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Designing for Frustration and Disputes in the Family Car

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ABSTRACT

Families spend an increasing amount of time in the car carrying out a number of activities including driving to work, caring for children and co-ordinating drop-offs and pick ups. While families travelling in cars may face stress from difficult road conditions, they are also likely to be frustrated by coordinating a number of activities and resolving disputes within the confined space of car. A rising number of in-car infotainment and driver-assistance systems aim to help reduce the stress from outside the vehicle and improve the experience of driving but may fail to address sources of stress from within the car. From ethnographic studies of family car journeys, the authors examine the work of parents in managing multiple stresses while driving, along with the challenges of distractions from media use and disputes in the car. Keeping these family extracts as a focus for analysis, we draw out some design considerations that help build on the observations from our empirical work.

Keywords: Car, Family Life, Frustration, Interaction, Media Practices, Video Ethnography

INTRODUCTION

The car continues to be a popular and seemingly necessary part of conducting family life. HCI studies of the car have extended from efforts focused on the driver-to support in driving and way finding (Brown & Laurier, 2012) to efforts that target the experience of car travel of the passengers (Juhlin, 2010; Wilfinger, Meschtscherjakov, Murer, Osswald, & Tscheligi, 2011).

Studies of collaboration in the car, highlight the significant role played by passengers in providing driver support (Cycil et al, 2013; Brown & Laurier, 2011) as well as in managing assistive technologies (Forlizzi & Barley, 2010; Perterer, Sundström, Meschtscherjakov, Wilfinger, & Tscheligi, 2013) on journeys. There is, then, a growing interest in how passengers have an impact on the wider experience of car travel. Based on recent travel data, on average more trips were made by people living in households containing two adults with children than any other household type (Dft, 2012). The same report found that the car is the most frequent mode of transport for children aged

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5-10 years. Despite these figures, families in cars still remain a neglected part of most HCI studies with the exception of a few (Wilfinger et al., 2011; Eardley, Hyams, & Sellen, 2004) . Our work is therefore placed to further understand how frustrations develop and emerge in the context of family car travel.

In this paper, the first sections set the background for the study-discussing driving as a source of frustration, the demands of family roles and the infusing of technology into the car. In the data and analysis, we draw on examples of frustration from empirical data of families and finally, we conclude with some design considerations based on the needs of families identified from our findings.

FRUSTRATION AND DRIVING CONDITIONS

Research on frustration in the car in the past has focused on studies of cognitive overload (Uchiyama, Kojima, Hongo, Terashima, & Wakita, 2002) and the effects of aggression and mental state on driving behaviour . Therefore it is observed as an interplay between the mental state of the driver and the prevailing road conditions (Underwood, Chapman, Wright, & Crundall, 1999). Difficult driving conditions have been more often associated with drivers' angry or aggressive responses in the car while encountering congested roads and long journeys. Therefore, the focus of past inquiries has been based on the driving activity itself. In our study we do not directly measure frustration in the car (as this would be challenging to do in real time driving), instead we describe from empirical ethnographic data some of the sources of frustration that can contribute to stress for drivers in the family car. Previous studies in the HCI literature have spoken in detail of the distractions experienced in cars and have led to useful insights on how technology and car design may support drivers better (Burnett, 2011).

Frustration in driving contexts has also been further explored in the context of 'road rage' or 'aggressive driving'. Brewer, (2000) provides a comprehensive framework of factors that contribute to the frustration for drivers. In his model, he points to a combination of travel and personal demands, moderated through difficult conditions in the road and their affective responses as giving rise to aggressive driving. What's useful from his framework for our own study is that we are concerned with the first part of it, which refer to the personal and travel-related demands-in our own study, we see that pointing to parenting and care duties that are carried out through the family car. While frustration in general (Uchiyama et al., 2002) and commercial contexts driving and has been explored, the needs of the family car has been neglected in HCI with the exception of a few explorative design studies (Eardley, Hyams, & Sellen, 2004; Cycil et al, 2013) and studies around safety aspects of parents driving with children (Koppel, Charlton, Kopinathan, & Taranto, 2011). We further build on this gap by exploring the family car as an inspiration for technology design against frustration and disputes.

