicated in collaborative calendar use in the home, only a provisional one. No doubt that there is still more to be uncovered, just as our current studies have shown that there is more to the design of GCSs as design moves from the workplace and into the home. The listing does give us a definite or concrete starting point for reasoning about the design of GCSs for domestic use, however.

Moving GCSs from the Workplace into the Home

The accountable character of calendar use in the home moves design beyond automation to consider how the collaborative and artful uses of calendars might be supported. Previous work on calendar use has identified a taxonomy of

'calendar work' involved in the collaborative construction of 'shared workspaces' or, more specifically, of GCSs. In our ethnographic studies of calendar use in home settings we have paid deliberate attention to the interpretive work involved in calendar work, which consists of an orientation to and careful description of the 'missing interactional what' of organizational studies (Garfinkel 1986). Explication of the missing interactional what of calendar work specifies in real world, real time detail just what such abstract taxonomic categories as 'orienting', 'recording', 'reminding', 'scheduling', 'tracking', and 'recalling' events within and over the temporal order of calendar work look like concretely; what 'orienting', 'recording', and 'reminding' consist of as recognisable 'jobs' of cooperative work; how 'scheduling', 'tracking', and 'recalling' get done in members collaborations. Furthermore, paying attention to the missing interactional what serves to respecify abstract taxonomic categories in terms of a distinct corpus of accountable work-practices that observably and reportably make up or constitute 'calendar work' in the real world. That corpus of practices is ignored by formal analytic accounts of calendar work, replaced by abstract taxonomic categories that describe work-practice generically and in terms of definitions. Real world work-practice is, as such, rendered unavailable to design reasoning.

Moving from Home Studies to Inform Design Reasoning

Explication of corpus members serves to highlight a number of essential issues as the design of GCSs moves from the workplace into the home. In the first instance, it is grossly apparent that the availability of calendars to collaboration is currently constrained. Paper-based calendars are situated in the home and, as such, are not available to collaboration outside of the home. This may seem like a trivial point to make. If we consider the occasion of Alex and Sam's dispute, however, or the interaction between Sarah and Helen, it soon becomes clear that this is not so. Where Sarah and Helen are concerned, it is plainly visible that only one party has access to a calendar. The other party must remember the date scheduled for meeting and update her own calendar at some later point when access is achievable. Personal schedules are often arranged on-the-fly and human memory is notoriously faulty – we can and often do forget to update our schedules. It is just such an occurrence that occasions Alex and Sam's dispute – Sam "didn't get enough notice", he was "busy", he "forgot" and, because he forgot to update Alex as to the change in schedule at the time the change arose, he didn't broach the issue until it was "too late" to do anything about it. So the first design issue that arises is that of making calendars available to collaboration outside the home; of transcending existing constraints of paper by 'getting the calendar off the wall' and making it 'transportable' through design so that it is available to collaboration

‘anytime, anywhere’, a demand long recognised in studies of workplace calendar use (Ehrlich 1987).¹

Supporting off-site calendar use anytime, anywhere raises a number of issues that we think it important for design to consider:

1) Merging the Digital with the Physical

It might be argued that there is no challenge for design here, that solutions are already at hand in the form of PDAs which include electronic calendars. This would be to miss one of the central points of domestic calendar use: namely, that they are situated in the home in order to provide for collaboration and awareness. Making the calendar disappear from the home is not the solution to off-site access. Rather, it is important for design to maintain the calendar’s visible presence in the physical space of the home and, at the same time, to devise support providing off-site access. Design needs to merge the digital with the physical then, enabling members to situate electronic calendars in the physical space of the home - to locate the electronic in a physical and visible place - and to provide access to the physically situated electronic calendar outside the home via mobile devices. An example of one such arrangement is provided by Tullio et al. (2002):

The Augur system is comprised of a number of components that process, store, and serve calendar information located in a central relational database ... To harvest calendar information, we have implemented PalmOS conduit software that automatically sends calendar information via FTP to our parsing module upon synchronisation with a networked computer. The parsing module reads the PalmOS calendar and updates a table of events in the database whose fields are designed to match the VCalendar specification. A user ID number is associated with each event to identify its owner. A second table lists the system’s users and their IDs.

