

Ritual Machines I & II: Making Technology at Home

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ABSTRACT

Changing patterns of both work-related mobility and domestic arrangements mean that ‘mobile workers’ face challenges to support and engage in family life whilst travelling for work. Phatic devices offer some potential to provide connection at a distance alongside existing communications infrastructure. Through a bespoke design process, incorporating phases of design ethnography, critical technical practice and prototyping we have developed Ritual Machines I and II as material explorations of mobile workers’ lives and practices. In doing this we sought to reflect upon the practices through which families accomplish mobile living, the values they place in technology for doing ‘family’ at a distance and to draw insights in to the potential roles of digital technology in supporting them. We frame the design of our phatic devices in discussion of processes of bespoke design, offer advice on supporting mobile workers when travelling and articulate the values of making a technology at home when designing for domestic and mobile settings.

Author Keywords

Ritual; Family; Phatic; Bespoke; Mobility.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

As we progress into the 21st Century patterns of both living and work-related mobility are changing across most industrialized nations [26, 28]. Families are under increasing pressure [7] to support new kinds of domestic arrangements such as living apart together, commuter marriages and long-distance parenthood [28]. This is giving rise to what some have termed the development of the ‘post-familial family’ and the mobile worker (someone who either frequently stays away from ‘home’ or is absent for extended periods, in the course of their work) [11].

The kinds of telecommunications infrastructure we have in place in industrialized nations offers intriguing support to the distance imposing patterns of mobile work [48]. Consequently, visions of the network society [6] and our living digitally [33] are very much coming to fruition. Networked technologies such as video communication, much vaunted as a panacea to our communication problems, have a long history of critical scrutiny within the HCI community [12]. But our research concerns have had little impact on the mass adoption of video-based services such as Skype.

The challenges of remote living and working however go beyond focused attentive communication as may be supported by video [10]. Studies of phatic technologies [49] point us towards a need, or role, for technology in supporting *intimate connection* at a distance. Mass adoption of such technologies however, does not seem close, and often the technologies, where they are described in prior research, do not particularly speak to the concerns and contingencies of the mobile worker navigating their relationship to home.

In thinking through the haecceities of remote workers’ lives, we became interested in the patterns, rhythms and rituals of family life [2]. Whilst we might commonly think of ‘ritual’ in broadly anthropological terms we can also think of it in more prosaic, quotidian ways. For example Wolin and Bennett [52] define family ritual as “a symbolic form of communication that, owing to the satisfaction that family members experience through its repetition, is acted out in a systematic fashion over time”. Arguably, the work of being a family comes from an engagement in just these prosaic ritual activities. We demonstrate love for one another through shared engagement in routine domestic tasks.

It is our contention that when away from home it is these rituals, these routine activities, providing moments of prosaic familial interaction that we miss. And it might therefore be ritual activities that offer a hook through which we might re-engage mobile workers with matters of family life, when far from home. We wished to speculate on how phatic technologies might be a resource for re-engagement with these activities when travelling for work, and to further understand the contingencies of living and reconciling a life as both a mobile worker and a family member.

These interests form against a backdrop of the developing Internet-of-Things (IoT) and explicit calls to understand how we can socialize connected devices designing them with ‘end-users’ in mind [31, 42]. Equally, within the HCI

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community there is a large body of research that has sought to understand how we can design technologies for domestic spaces and situate them within the home often entangled with, legacy infrastructure [23, 24]. Our concern for phatic technologies connecting mobile workers back to family life, within the home, clearly speaks to such research agendas.

Much of the recent work on technologies for family homes has taken a turn towards the design, development and deployment of technologies for these spaces, and a lot of the ethnographic work has considered the material aspects of domestic life (even notably in relation to aspects of rituals at home [38]). Resonating with such approaches is a concern for material engagement, exploring interaction through, and with, things in domestic settings. Responding to this we have adopted an explicitly *Research Through Design* orientation [14] to our work, where we utilise a *bespoke design* approach which incorporates critical technical practice [45] and has an affinity with elements of provotyping [3], to critically reflect upon the role of technology in supporting mobile workers' lives.

In the following sections we ground our design work in relation to extant research on phatic technologies, domestic computing and modes of design research within HCI. We present the results of a research project, which included phases of design ethnography, with case-study families, and then the design and evaluation (in-the-wild) of two technologies, each designed to both express our authorial voice as designers [39] and for a specific family to critically reflect on their working lives, exploring the complexities of their responses to (and at times limited) engagements with the fruits of our designerly explorations. Our work seeks to make the following contributions to the HCI community:

- We offer for consideration *two new phatic technologies* progressing the discussion of ways to support intimate connection in domestic settings;
- We present a set of observations on *techniques for supporting remote workers* when away from home;
- We illustrate a case-study of *bespoke design* combining critical technical practice and provotyping as strategies for HCI design;
- We provide notes on the importance of *making technology at home* in HCI design work.