BEYOND DRIVING: BALANCING WORK, FAMILY, AND ROLES

Cars have changed the way families experience everyday routines with an 'imposed' flexibility which enables parents to organise trips and plan errands based on their availability and expectation of traffic flows rather than being dependent on the fixed schedules imposed by public transportation (Dowling, 2000). In the past, authors have described the experiential aspects of driving such as driving in difficult conditions (Watson, 1999) as well as the social relations between drivers and their cars (Dant, 2004). These often focus on the driver's engagement with the road and driving conditions. While

these are important, following along studies of the mundane production of activities, we are interested in the ordinary production of family life in car journeys (Laurier et al., 2008). This brings focus on what is happening inside of the car and its occupants and how that shapes the journey. Frustration and disputes are part and parcel of many family interactions, including those within the family car space.

It is important that we recognise the car as a *time*-space that is shaped through the varied journeys and demands that are placed on it by drivers and passengers. Long journeys allow novels to be read, meals to be consumed and require stop-offs for food (Dant et al., 2001). Similarly, different reasons for travel (even along the same routes) may also result in different activities within the vehicle, with, for example, mobile technologies being used for homework or games depending on whether a child is travelling to, or from, school. Familiarity with routes and routines enables drivers to navigate in fairly relaxed fashion. However, when faced with frustrating road conditions on a routine journey, drivers report to feeling more stressed than on a casual journey (Brewer, 2000).

The car is a space that supports care and care work may be facilitated and exemplified through driving (Barker, 2009; Bowlby, 2012; Ferguson, 2009). For busy working parents, the need for awareness systems to foster communications between family members is all the more necessary now (Khan, Markopoulos, Mota, IJsselsteijn, & de Ruyter, 2006). In our own data we found that the everyday tasks of transporting children to and from various activities are often handled by mothers (Barker, 2011). Travel time is valuable for families in the car because it is often time spent telling troubles, experiencing togetherness and providing opportunities for resolving disputes and for teaching and learning (Laurier et al., 2008). With the car becoming a crossover point for so many family routines and activities the likelihood of parents and children becoming frustrated with one another grows ever greater.

DISTRACTIONS, NOISE, AND DISPUTES: IN-CAR INTERACTIONS AND TECHNOLOGY

The varied social practices that take place within these confines provide the basis for the development of new forms of mobile computing tailored to its architecture, the dwell time of its occupants and the purposes of its journey. The entry of portable technologies such as the mobile phone further supports the displacement of work, leisure and sociability into the car (Haddington & Rauniomaa, 2011), in effect, *'the automobile becomes a new form of communications platform with a complex set of possibilities'* (Featherstone, 2004). Time in the car is now spent doing things that were once done in offices, houses and cafes, transforming how the car-space is used- from a mode of transportation to an extended living room, to a mobile office (Laurier, 2004).

The possibilities offered by the car as a media platform have long included turning on the radio or playing a CD (Bull, 2004) to break the monotony of the engine's sounds or reading paperwork and calling clients while on route to the office (Laurier, 2004). The growth of new networked and portable digital media in the car reconfigures the practices of travel and the car becomes a mobile environment with room for the performance of multiple activities. Indeed the family car is an important site for studying of behaviour as occupants significantly impact how a journey unfolds (Nevile, 2012; Koppel, Charlton, Kopinathan, & Taranto, 2011).

With the arrival of new technological possibilities, studies have looked at how these possibilities are managed as potential sources of distraction from driving (see Haddington & Rauniomaa, 2011; Nevile and Haddington, 2010). From the beginning of car travel passengers have talked to the driver, this talk in itself then providing the possibility of distraction from driving (Nevile, 2011), passengers also pass objects around within the car and assist in giving

directions or map reading (Brown & Laurier, 2005). 'Multi-activity' refers to simultaneous and concurrent activities that may or may not interrupt the current main activity. Mondada (2010) explains that while peoples' engagement with more than one 'task', may often be treated as distracting, car travellers skilfully move between multiple activities through analysis of projected events on the road as being more or less demanding, for example, taking bites of a sandwich while waiting at a stop-light. Correspondingly, passengers also monitor the traffic and features of the road to judge when the driver will be able to switch between driving and talking to them (Mondada, 2009). However, other studies have found that negotiating these activities with child co-passengers in the car, can be *distracting* (Koppel et al., 2011).

