# The HomeCar Organiser: Designing For Blurring Home-Car Boundaries

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## Abstract
Ubiquitous computing is having an important impact on family life with a wide range of technologies supporting and creating the need for connected and smarter homes. In particular, mobile devices are allowing families to connect activities across spaces, which include the home and the car. This paper presents a new design concept – the HomeCar Organiser – which is a connected system that enables families to coordinate schedules, activities and artifacts between the home and activities placed in the car. The design of HomeCar Organiser was informed by an empirical ethnographic study of family car travel practices in the UK over one and a half years. The study motivated us to consider how routine practices of everyday life are negotiated through and in the car while supported by a range of technologies.

## Author Keywords
Family life; cars; mobile media; domestic technology; video

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H.5.m. Information interfaces and presentation


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## Introduction

Smart, connected devices are increasingly popular in domestic spaces as people turn to technology to organise and manage their everyday life needs. Tools like temperature controls and remote power managers offer solutions to automate various aspects of home activities. Their applications into the design of the smart home has been of particular interest to researchers in the socio-technical tradition [12,13]. Within ubicomp, researchers in the domestic sphere has looked at the ways in which technology is embedded into peoples' lives [9] and more importantly, the role it plays in shaping how people interact with each other and the spaces around them.

As families spend an important part of their time travelling in cars, routines of parenting and caring increasingly involve the family car [1,5]. The social science and mobilities literature has examined the family car as a space of care and support for various parenting practices – including the coordination of journeys and homework assignments to children [10]. However, the study of the family car as a space for technological innovation has been limited to leisure and gaming [3,15] with an exception of a few HCI studies focusing on technology to support such family life and collaboration [4,6]. For many families that juggle multiple responsibilities and roles, technologies like mobile phones have become a part of everyday driving activities to coordinate events and interact between family members.

This paper reflects on an ethnographic study of field observations of routines both in the home (before setting off for a journey) and within the family car. The study, which took place in the UK for over one year, captured a series of social interactions and media practices within the car. Motivated by the need to support these interactions and practices, we present a preliminary design exploration, the HomeCar Organiser, which was developed in a series of workshops.

## Supporting Everyday Family Practices with Technology

Our approach on technology for the car is situated with the context of family life, which differs significantly from driving in isolation. For example, spending time in the car is more than just travelling for parents who have opportunities to flexibly organise trips and plan errands based on traffic and length of travel parameters [10]. The boundaries of home-car activities might be commonly blurred when time spent in cars is used to resolve issues and build togetherness of the family unit [7]. Further, family car conversations also suggest that the time spent in cars may be used to oversee children's homework assignments as well as coordinate upcoming parenting tasks. Thereby the car has become an active collaborative space for families and opportunities for technology to support such interaction.

Current considerations of technology designs in domestic aspects of family life focus on organisational routines and coordination practices; however, this might be exclusive to being around the home [8] or within the car [6]. Few exceptions of design concepts have addressed coordination of home-car activities [2,11]. There needs to be further attention on how domestic practices of caring, educating, reprimanding and feeding of children takes place within car and how technology can support these boundary transitions.


Fig 2: Calling and checking about the 'jacket'


Fig 1: Problems while en route

## Field observations to Inform Design

The design of the HomeCar Organiser was motivated by an ethnographic work carried out over a period of one and a half years with twelve families in the UK during 2012-14. The researcher spent a week conducting ethnographic field visits to family homes and accompanying them during family car travel. The families were recruited via participation calls on university intranet, supermarket noticeboards and online parenting websites. Most of the families belong to middle and upper middle class families residing in the West London area. There were ten two-parent and two single-parent families in our study. In five of the twelve families, solely the mother carried out driving responsibilities while in the rest, parents and grandparents shared driving. The families in our study had children between the ranges of 1.5 up to 16 years of age.