BACKGROUND

Below we discuss extant work used to ground our design space. We work through phatic communication devices, the domestication of technology (i.e. situating technologies in the home), and then aspects of design research, germane to our methodological positioning.

Connecting Through Phatics

Phatic technologies are devices that serve to express the non-verbal emphatic, emotive and paralinguistic elements of communication [18]. There have been a variety of studies of phatic technologies (although not all would perhaps use that term), which construct points of communication

and connection between people (and places) through a diverse set of technical and sensory arrangements. We have previously discussed a variety of such technologies and how they can be productively critiqued to inform the design of technologies for remote workers [8].

A subset of the work around phatic communication has explicitly sought to engage notions of ritualized activities. In particular, work from the Interaction Design Lab at the University of Melbourne has explored support for intergenerational play with The Magic Box [49] and for reunions after work-related absence in Rendezvous [29]. These pieces eloquently demonstrate the importance of a nuanced socio-technical understanding of the context of use when developing technologies that work specifically with and for families. A more comprehensive review and critique of the broad range of phatic technologies can be found in [25]. Perhaps important to take from such discussions though is an understanding that whilst the phatics themselves are obviously designed with separated individuals (or groups) in mind they often fail to critically consider the placing of technology within the 'home' as a *mobile and contingent locale* and there is less emphasis on understanding the specific contingencies of the mobile worker and family-person.

Domesticating Technology

A host of studies over the last 20 years have, however, critically examined the development of technologies specifically for the home. Good overviews of the range of critical considerations at play in domestic computing research can be found in [24] and [27]. Of specific interest here are a set of studies which have addressed topics around the practical everyday organization of domestic activities (e.g. [21, 35, 47]) which demonstrate the need to ground technology design for the home within socialized understandings of the setting. Research has also addressed the division of roles and labour within the home [46], and the potentially gendered implications of this for technology design [41, 44]. Studies have also begun to address more ritualistic aspects of family life around 'events' such as the Sabbath [51] and Christmas [38], which help to highlight the rhythmicity of technology use in the home, and which point to the value of 'slow technologies' in domestic spaces [36].

Of significant importance though is the characterization given to research in this space by Crabtree et al [9], who argue that our interests should lie not in designing technologies that are easier to manage but in designing technologies that allow us to better manage *everyday life*. Nonetheless however, an overarching critique of much of the research in this space, is that it has struggled to address alternative domestic arrangements, in light of the turn to mobility [48] and the changing nature of domesticity which might now support radically altered familial structures (see also [20] for further support of this point).

There is also a growing interest amongst the CHI community in work, which explicitly explores matters of 'work-life balance' [13, 43]. Much of this work explores how digital

technologies make porous the boundaries between home and work [7, 34, 37]. And this is of obvious issue with mobile workers. Importantly, Graves Petersen et al [20] discuss tactics for ‘homing’ practices amongst mobile workers, astutely demonstrating the fluidity of the concept of home (see also [5] for discussion of the value of being away to our understanding of notions of home). This is important because it counters a false dichotomy of home versus away, and yet highlights the importance of understanding how technology can be woven in to the practices of homing – such as connecting, territorializing, bubbling, gift giving and differentiating [20].

Arguably then, of value for the study of supporting mobile workers living with remote family is research that critically considers the potential roles of phatic technologies within the complex socio-technical and hyper-mobile settings of some modern families and contemporary working practices.

Design Positioning

We wish now to turn to matters of design. The work that we are producing within our research sits squarely within an emerging community of practitioner-researchers who engage in Research Through Design [14, 50]. This is becoming of increasing interest to the HCI community [16, 39], and resonates with our work because of the potential value of making design interventions and material explorations explicitly as a *form of inquiry* [16], with materiality being so important to an understanding of domestic spaces [30].

Within HCI we have seen recent discussions of annotated portfolios and workbooks [4, 15], which underpin the value of articulating and demonstrating design process and thinking within research. Equally, there has been much discussion of the potential value of critical design to HCI although as Pierce et al., [39] demonstrate, notions of ‘critical design’ are complex, circumscribed and in urgent need of careful consideration. But none-the-less modes of critical inquiry delivered through design are of evident value and give vital space for more authorial approaches to developing understanding [ibid].

Further to the discussion of criticality are notions of reflective design and in particular critical technical practice (a term borrowed from Agre [1], and akin, in part, to Critical Making [40]). We would seek to align ourselves with such positions, which emphasise generating knowledge *through* practice. Although in-line with Pierce et al we believe that design research might better be placed in such endeavours to deliver tactical rather than ontological understanding.