DESIGNING FOR (FAMILY) FRUSTRATION AND DISPUTES

Frustration when considered in design is in relation to the frustration users experiences with computers (Hone, 2006; Norman, 2002). Families have been seen as a source of inspiration for the design of technology within HCI (Park & Zimmerman, 2010; Taylor et al., 2006). This has traditionally focused on the home space, with a few studies extending to support family activities outside the home (Inkpen, Taylor, & Junuzovic, 2013) . In our work, we would like to connect the family work done in cars, as opportunities for technology design and development. In this article our target therefore is instead around examining family based interactions characterised by frustration and providing insights into those for design.

METHODOLOGY

The data presented here draws on ethnographic and video studies carried out over a period of seven months with five families in the UK during 2012-13. A week of ethnographic field visits to the family homes were carried out during which the researcher accompanied them on car journeys. Following on from this, the researcher provided the families with two video cameras and asked them to record their family journeys for the next 3-4 weeks. Given the challenging environment of the car as a research field site, families recorded most journeys without the researcher present. This enabled the data to be collected over long journeys and gave a good representation of overall journeys that families made over the course of a month. One camera was mounted above the dashboard, and recorded a dual image of the front seat, and the road through windscreen; the other was mounted on the rear windscreen to record back seat passenger interactions (See Figures 1 and 2). Over 40 hours of recordings per family were returned and clips that were to be used for analysis were reviewed and approved by participants for use.

In the analysis that is presented in this paper, we use two sources to present the data extract: ethnographic observations with families from the researcher's field observations and fragments from the video recordings of car journeys. Extracts from the researcher's field notes provided rich descriptions (Crang, & Cook, 2007) of the mobile lives of families in the car. Analysis of video extracts was based on the video ethnographic work that emerges from conversation analysis and ethnomethodology (Heath, Hindmarsh, & Luff, 2010). Through these extracts, we attempt to show how people and technology reflexively produce their social context and to examine the role of talk and actions around technological artefacts (Heath & Luff, 2000). Thus we point to how frustration from interaction with both passengers and technological artefacts was managed.

Most families had primary school age children (refer Table 1) with the exception of one family who had teenage twins (F3). Based on the field data, we observed that mothers were responsible for family journeys involved with driving children during the week. In one family (F4), the mother studied part time and hence

Figure 1. Front camera set-up

Figure 2. Rear camera set-up

Table 1. Represents demographic details of families

Family Code	Family Structure	Weekly Family Driving Responsibility	No. of Cars	Children	
				Ages (in Years)	Gender
F1	Dual	Mother	2	8 and 7	M, M
F2	Dual	Mother	1	7	M
F3	Dual	Mother	2	16 and 16	F, M
F4	Dual	Mother and Father	1	7 and 10	M, M
F5	Single	Mother	1	6 and 10	M, F

both partners shared driving responsibilities. In another family (F2) the mother held primary driving responsibilities in the family as her husband did not drive.

DATA AND DISCUSSION

Families and parents are ever more mobile, yet correspondingly pressed by the demands of tight work schedules and spatially distributed obligations. The car however provides an opportunity to carry out the work (and play) of family outside of the traditional home spaces (e.g. around the dining table or in the living room). Drawing from our data, we list below some sources of frustration that emerge for doing family-work in the car and further provide design considerations for the current context.

In this section, we use examples from the data to focus on some of the most prominent sources of frustration in the car. We broadly classify these as *journey-specific demands* and *background noise and disputes* affecting the driver.

Journey-Specific Demands

To fit into the routine demands of the family, car journeys require preparation and organisation. Parents often get into the car with more than just the car journey in mind and this may further place demands on their attention and recollection of items to organize for a specific journey. Even families doing routine school drops and pick up's needed to remember items like completed reading sheets or a gym bag for an after school activity on certain days.