Following the field visits, the ethnographer made detailed field notes and observations of the organisation of family members including several pre-journey preparations. Following the observational part of the study, parents were given two video cameras and asked to record their family journeys for a period of 3-4 weeks. The observations and recordings were then analysed with a view on developing design concepts and subsequent user requirements to support family life in cars.

A specific motivation came from observations of how parent drivers face difficulty in locating stuff in the car while driving for various routine activities. Parents often search for an artifact while being unsure about its presence in the car. The relevance of the search during the journey was also important, as the journey itself would be futile without "swimming trunks" for a swimming class or boots for an outdoor activity on a rainy day. Further, we observed that parents use technology in the car to support search efforts and communicate with distant others (usually the other parent who had packed the car). The description of a day in Leila's family described below is an example of one of resources used as design inspiration during workshops along with accompanying video of the journey to inspire design ideas.

**Family 1:** Leila is a stay at home mom. She has two sons aged 3 years and 1 and a half years. She does most of the driving in the week her husband is an accountant at a university. As the children have not started school, most of her journeys involve taking the children for various short trips to the park, visiting grandparents and going to the supermarket. Both parents use a lot of technology in the car (smartphones, GPS, Tablets). Devices were also offered as sources of entertainment for the children. The mother uses the GPS and her phone for navigational assistance and coordination of pick-ups while in the car (along with her husband), and while driving to new places for activities. The mother described herself to be quite a "stressed out driver" as she had to manage many responsibilities while driving.

Fig 3: Design ideas for connecting various home and car activities

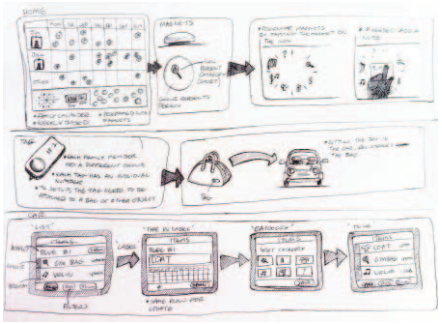


Fig 4: Early Concept design for the HomeCar System

**Example Journey:** *"Mum and the two children are getting ready to set off for a forest walk. Dad is helping pack all the stuff into the car while mum sets up the GPS and gets ready to set off for the trip. Dad straps the children into the car seats and puts all the stuff in the boot. Mum says goodbye and starts to head off with music playing in the background. Just a little while into the journey, she realises something has been forgotten. She looks around and almost naturally reaches for her smartphone-leading on a series of events- stopping the car, dialling a number and calling (whom we assume is the father) to check if he had put the children's jackets in the car. The extract ends in her receiving the confirmation that the jackets were in fact packed into the boot. We see several constraints here-the children not being able to support her search, she doesn't use the device capability (hands-free) and the whole episode emerges to be very stressful."*

## Design Workshops

The design work was carried out in two parts, the first part was an abstract-level, brainstorming session where we involved Design Masters and PhD students in a data-led discussion and then asked to articulate ideas they had in the form of posters. These ideas then formed some impetus for a full day design workshop where we had experienced researchers discuss and develop prototypes of a number of relevant concepts related to the family themes in the data.

*Brainstorming session*

In this data-led session we invited seven design students who were asked to look through the empirical examples from the family car material and identify problems and opportunities based on the family activities situated in the car. Participants looked at perspicuous examples of family work being conducted in the car and were then asked to brainstorm in groups to identify focal points as opportunities for design. Following discussion and affinity mapping of various observations in the data, the participants arrived at some key areas where design could intervene.

-Technology design for family activities within the car needs to support busy and stressful parenting. Critical to this is the need to connect as any activities as possible that are carried as part of family routines as well as seamlessly integrate technologies that support these interactions.

-Supporting the playful and entertainment aspects of the family car by catering to the needs of backseat passengers. A need was identified to provide support for the management of portable devices and design age-relevant content for children.

In this paper, we retain our focus on the first area to discuss the design and development of the HomeCar Organiser that is a system developed based on the needs of the families that took part in the ethnographic study.