With this concept of generating ‘tactical understanding’ in mind we have been drawn to the design and deployment of ‘provotypes’ [3], a deployed design, an explicitly provocative prototype, which is provisional, open and possibly incomplete although allowing for the language of consumer products to be utilised. The aim of such designs is to perturb space and social dynamics to foreground implicit assumptions and concerns within a research population. Ac-

ordingly, our work also sits alongside a long, and sometimes contentious, history of ‘probes’ of various forms and guises within HCI (see for example [19]). This ‘provotyping’ approach marries well with a more authorial [39] approach to design in which the designer’s intent and interpretation is foregrounded, whilst allowing us as designers to engage in critical reflection through making [1] as the provotypes are developed. In an almost double hermeneutic, we might foreground and critically evaluate our assumptions (as designers) through creating designs to provoke critical reflection amongst a research population. A significant benefit of such an approach is that it develops understanding (research through design) in scenarios where there may unexpectedly limited end user engagement with a provocative technology.

As will be explicated further over the following sections, we have in our research, chosen to adopt a process of bespoke design which, allows us to bring an authorial voice to the development of networked artifacts, provisional phatic technologies, which we have subsequently deployed as generative research tools amongst a set of case study families, all of whom were supporting mobile working arrangements of various forms. In doing this we sought to reflect upon the practices through which families accomplish mobile living, the values placed in technology for doing ‘family’ at a distance, and to draw insights in to the potential roles of digital technology in supporting them.

NOTES ON METHODOLOGY

Family Rituals 2.0 was a two-year research project supporting collaboration between four partner universities in the UK. Elements of the research included depth interviews with both a range of employers of mobile workers and the workers themselves (including their families). Alongside the generation of this broader understanding of mobile working and family practices, two of the collaborating institutions (the authors of this paper) engaged in dedicated design research. This research aimed to understand how regular separation from home affects the lives of five participating families, capturing the daily rituals that form family life when together and separated and critically considering the role of technology in their mobile living. Each family was the recipient of a bespoke technology, designed for them, to foster reflection on their values and practices. In this paper we reflect specifically on two of these engagements (chosen as completed case studies), providing discussion of two specific families and the associated bespoke design that was developed for each of them, ultimately reflecting on their engagements with the designs and the broader lessons learnt from this process. Our bespoke process was adopted for two reasons 1) our qualitative research commitment to idiographic and empathetic modes of enquiry which values single case studies; and 2) because the process of designing multiple alternative technologies allowed us as designers to reflect deeply on the various assumptions embedded in our responses to the research space.

Process of Design Engagement

Our research engagements with the families were structured into four phases over a period of roughly nine months. *Phase one* involved an introductory home visit or Skype call (as necessary) and interview, discussing the family's situation, typical activities and their practices around being separated by work. Families were also given a pack of cultural probe materials [17] to complete over the following four-six weeks for *Phase two*. This culminated in a second (at-home) interview structured around the probe pack material the family had generated in that time. *Phase three* involved the design and development of a bespoke 'Ritual Machine' for each family. A third interview accompanied the deployment of the technology with the family gauging their initial reactions. In *Phase four* families lived with their Ritual Machine for a period of up to eight weeks before being given a final interview, talking about their experiences of living with their machine and their final reflections on their rituals and working practices. At all stages the process was documented with video, audio and photography.

Our Participating Families

Families were recruited by a combination of on-line advertising and word of mouth. They were required to have at least one member whose work frequently took them away from home over night. Family One were Craig (36), Holly (33) and their son Sam (two), living in Edinburgh, where Craig works as a consultant in the financial sector and Holly is a public relations professional. Craig is frequently away from home for two or three nights during the week, visiting clients in London and the south of England. Holly is establishing her own company (from home). Holly is Sam's primary carer. Family Two was Hywel (40) and Jesper (40), living in East London. Hywel works in fashion, is a lecturer and a freelance writer, and is primarily London based. Jesper works in the hospitality industry, and is typically away from home up to eight times a year on both short and longer trips, sometimes for several months at a time.

DESIGN ETHNOGRAPHY

We designed three cultural probe packs 1) a family pack with probes to be completed by all family members together; 2) a pack for the mobile worker to complete during work trips, and 3) a pack for those at home to complete while the mobile worker was away. Each pack contained a playful collection of diverse printed and object-based activities to provide us with an idea of their domestic and family life, and more importantly insights into the significant, everyday rituals that formed it. In addition we wanted to be sensitized to their values, styles and attitudes.