While the Augur system is designed for workplace use, it nevertheless articulates one way in which designers might think about configuring technical solutions for home use, exploiting networked displays with relational databases and mobile devices to support calendar use inside and outside the home. Such configurations may serve to make personal schedules available to account anywhere, anytime, not only supporting Sarah in her work with Helen, or Alex and Sam’s scheduling arrangements, for example, but also, making Sam’s schedule available to account in his conversation with his boss, which might see different outcomes in the first place. Where Tullio et al. concentrate on making members schedules available to account in terms of predicting event attendance and co-scheduled participants when considering support for ‘interpersonal communication’, we would suggest that the design of GCSs needs to consider

¹ As Ehrlich put it, “interviews revealed that managers maintain off-site contact with their calendars ... [this] suggests that direct phone access to the calendar may in fact be very valuable”. Today, with the emergence of the mobile phone and PDAs, design can easily configure new ways of supporting direct access to the calendar off-site.

supporting the negotiation of schedules when moving from the workplace to the home. This is not to criticize Tullio et al., it is only to recognise that the needs of the home are different to the needs of the workplace: predicting event attendance and making members aware of who else is attending a scheduled event is not a pronounced feature of calendar use in the home, whereas negotiating schedules evidently is.

2) Devising Negotiation Protocols

The ethnographic instances we have provided instruct us that calendars are employed in domestic settings as temporally projected plans. It is observable too, especially in Alex and Sam's case, that these plans are not fixed but subject to contingency and change. Schedules are continuously negotiated and updated then, and it is important that design support this central aspect of calendar use. What we have in mind here is the augmentation of coordination protocols through the design of negotiation protocols. The instances show us that coordination protocols are embodied in and expressed through a contingent range of visibly distinct annotations that enable the members who use the calendar to see at-a-glance who has made an entry to the calendar, and explicatory notations that 'tell' members what particular entries are about, what they refer to. While it is important to support these accountable practices, we believe that design also needs to consider how the making of annotations and notations is provided for and organized in the electronic workspace? In other words, we believe that design needs to consider the development of a range of negotiation protocols that make data transactions transparent to the members who use the calendar to coordinate their actions and so support the accountable computer-based scheduling and re-scheduling of events.

By 'negotiation protocols' we refer, then, to computer-mediated methods of interaction and communication that allow the users who own and share the calendar to make one another aware of and respond to data transactions, such as annotating a particular date on the calendar and adding a notation (Greif and Sarin 1987). Thus, and for example, when a member makes an entry, or updates an entry, others sharing the calendar are made aware of the making of that entry or update and may, in turn, enter into negotiation. The question is how?

- Are data transactions reflected in the physically situated calendar, by the use of colour highlights for example, and for how long?
- What about situations in which members are distributed, is some form of alert required via SMS when an entry is made?
- How are the conditional statuses of data entries to be represented on the calendar and conveyed to distributed users: is a 'candidate' entry being scheduled, is a 'conflict' caused by the entry, is a 'change' to the schedule being occasioned?

- How are users sharing the calendar to respond to data transactions, how are they to ‘query’ an entry, ‘put it on hold’, or ‘approve’ a new data entry or change to an existing entry?
- And how do these issues combine with annotation and notation to provide a coherent range of functionality across a network of static and mobile devices?

While there are undoubtedly a variety of ways in which these core issues may be addressed technically, the point here is not to sketch out a design solution but to inform design reasoning by recognising the need to devise negotiation protocols to support the collaborative and distributed use of domestic calendars.

3) Supporting Collaborative Access

It is observable in our studies that the collaborative use of domestic calendars extends beyond the home and the parties who own them. ‘Outsiders’, including members of the wider family, are often party to the use of domestic calendars. This raises the issue of access rights, as it is observable in our studies that access is occasioned: outsiders only have access to calendars when they are directly involved in the scheduling of events, and even then they do not appear to have write permissions. Supporting access control is an important matter when we think about making calendars available to collaboration online. Unlike many GCSs designed for the workplace, open models of collaboration cannot and indeed should not be assumed. The domestic calendar is a personal object, not in the sense that it belongs to one individual, but in the sense that it belongs to a very small collection of individuals to organize and coordinate what can only be described as their intimate affairs. Respecting the intimate character of the domestic calendar is important as design moves into the home, which means that designers will have to consider the development of collaborative access models that enable members to control distributed access and use.