Organising the Car Journey

Families used the car as a proxy space for parallel family activities while parked outside the buildings where one child was undertaking some activity. While 'waiting' in the car they completed children's reading exercises, eat lunches/ dinners and so on:

I have to make sure we have planned our time efficiently. Once we get to the activity centre, Laura has to have her lunch, while my son has swimming class. Then while she has gym, my son finishes his homework. [F5]

Because time spent in the car is budgeted as family 'work' then it has to be set-up with food supplies for one child and homework paper and pencils for the other. While it was not always easy to bring the children's lives into the car, parents pointed out ways in which joint efforts were made to utilise time more effectively (See Figure 3). As the same parent went on to tell us:

Well the children are very good. They do their reading assignments in the car between journeys. As long as they don't get into fights.. (laughs) [F5]

This being said, things did not always go smoothly. Since activities were closely knit with orchestrating a number of schedules and

Figure 3. Doing reading assignments in the car

demands on time, often forgetting one detail would throw the whole journey off schedule. As one parent said:

It's just so stressful sometimes to think about how to manage the day between drop offs and pick-ups. And if you just forget one thing-it can throw the whole schedule off. Last week Tim forgot his swimming stuff and we realized it too late (after reaching the activity centre). There was no time to go back and get it. We had to just wait it out until the next activity for my daughter started. [F5]

There is then a certain lock-in from the logistics of childcare that prevents correcting errors that are discovered 'too late' (i.e. too far into the journey). Parents cannot cleverly turn this time period into car into something else and it is left instead as a frustrating extra wait in the car which has not been prepared for. These times together in the car are particularly relevant for certain forms of family with greater demands on their time and space- including single parenthood, working parents and parents who return to education or training.

Managing Roles and Responsibilities

Parents who shared driving responsibilities had to be systematic in managing the handover of responsibility to the other parent, as it could otherwise result in confusion. One parent describes the frustration she experiences when her husband picked up her son from the activity centre before she could get him and did not inform her:

(The mother says to the researcher in the car) This is the kind of panic you don't want as a parent. I leave work early to make sure I am on time to pick him up from the centre and my husband's just walked over there and taken him home. It's so annoying when such miscommunications happen. [F2]

First the mother expresses the panic of not finding her at the activity centre. Following on, an annoyance at the miscommunication and resulting frustration that the task she had driven and *"left work early"* for was already done. For many working parents, the time spent in the car provides an opportunity to spend important time with their children talking through what is happening in their children's daily lives as well planning for the short-term future with them.

Responding to Trouble at School

The school journey is a regular feature of family car travel for many families. While the parents were aware of the troubles that they took from

their home into the car on the journey to school, when collected by parents, children brought problems with them into the car that the parents were not necessarily or expecting able to understand. Being unable to make face-to-face contact with the children given the spatial configurations and the demands of driving made it difficult for parents to discover the nature of why the child was upset and respond appropriately. As one parent described:

Their (children) behaviour is so dependent on their mood and how their day went at school or after school activities. Sometimes they can be really difficult on a journey when their day was particularly bad. It takes a lot of effort to get them motivated from one activity to the next. Otherwise the car journey ends up being crazy. [F4]

The easiest way parents could deal with an upset child on collection was to try and ignore them if they were driving alone. If another parent was present in the car they could begin to establish the source of what had upset the child and what could be done to remedy it. Dealing with children's troubles is particularly challenging in the car, as the option to stop and deal with the concern immediately may not be possible. Hence while designing supportive in car systems, researchers need to consider how the spatial configurations of the car impact and can bear on the interactions of passengers.

Background Noise and Disputes

The car is an enclosed space where people are in close proximity to each other and the likelihood of distractions and disputes arising from co-passengers is high. In this section, we describe sources of frustration that arise during the course of car journeys as a result of distraction from media use and disputes between passengers. When children are in the car, there are demands placed on the driver's attention for conversation and interactions such as passing something to eat or play (Koppel et al., 2011). In addition to this, it is evident in our data that sometimes parents (who are driving or non-driving passengers) needed to intervene in the midst of fights and disputes.

Whose Background Audio?

In the car, passengers and drivers share the same soundscape and this may not always be a good thing. For example loud sounds from portable games or children increasing the volume on the stereo were problems frequently faced by parents. Portable game consoles are popular with families and were frequently carried on long and short car journeys to keep children occupied. However, managing the sounds produced by games then posed challenges for parents while driving. You can observe this in the excerpt that follows from exchanges between a parent who is driving and a child in the front passenger seat.