These packs were carefully designed to communicate a seriousness and level of finish that would help to build trust with the families for the later machine deployment. The set of probes consisted of the following items: *Home* – a) digital question box asking timely questions of the household while the mobile worker is away; b) booklet called *What Makes You You?* with questions and tasks for the family; c) like/dislike camera and stamp activity; d) card asking about

house rules. *Away*: a) booklet called *Your life as a Mobile Worker* for the mobile worker to complete whilst away; b) list of photos for the mobile worker to take during work trips; c) set of maps with stickers for the mobile worker to indicate trips and social networks.

Design Ethnography Results

The fragmentary information collected from this phase provided us with a vast range of 'data' from each of our families. This provided inspiration and insights for us to inform our bespoke designs. This included activities the families shared together, their engagements with digital technologies and where indicated, their aesthetic preferences.

Using the full diversity of material generated, for each family we began to make early design responses that we believed might create or extend rituals around periods of separation. We were not looking for solutions to '*the problem of separation*', rather something that would provoke conversations about their quotidian rituals, experiences of home, and separation from it. We intended the resulting Ritual Machines to be playful and provocative.

We used sketching of all forms to develop our ideas and allow them to be productively critiqued towards working artifacts that we could live with the family in and out of the home for an extended period without our intervention.

ELABORATING OUR BESPOKE DESIGNS

In this section we describe the designs of Machines I and II:

Ritual Machine I – 'Drinking Together Whilst Apart'

For Craig and Holly in Edinburgh, our ethnography revealed glimpses of their working lives with the pleasures and strains of being parents to an inquisitive toddler. We got a sense too of the continued enjoyment of their own company and that of their friends, with many photographs of parties and times together. They were generous with their responses and we felt had a sense of fun that we could perhaps leverage. It was clear that while separation from home did cause some tensions, at least for Craig it also represented a period of some freedoms.

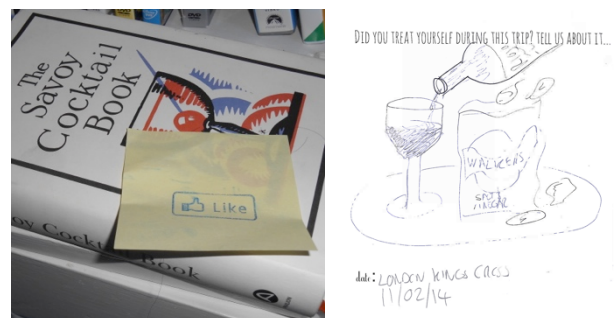


Figure 1 Ethnographic material from Craig and Holly

In collecting and synthesizing the returned probes and transcribing the interviews we were looking to find specific existing quotidian rituals that we could propose extensions to or opportunities to suggest another. See Figure 1. We quite quickly focused on their reported simple shared pleas-

ure of having a drink together at the end of the day, when Sam is finally asleep and they have done “*all the serious stuff*”. So we began to sketch, prototype and refine designs that would *allow the couple to drink together whilst apart*.

This was done knowing that whilst alcohol can be problematic it is a frequent element of ritual in secular and non-secular practice, and clearly an existing element of Craig and Holly's lives. Previous work such as *Lover's Cups* [32] has also focused on the social dynamics of shared drinking.

After a few design iterations the machine had two elements: a wine dispenser in the home that was triggered to pour a glass by the action of a remote electronic bottle opener. Both elements connected wirelessly to the Internet, the bottle opener via local smart phone. The asynchrony of this relationship was deliberate. As the design evolved the agency of the person at home (presumably Holly) was explored, by requiring that a glass be inserted into the machine before it operates, and causing that action to initiate a notification on (presumably Craig's) smart phone. The alert would be sent regardless of the frequency of the action.

This machine had to safely live in Craig and Holly's home for a period of weeks without causing distress or harm. We were aware that our efforts would be focused on a small number of moments and that the success of the interaction rested on making this as seamless as possible. This required a very careful level of design and engineering. We were both dealing with liquids that were for consumption and in combination with electronics and a small child.

We were clear that our intended location for the wine dispenser was the family kitchen, which of course we could not dictate, but we styled it to share a design language with common white domestic appliances. The visibly upturned wine bottle and waiting glass beneath were intended to make the function of this part of the machine as unambiguous as possible. The choice of WiFi as the networking technology allowed the dispenser to be installed with minimal disruption, it simply had to be sighted by an electrical socket. The family would need to clean and maintain it.

The wine dispenser contains a WiFi connected Arduino Yun, controlling a high torque servo-motor that mechanically operates an unmodified wine optic. Sensors detect the glass and LEDs cause it to be illuminated when inserted.