At a gross level, distributed access and control will rely on the definition of roles enabling members to specify certain categories of user such as ‘owner’, ‘friend’, and ‘guest’ to which gradations of access, read and write privileges are assigned. Thus, ‘owners’ might have full access, read and write privileges; ‘friends’ might have partial read access where the details of the owners’ full monthly schedule is made visible; and ‘guests’ might have limited read access where the details of the owners’ full monthly schedule are concealed, for example. Many of these techniques are already available in workplace GCSs. The challenge for design here is one of devising an appropriate and intelligible collaborative access model that enables members to manipulate existing techniques and so control and manage distributed access to the domestic calendar through the specification of roles determining access to the available range of calendar operations (Grief and Sarin 1987). A further challenge is presented by the possibility of distributed real time collaboration, in contrast to co-located

collaboration, where members simultaneously interact with the calendar from different locations. This will require the development of a further set of computer-mediated interaction techniques that enable members accessing the calendar and collaborating from distributed locations to establish, work up and maintain a shared orientation to the calendar and so conduct their negotiations. These ‘tele-pointing’ protocols will support the moment-by-moment making of the transient physical gestures that allow members to highlight, point out, and draw connections between calendar items, which successful negotiations observably and reportably turn upon.

Supporting Accountable Work-Practices

Consideration of the technical implications of members’ accountable calendar-based work-practices has led us to reason about the essential nature of technical support and suggest a number of important factors that we believe design should take into consideration when moving GCSs from the workplace to the home. These include but are not limited to the following.

- **Anywhere, Anytime:** Considering the nature of technological configurations to move calendar use beyond existing constraints while, at the same time, respecting and supporting existing configurations. In short, electronic calendars should be made available to collaboration in the physical space of the home and off-site, anywhere, anytime as occasion demands.
- **Computer-Mediated Communication and Interaction:** Considering how compliance with coordination protocols through the making of annotations and notations is organized. This requires design to devise negotiation protocols that support computer-mediated communication and interaction and so enable members to negotiate their schedules through the active use of the technology.
- **Data Sharing and Distributed Collaboration:** Considering the development of distributed collaborative access models that enable users to control and manage data sharing through the specification of roles and other appropriate criteria. It is also important to consider the design of computer-mediated interaction techniques supporting the production of shared orientations that underpin negotiation.

Again, this listing is not exhaustive but provisional – undoubtedly, as with the development of GCSs in the workplace, there is more to be articulated at this early stage in design’s progression into the home, particularly regarding just how these concerns might be addressed as a technical job of work in design. As ethnographers we do not possess the technological competence to construct particular design solutions – that is a matter for a technical staff to work out (Rouncefield et al. 1994). The utility of our work lies in the elaboration of the design space and our articulation of the ways in which that might be achieved

methodologically as design moves out of the workplace and into the home. Specifically, in this case, our studies provide first-hand knowledge of the accountable work-practices implicated in domestic calendar use; practices that are missed by formal analytic accounts. Our studies make real world uses of domestic calendars visible and inform design reasoning as to the real time arrangements of collaboration that provide for and constrain calendar use in domestic life. We would suggest that developing such an appreciation of domestic media more generally will open up new possibilities for design (Anderson 1994).

Conclusion

This paper contributes to the design of Groupware Calendar Systems (GCSs) for use in domestic life. Through ethnographic studies of domestic calendar use, family members of a corpus of accountable work-practices illuminating the design space and informing design reasoning have been unearthed. In particular, the corpus emphasizes the need for design to consider how the physical and the digital may be merged to support collaboration ‘anywhere, anytime’; the necessity of devising negotiation protocols supporting computer-mediated communication; and the development of collaborative access models and interaction techniques to support data sharing. At a more general level, this paper contributes to the continued development of CSCW as design moves out of the workplace and into the home through the articulation of a distinct methodological approach to ethnographic study. That approach instructs us to attend to the ‘interpretive work’ involved in the use of artefacts to coordinate practical action – i.e., instructs us to attend to the ways in which members make sense of artefacts, make them meaningful, intelligible and accountable and so effect coordination through the use of artefacts in the home. This focus requires that we suspend the use of formal analytic and representational devices such as theories, models, and taxonomies of interaction and instead attend to the missing interactional what of such organizational studies. This, in turn, draws our attention to the family members of distinct corpus’ of accountable work-practices – embodied work-practices which observably and reportably give life, purpose and utility to particular artefacts. Through these real world practices, artefacts come to find a place in the home and members collaborative activities. Their explication through careful description serves to sensitise design to important factors influencing the ways in which future technologies may be appropriated by members and so be made to fit into and resonate with the requirements of domestic life.

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