*Design Session*

In a full-day design workshop, we invited 14 participants including industrial designers, experienced design researchers and games design students to participate and work through material developed from the brainstorming session. The group worked through several family issues of organising and planning for journeys based on what was observed in the data as well as the knowledge of parenting resources available. They articulated their ideas through posters and briefs

for potential design problems from what was inherent in the empirical material. While working through this material, they found that organisational and planning issues around family trips were of particular importance. Designing new technology systems and integrating current technological resources to support these features seemed the way forward. At the same time, they were faced with a number of opportunities and roadblocks.

For example, these are some of the challenges faced by designers while constructing the system:

DEALING WITH IMMENSE AMOUNTS OF INFORMATION

We observed that families were bombarded with a lot of information from checking on their children's work, domestic chores, checking emails, as well as managing their professional work. Time between drops and pick-ups were used to check emails, and recuperate before continuing to the next activities. Phones were used to co-ordinate pick-ups, share calendars and provide care-givers with updates. There was also a debate here for designers on what 'good' technology would provide for families. They seemed to conceptualise good technology as that which was less distracting/annoying, more useful and interactive but also not "noticeable" by giving too many alerts or alarms. Hence there was a strong focus on seamlessness.

INCORPORATING PEOPLES' SCHEDULES AND ROUTINES

Another challenging aspect is the incorporation of varied schedules and patterns in a meaningful way. Most of the families had arranged their week such that a few days in the week were devoted to after school activities while other days were relatively relaxed. Half-term holidays (term breaks) were more difficult to manage as routines and patterns changed during these periods and parents had to make specific arrangements to work around varying availability of carers.

*IDENTIFYING SPACES WITHIN THE HOME WHERE* TECHNOLOGIES WOULD FIT AND CONNECT THEM TO THE CAR.

While developing systems, we were aware of existing technologies and organizational systems (information on fridges and home notice boards) that operate in that family home as reported by studies of technology deployment in the home [14]. The idea was to use these as inspiration to seamlessly embed systems in peoples' routine practices. Families also tend to organise work and activities within shared or multiple workspaces like kitchens and dining rooms making these useful resource centers for technology design.

## Developing the HomeCar Organiser

In developing domestic technologies to support interactions, we find it relevant to draw on the resources which members of the unit use within a setting. We are also drawn to build around the 'human aspects' of interactions, which tend to be spontaneous and not always bound up in pre-planned activities but may be open to change. Consistent with previous design work with families [12], we were keen not to create a system that is simply automated, but builds on the enmeshed sociality of members' behaviour. In constructing the system, we are drawn to the spatial configurations of the home and the car, the temporal significance of schedules and routines and finally the physicality of artifacts that are used by the members of a setting.

*Spatiality: Home – Car Connections*

As a significant part of planning for a journey occurs before setting off, it is important that families are prepared before the journey begins. During this time, parents may coordinate various items that need to be carried for a journey and may even consult schedules and planners while doing so. This meant that a considerable time is spent arranging items in the hallways of homes or driveways before loading them into the boot of the car. Negotiations may be made with children about what may be taken and if necessary any prior arrangements may need to be consulted. Further once in the car, drivers' access to specific spaces such as the backseat area and the boot space is severely restricted. This distributed of work before setting off meant that the placement of a support system had to support and bridge the work carried out across these areas in preparation for journeys.

*Temporality: Retaining Flexibility*

The other aspect of the system that designers identified as important is adaptability to the needs and patterns of the family and their routines. This meant an understanding of who shared care responsibilities and how to integrate their involvement into systems. Systems would need to be easily updated with changes in weekly patterns and schedules. Another feature may include updating schedules and availabilities based on personal calendaring systems. Several families in our study discussed the need to coordinate calendars with partners or grandparents who shared caregiving duties. Thus, the component of the system may link to many sources of scheduling to effectively support distributed activities-for example, including phone calls and online calendar entries.