The design of the bottle opener had to mechanically remove a bottle top without itself breaking with the forces involved. The *teeth* from a novelty electronic opener were used around which a new device was built. We were aware that this device would operate in public and be taken on public transport, including flights. As such we wanted to ensure that it would not be read as a piece of DIY technology and arouse suspicion. The case was carefully constructed, with the electronics built on a professionally produced PCB and easily inspectable, with a switch for *airplane mode*. The bottle opener contains a Bluetooth 4.0 module, it senses the presence of a bottle top in its teeth by conduction.



Figure 2 Interactions of Drinking Together Whilst Apart

Craig owned an iPhone and we designed a bespoke application (app) for his device to connect with the bottle opener by Bluetooth and then home to the wine dispenser by any available Internet connection. The interface is deliberately sparse, the graphics communicate the full state of the system, wine can only be triggered by the use of the bottle opener, there is no shortcut on the iPhone. See Figure 2.

As with all our machines we carefully managed deployment. A cardboard box was prepared to safely package all the elements and to communicate a seriousness when presented to Craig and Holly. In addition we prepared an instruction manual that described the procedures for safely fitting a new wine bottle and cleaning the optic.

Ritual Machine II – ‘Anticipation of Time Together’

For Hywel and Jesper in London, we found much inspiration in their attitude to time keeping and routine, Jesper's love of travel and Hywel's design sensibility. Jesper told us he "had never been late for anything in my life" and together they recounted the sequence of events every morning starting with waking at 4:30am. Jesper's *Diary of a Mobile Worker* gave us further insights into professional travel and accommodation in the high-end hospitality industry. Our visits and their photographs highlighted to us how carefully their home was curated. This was especially true of the living room, where choices were made exclusively by Hywel with close attention to colour and materials. While their working lives were both very busy with regular periods of sometimes-sustained separation, they told us of their frequent holidays or weekends away together, which were carefully planned and anticipated keenly.

We sketched around the themes of time and travel. Finding mechanical departure boards evocative of a more romantic age of travel, being particularly drawn to their sound. We

thought about clocks and representations of passing time and settled on a machine that would structure a ritual around *setting a countdown timer in anticipation of a future event*, probably a shared holiday or becoming reunited.

We found a commercially available flip-dot display and our design became structured around this. We felt that the resolution and form of the display best suited abstract shapes and representations of long periods of passing time and in particular we thought of sand timers and pitch drop experiments. For this reason the displays were configured vertically, to allow time (dots) to fall and fill. We were consciously making an exemplar of Slow Technology [22].

We were clear that it was our intention that the machine would be designed for the living room and as such we would need to work hard for it to be accepted into that space. The monochrome colours of the final case and display were dictated by this. We had discussed designs that would be wall hung, but felt they complicated the installation and increased the likelihood of rejection, so the design became floor standing - reminiscent of a high-end speaker. As with the wine dispenser the use of WiFi allowed the machine to be connected to the Internet without the complication of cables, the unit required a single cable for power.

We decided early that all interactions with the display would be through the couple's iPhones. The display's only point of external interaction is a power switch. In this family we designed a symmetrical relationship with the machine for both people. While the interface could be used remotely, we became interested in how we could structure ritual acts around the machine when both were present. Using Apple's iBeacon proximity technology we were able to estimate the display between each phone and the display, this allowed us to prototype a series of proximate interactions. We enjoyed the Cold War film language of double locks and secure systems that require two people to initiate a sequence.

Through a series of explorations with the flip-dot display, prototyped interactions through iPhones using their touch sensing and proximity with an iBeacon, we designed a series of machine behaviours/interactions to set a future event and then structure the time in anticipation of it, creating moments of interaction and we hoped, reflection. The sound of the display was central to this. The mechanical action of the turning of each dot creates a short tick, so that movement on the display produces a naturally synchronized sound track, small changes of individual dots make a small noise, large changes a larger sound. In Hallnas and Redstrom's terms this is the display's soniture [22].

The iPhone app shows what is currently displayed on the flip-dots from wherever they are, be they home or away. Touches on the iPhone screen are relayed to the flip-dot display in real-time allowing simple gestures to be communicated home, a simple phatic exchange.

Before the event is set the display presents two small circles that appear and disappear every second, sounding like a

ticking-clock. When an iPhone is close by and running the app, the display will respond by expanding one of circles as a button, which is clicked on the iPhone screen. The other circle will continue to animate until the second iPhone is also close and has also activated their button, see Figure 3. At this stage a circular wheel interface for setting the date spans both devices, such that when they are placed together the image is complete. By rotating around the circular the time is moved forward and backwards. One revolution of the wheel moves time by one day; a week hence can only be reached by rotating the wheel 7 times. The minimum duration of the timer is one day in the future; we did not wish it to be used for shorter periods than this.