F2 Extract 1

Mum is driving home from the shopping centre with her son in the front passenger seat. Son is playing a game on his DS. From the mother's attempts to engage with what the child is doing, we see that she wants to interact during the journey:

Son: *Oh straight away I got killed (.)*
Mom: *What you playing?*
Son: *(inaudible)*
((mom tilts head towards the direction of her son))
Mom: *Pardon? ((glances towards her son))*
Son: *(inaudible)*
Mom: *NO, what you playing?*
Son: *Dunno what it's called*
Mom: *It must tell you(.) You need to read it. read the words on the screen. 'They'll give you a clue.'*
((child continues playing on the handheld device))
((19 secs pass during which the game produces a constant beeping sound))
Son: *That's me who's doing that.*
Mom: *Can you turn it down please baby? ((looks in the direction of her son))*

((reaches out to increase the volume on the radio))
(2.0)
Mom: *I can't hear the radio with you - 'with your game.'*

The mom tries initially to engage her son in discussion as she catches the end of one of his rounds in the game. She uses the game itself as a topic initiator but the son continues to devote his attention to the game rather than her (See Figure 4). We see this in line 7 when she asks the child what he is playing. Both in this family and others who participated in our study, we found that parents wanted to interact and make conversation when children were in the car. Often this was the case when there was no other adult passenger as within this extract.

What follows after is an extended period of no conversational interaction but only the sounds from the game console. The son then starts to initiate a discussion around the game (line 12) referring to the 'sound' in order to indicate to the mother that his action in the game is creating the sound. Here, we see the child making visible something from his interaction with the game that is out of the mother's vision-given that she is focused on the driving task. However, to the mother, for who only the sound is noticeable, this restricted interaction is frustrating.

She is then left with only the loud sound from the game (see line 11) she both asks her son to lower the volume of his game while she in turn raises the volume of the radio (noticeable in the increased volume in the video recording). Therefore, in a frustrating situation, neither the audio from the radio or the game, are being shared willingly inside the car. The son uses the game to stay occupied on the journey and the mother, from what is observed from the exchange, turns up the radio in an effort to drown out the game sounds.

Disputes Arising from Turn-Taking and Sharing

When more than one child is in the car, appropriation and allocation of game-playing devices becomes a cause of potential dispute in the car. If one child is playing a game by themselves, often there were problems that arose when the other child became interested in the same device.

Often parents stepped in and tried to save the situation by taking one child's attention away from the device or offering other options as we see in the exchange below.

F4 Extract 2

A family of four are in the car on a journey spanning an hour and a half. The younger child

Figure 4. What are you playing?

(Tom) was given a turn on a digital puzzle console. The older sibling (Daniel) who held the device previously, wants to regain access to it:

((Daniel reaches across to grab the device from Tom))
Tom: *Stop snatching!*
((Daniel pulls back and retains device))
Mum: *Is it an Anagram? Is that what it is?*
Daniel: *no, it's letter skills. Tom keeps saying that it's SNOOZE.*
Dad: *Tom, look! Tom...*
Mum: *Look Tom it's an Argos truck (points outside the car)*
((Tom glances outside while retaining device))
Mum: *Tom, GIVE IT BACK. Give it back.*
((Daniel groans in the back reaching across for the device))
Dad: *Daniel.*
Daniel: *But I...But I asked mum.*
((Mum looks for something in her purse, pulls out her phone))
Mum: *Do you want to play bounce tales? Tom? Bounce tales?*

The situation arises as Daniel attempts to retrieve his device back from Tom, which upsets the latter. What ensues is a complaint that the younger child is doing something that perhaps should not be done in the game: *"Tom keeps saying it's SNOOZE"*. The situation seems to be heading towards a fight when both mother and father step in to distract the younger child by pointing to something outside the vehicle, a technique parents often use to divert attention from arguments.