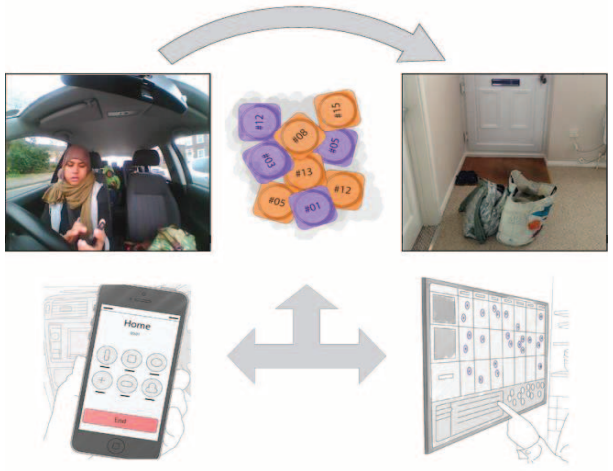
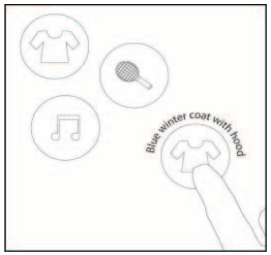


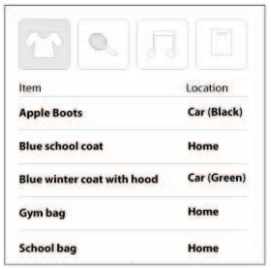

Fig.5 Description of the elements of the HomeCar Organiser

*Physicality: Incorporating Existing Technological Artifacts*

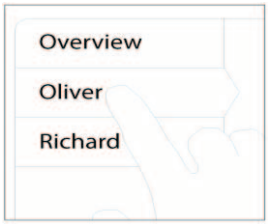
Advancements in technology allow people to develop new ways of coping with situations. However, the work that goes into sustaining family life and routines continues to be invisible and distributed in hybrid sets of devices. Families seem to adopt a variety of organisational systems (diaries, smart phones, calendars) for their activities. Smart phones were an essential piece of technology for many parents in our study. They used it to navigate, make calls and use as entertainment devices for children. As noticed in our data, families tend to change, upgrade and replace technologies far more frequently than cars. This gives us a further motivation to incorporate technologies into the design of systems for the car and home. Further, the planning and organising was centered around




Selection




Association




Personalization

Fig 6: Components of the digital noticeboard

artifacts – whether a child's jacket, boots or spelling test as well as spaces such as hallways and driveways for easy access to and placement of items.

**Description of the System:**

The HomeCar organiser encompasses three physical technological components. First, there is the *Black box* situated in the family car, which registers artifacts that are within close proximity (linked to a tagging system). Second, there is a digital noticeboard that is placed within the family home and, third involves a tagging system to enable the artifacts to be tracked through individual tags that are attached to the family artifacts. All three physical technological units are connected via the intranet.

The *digital noticeboard* is a tool to help families organise their week, with the added benefit of creating a reminder system by showing their daily activities visually within the home. This is accomplished by displaying the days of the week across the top of the digital noticeboard and each child allocated area below. To incorporate the flexible and busy family lifestyles, the digital noticeboard needs to be easily updatable. To this end, magnets present markers representing individual family artifacts needed on specific days. Not all tagged artifacts have to be displayed on the digital noticeboard – it is only those that need to be remembered. These may be updated and placed by parents while planning the schedule for weekly/daily activities. These magnets, when setup through the digital noticeboard, display a category icon (e.g. clothes or music). When pressed digitally, they display a note with more information about the corresponding artifact (e.g. location and description).

*Tagging System:* the digital noticeboard includes separate functionality that enables the family to easily search for and find the location of tagged artifacts. This can be accomplished by searching for the artifact via the category or the family member it belongs to. Each tag is part of a color-coded numbered set, with each set being assigned to an individual family member. The color-coding and numbering allows for a default setting and removes the initial pressure from the family to go through the setup process. This default setting will assign the artifact within the digital inventory a color and number – this color and number being easily matched with the physical tag attached to the artifact.