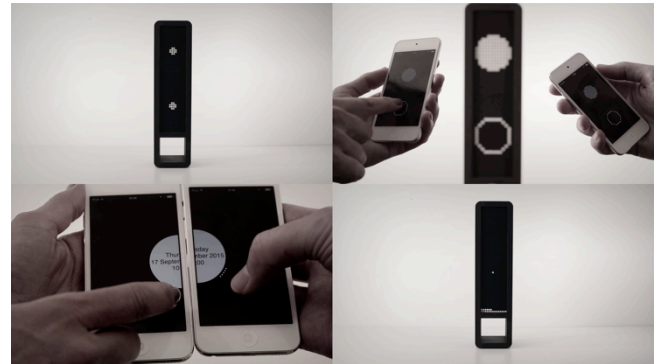


Figure 3 iPhones interacting in proximity to the machine

When the negotiated time is reached both parties have to touch their screen together. Once the time is set the display begins to fill from the bottom with white dots, such that when full the time has arrived. Dots fall from the top of the screen like a sand timer, dropping one by one until they reach the bottom. Depending on the duration of the timer, their movement is very slow, for a date several days away the display will change once or twice a minute. Consequently with the infrequency and volume of the resulting tick, the sound is almost imperceptible.

Once set, the timer can be reset by both iPhones being close to the display and being shaken at the same time. When the moment of the event finally arrives a fast moving, fast changing and consequentially loud celebratory animation begins. This continues for 5 minutes before the display begins to wait once more to be set. The display itself contains two 14 x 28 flip-dot units controlled by a Raspberry Pi 2 running openFrameworks with a RS485 adapter, plus modules for WiFi and Bluetooth 4.0 (to advertise the iBeacon).

This machine was also delivered personally in a bespoke cardboard box with another illustrated instruction manual that described interactions. To protect the paintwork of the case and to protect the sensitive flip-dots, we wore gloves and asked the family not to touch or dust the display.

Family 1 – Holly, Craig and Sam

While Holly and Craig greeted the machine with a good deal of approval and excitement, there was soon a note of hesitation. They were perturbed as to the implication of our

focusing on their ‘drinking’ ritual. As Craig commented: *Being judged isn't the right word...* (Craig). Holly further tried to rationalize her behaviour, or perhaps more appropriately, what she saw as our perspective on it: *“We are not alcoholics but we do like to have a drink, and we do, like most of the country, think ‘Oh, we really should cut back.’ It's only to do with our own insecurities.”* (Holly). Clearly they were at pains to try and make sense of what they saw as our interpretations of their values and interests.

Following unpacking there was an immediate problem: the machine would not fit in the kitchen. Importantly between the initial visits and deployment, Holly and Craig had moved home, so our view of their living space was outdated. With the bottle inserted in the machine it was now too tall to fit under their kitchen units. There was nowhere for it to be placed out of Sam’s reach. The machine had become ‘place-less’, and this impacted on how they felt it was used:

“The biggest thing, is what you said about the physical location of it. If we were in our old flat and it was out on the worktop, and it was just there [...] We would probably have used it more, as it was kind of, to a point, it was in-your-face.” (Craig)



Figure 4 Craig uses the machine over FaceTime

After a period of weeks our logs showed that the machine had not been used to pour wine. Messages were routed via our server and we recorded time-stamped events each time the app was opened, a glass was inserted or the bottle opener was operated. As the date of the retrieval of the Ritual Machine drew closer, we asked Craig and Holly to make a special effort to use it.

“There was actually the final D-Day. Gary was round, just for dinner, and we were like, right, let's do it! And we did. It was funny that I actually had somebody with me here when we finally did use it. I think that it really showed, actually, that I don't really drink that much on my own, even if Craig was actually on the other side on FaceTime.... If I am going to have a drink, I would rather have a drink when he is here rather than on my own” (Holly).

On the day of collection we discovered the machine shelved and unplugged, next to an unused bread maker. There had been no site for this ritual to establish itself. There could be no casual interactions with the machine; on each occasion it would have to be temporarily set-up and then packed away.

In addition at the final interview it became clear to us the complexity of the moment we had designed, where all the conditions needed to be correct. *“So you are thinking about it three days before you actually have a drink.”* (Holly). This included that the machine was on, a bottle of wine had been opened, that Sam was quietly asleep, that Craig had remembered to take the bottle-opener (*“you just forgot it numerous times”* (Holly)), that he had a beer and was ready to drink it in a place that he would feel comfortable. In talking through the complexities of use Holly and Craig reflected on the deeper value of their shared drink time: *“It's not so much about just another busy day, they're all the same. It is actually about marking being physically in the same place at the same time.”* (Holly). This importantly brought to the fore the notion that the ritual was a marker of coming back together, signaling the end of the mobile work; and that for them was the important moment.