Their shared efforts similar to previous examples, point to the familiarity with the child's interests and drawing on their own parenting resources. When the child still does not return the device, the mother firmly tells Tom to return the device. Daniel's second attempt to grab the device and the father's admonishment provides us with the indication that her directive has not worked. What follows this is her action of rummaging through her purse and retrieving her phone to offer a second distraction with an offer of playing another game on this instead.

What is to be noted here is the *immediacy* with which these actions are accomplished. While in the car, parents cannot wait out a dispute; dealing with it calls for an immediate response, or here, as we see, a number of responses, before the situation can be resolved. In this manner, we see the joint work of parents in dissipating disputes around devices in the car. We also notice how the mother's offer of *'bounce tales'* is made in order to draw attention away from the puzzle. It also reveals a sense of how disputes may be worked through using the resources of parenting and points to the practical actions of diverting attention through distraction (calling attention to the outside) and alternatives (offers of a different play media).

Design Considerations

Design for the family car, needs to consider the complex interactions of temporal and spatial demands in carrying out family activities. While entertainment media offer solutions for stress and frustration, based on some of our field observations we suggest some recommendations that can better improve their integration into the car environment to support the work of parents.

The Car Manifest

Our findings point toward the centrality of preparing and packing things into the car and systems that help parents check whether they have the right equipment for the day would be useful. One possibility then is car systems that integrate tagging, recognition and tracking of items as a part of the routine of getting ready for the journey. This may be easily incorporated into existing smart phones and tablets that parents have. NFC technologies can provide for opportunities through which everyday objects like the 'gym bag' or 'lunch bag' required for specific journeys may be tagged in. For parents sharing driving responsibilities, integrated communicating systems may send a message to the

other partner from one activity to the next. For example, when the parent reaches gym class, picking up the location via GPS, the car system may be able to prompt the driver to send a message to the other parent *"Son dropped off at gym class-pick up in an hour"*.

Anticipating the Pick-Up

A second issue was the unpredictability of children's troubles and moods when picked up from school or other activities. Affective computing that recognises driver emotions (Eyben, Wöllmer, & Poitschke, 2010) may be extended to passengers to communicate to parents if the children have had a pleasant or difficult day at school. Future technology for the back seat may incorporate a brief record of the child's day sent to the car in advance of the child being collected would help parents shape their responses. For example, the parent may anticipate the child's results from a spelling test or participation in a quiz. Parent's knowledge of this may give the child an opportunity to use time in the car to discuss a difficult day. Awareness systems designed to foster family communication in the home can be extended to the car in order to allow information to be gathered from family activities over the course of the day (Khan et al., 2006).

Attaching 'Car Mode' to Entertainment Media

Similar to parental control on car windows from the front seat, entertainment controls for parents may be useful to exert control on how media is used and moderated. Volume controls for in-car media can be centralized if the technology is embedded into the car. While these are separately available for mobile phones (e.g. Android Car Mode) and portable devices, they still require manual activation. A RFID tag embedded on the inside of the car could trigger an enabled device to silent mode. This could be similar to the 'flight' mode when personal technologies are carried on flights.

Intelligent Technology Use

Sharing a device in the car between two children can be particularly challenging when both want to play at the same time. To address the issues around arguing for taking turns on a device, future in car systems may incorporate 'turn taking' to reconfigure a game for more than one child passenger. Technology is limited by certain fluidity-for example the distraction tactics used by parents happens immediately and spontaneously. However as technology gets smarter, it may be able to recognise disputes-based on escalating speech and even switch off when children are unable to share in an amicable fashion.

CONCLUSION

The varied demands that a family faces during car journeys make the family car a worthwhile site for the study and design of technology against frustration. Our fieldwork of family car journeys has helped us gain a better understanding of the sources of frustration in the family car. The key sources of frustration and disputes that come up in the data pertain to the organisation of the journey and the contribution of entertainment media. It helps us further consider and inform how technology for the car can better support the nuances of family journeys. The paper also provides future directions for design of technology in the family car that consider the range of needs for families including, organising of the journey, affective components for child passengers and intelligent systems for portable technology in the car.

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APPENDIX

CA Transcript Notation:
((…)) - non-verbal behaviour
WORD - capitalized word denotes emphasis while speaking
'word' - Softly spoken words
(.) - micropause