*Connectedness:* the HomeCar organiser inventory can be accessed on the move through a secure mobile designed website via parents' smartphones. This enables easy access to information on various artifacts and provides alerts to the driver/parent if something is missing. We find that this will be a relevant feature as many families in our data were using smartphones to both coordinate journeys and trips with partners and carers. There is also potential to further integrate the mobile feature with the car's system if the system is supported. Issues of distraction may also be further compensated if the car is able to recognise when something is missing. In the examples from the field, we observe that in situations where the parent-driver is missing something relevant to a journey, this caused a stressful situation that adversely impacts the way in which the driving is done.

We have therefore used our observational work with families to design and conceptualise components of a system that we believe will be helpful for families to support multiple responsibilities across temporal and

spatial boundaries of the home and car. We are now evaluating this concept with families to receive feedback on various features of the system for further development.

## Conclusion

In this paper we presented the design of a simple organiser system connecting the home and car. We build on the notion of family activities not just being restricted to the single space of the home but carried into any space where families construct the notion of "being together" and engaging in family-related activities. As activities are spread across home-car boundaries, the main focus of our system design is to connect them in a seamless manner. We foresee that such a system will be useful in understanding how the boundaries of the home and extended domestic space of the car can connect and support activities across both spaces.

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## References

1. Barker, J. 'Manic Mums' and 'Distant Dads'? Gendered geographies of care and the journey to school. *Health & place 17*, 2 (2011), 413–21.
2. Brown, B., et al Locating family values: a field trial of the whereabouts clock. (2007), In *Proc UbiComp.* 354-371. Springer-Verlag,
3. Brunnberg, L. Backseat gaming: exploration of mobile properties for fun. *CHI'02 EA*, (2002). 854-855
4. Cycil, C., Perry, M., Laurier, E., and Taylor, A. 'Eyes free' in-car assistance. In *Proc. MobileHCI '13*, ACM Press (2013), 332- 341.
5. Dowling, R. Cultures of mothering and car use in suburban Sydney: a preliminary investigation. *Geoforum 31*, 3 (2000), 345–353.
6. Eardley, R., Hyams, J., and Sellen, A. In-Car Concepts to Support Working Parents. (2004), 58113.
7. Goodwin, M.H. and Goodwin, C. Car Talk: Integrating Texts, Bodies, and Changing Landscapes. *Semiotica*, (2010), 1–44.
8. Khan, V.-J., et al. Intra-family communication needs; How can awareness systems provide support? *Intelligent Environments, 2, 2006, 89–94.*
9. Krumm, J., Abowd, G.D., Seneviratne, A., and Strang, T., eds. *UbiComp 2007: Ubiquitous Computing*. Springer Berlin Heidelberg,
10. Laurier, E., Lorimer, H., Brown, B., et al. Driving and 'Passengering': Notes on the Ordinary Organization of Car Travel. *Mobilities 3*, 1 (2008), 1–23.
11. Park, S.Y. and Zimmerman, J. Investigating the opportunity for a smart activity bag. *In Proc CHI '10*, ACM Press (2010), 2543.
12. Taylor, A.S., Harper, R., Swan, L., Izadi, S., Sellen, A., and Perry, M. Homes that make us smart. *Personal and Ubiquitous Computing 11*, 5 (2006), 383–393.
13. Taylor, A.S. and Swan, L. Artful systems in the home. *In Proc. CHI* '05 ACM Press (2005), 641-650.
14. Tolmie, P. and Crabtree, A. Deploying research technology in the home. *In Proc. CSCW '08*, (2008), 639-648
15. Wilfinger, D., et al. Are We There Yet? A Probing Study to Inform Design for the Rear Seat of Family Cars. *In Proc. INTERACT* '11 (2011), 657–674.