Having said this the machine offered a variety of valued aesthetic moments for them, they appreciated the form and complexity of the object and as Craig said: *“It is quite satisfying in the sense of your action is making something mechanical do something from five-hundred miles away.”*

Whilst the machine was often unused, its presence in the house aroused curiosity from visitors: *“Most people are actually interested in it, “Wow! You are taking part in a bit of research.” And “How often have they been to see you?” And “What is it expecting to achieve?”* (Holly) Such was the curiosity that the machine became *“quite special”* to Holly and Craig: *“It was amazing, and that's reflected in our bragging about it, and when people were asking us questions, we were only too happy to go into lots and lots of detail, including practical demonstrations.”* (Craig).

However, Holly raised one intriguing critique about the pattern of gestures made by the machine. This focused on it pouring her a drink only when Craig opens a beer:

“Yeah, it was really annoying as well, because ... In some ways, actually, in some ways you can think ‘I can pour my own glass of wine. I don't need a man to pour my glass of wine.’ If you are going back to gender stereotypes it's actually the woman who's the hostess. It's the woman who is pouring all the drinks (Holly).

This moment for reflection offered by Holly demonstrates that such domestic technologies can never assume to be outside of gendered assumptions or interpretations.

Family 2 – Hywel and Jesper

Hywel and Jesper also meet their machine with a good deal of excitement, *“It looks very expensive. I didn't think it would be so big. I thought I was going to get a box with a screen on it!”* (Jesper). They rapidly made the connection with travel and departure boards, and they also referenced the Troika Cloud installation at London Heathrow Terminal 5, which had been an inspiration. The default animation changes every second and this causes a ticking sound, our intention was to create a strong association with time,

which was also quickly understood. Jesper commented, “*It sounds like a grandfather clock in the background.*”

We designed the machine to be sympathetic to the aesthetics of their living room, and identified a potential site within, but we could not dictate where it would sit. We knew that Hywel carefully curated that space and he would ultimately make that decision. When the machine was delivered it was quickly at home in an alcove of the living room as we intended and there it stayed. Demonstrating the success of the design Hywel commented:

“I was thinking the other day [...] you came in, we put it there in the corner, and we haven’t moved it, and usually I am obsessed about where things are in the house, we didn’t think of moving it, which is kind of really unusual.” (Hywel)

The machine became a fixture within the home, Hywel suggested that: *“when we knew we’d have it for a while, instead of calling it a machine, we gave it a name, it makes it easier. [...] We generally give names to things. Our car is called Bob. [...] We call the ritual machine Richard.”*

Since first meeting us Hywel and Jesper’s lives had changed. Jesper was spending less time away, having moved jobs. They had also bought a second home where they were spending many weekends together. They commented on the changing nature of their mobility:

“So, we’ve become so mobile and so portable....that (pointing to the machine) is not mobile, that machine is a physical part of this house, and our lives are not just this house, which it maybe was when we first met, like a year ago.” (Hywel)

This points to the dynamically changing nature of family life and the changing relevance of our intervention. When the machine was initially installed Hywel and Jesper had some minor concerns about its fragility and whether visitors might damage it. As well as their own guests and their cleaner, the whole house was frequently rented out for short periods. Our intervention allowed us to discuss how the home adjusts to the presence of paying strangers:

“Because we rent this house so much, we have not unpacked our toiletries, our bathroom is like a hotel bathroom, it’s almost like we are not staying... it does not bother me.” (Hywel)
“But this is definitely home.” (Jesper)

Hywel and Jesper set the countdown four times during the period they had the machine to mark a variety of small occasions and trips. See Figure 5. Hywel noted, *“it was exciting to see what was going to happen [...] I don’t know I thought maybe it was going to play music, but I’m glad it didn’t!”*. Whilst they did use the iPhone app away from home and display gestural touches on the machine, it was clear that this had been an infrequent interaction. However, the machine was the subject of conversations when they were apart. Hywel told us, *“yes, we’d text ‘how is Richard?’ - ‘Richard is ticking!’”* Asked if they felt that the machine had become a ritual for them Hywel argued, *“I don’t*

think we had it long enough, for a ritual to happen it has to happen long enough, to be permanent.”



Figure 5 Hywel and Jesper with “Richard”

What the machine did do however, with the accompanying interactions and discussions around the machine was prompt them to reflect on their work/life balance:

“Things shifted massively since we started on the project, we’ve been thinking about it too, we just turned 40, now its not just about work, we’re trying to find a balance, which I think we still haven’t done...” (Hywel).

“So did the project make you reflect on your work life balance?” (Interviewer) *“I think, the project, well not the actual machine, but conversations like this probably have done, so yeah, I guess in a way, whether it has been Richard or conversations like this, probably yes.”* (Jesper).

Again here, we see value emerging in the development of critical reflection on work/life balance, in part fostered by the design intervention (broadly conceived).

DISCUSSION

Our research has detailed the design and deployment of two new phatic technologies. Designed as research materials used to further explore the ritualistic aspects of domestic life for mobile workers and their families. Our devices, Machines I and II, were both engineered to create moments of synchrony and connectedness, in parallel with (rather than replacement of) extant communications infrastructure (e.g. mobile phones, Skype etc.). The two devices leveraged notions of ritual but to varying success. Machine I’s deployment highlighted the importance of the shared drinking ritual as a marker for finishing the period of mobile work – putting it at odds with a notion of remote connection and remote engagement in ritual. Machine II’s deployment was seen as less ritualistic by our host family because of an inherent notion of the length of time it takes to embed a *ritual* per se, within a family. Machine II did however promote a form of phatic connection that explicitly encouraged its users towards physical connection in time and space rather than remote, moving on the discussion of how phatic tech-

nologies might be positioned relative to other forms of communication device.

In the following sections we reflect upon three main issues. We highlight our learning from the deployments in relation to ‘Techniques for supporting remote workers’; we offer ‘Reflections on bespoke design’ as a research process; and we sum up with some considerations of the processes and importance of ‘Making technology at home’ in research.

Techniques for supporting remote workers

The function of deploying our provotype [3] ritual machines was to promote critical reflection upon aspects of mobile workers’ lives, to understand how they manage both family and work commitments. The families’ responses to our designs suggested five ways in which remote workers might be better supported, which we unpack further below:

Make connection easy / ephemeral – Whilst supporting ‘Connecting’ has been discussed as a valuable tactic for mobile workers [20] we can see that some of the lack of use of a system, like Machine I, stemmed from its not being at hand, as Craig had described. Where moments of connection are desired it must be done in ways that offer simplicity and lower barrier to participation. Connection is often possible through mobile telephony but it is not always appropriate, and casual phatic communication needs to be made ‘at hand’.

Protect mobility for the mobile worker – we were at pains through the designs to ensure that the materials we built could be mobile and could travel with the mobile worker without encumbrance. However, we needed to find stronger points of synergy between tasks and activities already being done by the mobile worker leveraging existing tasks, so that we did not add new routines (e.g. having to go back to your room to use a bottle opener) outside of regular practice. This resonates with Graves Petersen et al’s [20] suggested tactics of ‘Outboxing’ (preparing artifacts for moving) and ‘Rythming’ (living within certain patterns of activity).

Support efficacy at a distance – Craig’s interests in the aesthetic quality of having an effect at a distance reveal a value/interest at play that could be fruitfully exploited. The slightly magical quality of having agency in another space through actuated mechanisms was clearly enticing, as a form of engagement which has been little considered.

Celebrate reunion and anticipate togetherness rather than just connection – Evidently for Holly and Craig there was value in the shared drink ritual but for them its true value was in marking that work was done and that the ‘mobility’ had come to an end. Machine II was already responding to this notion and worked immediately with a sense of reunion and orientation towards the future of being together, potentially having more success for that. Systems such as Rendezvous [29] work *around* the remote working pattern and worry less about live connection focusing on creating shared connections – even if this might be in the future.

Positively encourage thought on work/life balance – our interventions prompted reflections on notions of work/life balance. This was never negatively perceived. Whilst most people who work in such circumstances do so because it works for them, the changing nature of family and attitudes (as shown by Hywel and Jesper) outlines that it is important to foster reflection on the patterns of activity that workers are engaged in and the satisfactions or frustrations they are having in this. Our material interventions actively (and beneficially) supported such productive reflection.

Reflections on bespoke design

Our bespoke design process was a dialogic interaction between the designers and the family. They were aware that the machine we had built encoded elements of their character and values within. The machine was presented as if a personal gift, albeit one that was to be returned to us. As such this machine would never be the result of a mass-production industrial process or be chosen by that family in a commercial context to meet a perceived need. It exists within the home only to create moments of reflection amongst the family about their values and attitudes to separation. In this way, and akin to a provotyping *strategy*, each machine may be seen in part as both a sensitizing tool (as per cultural probes) and a breaching experiment seeking to provoke reflection.

In order to create these real moments and experiences for the families these machines had to work. Work not only technically, but also within a family’s specific home environments and the spaces and infrastructures they move through when traveling and over a prolonged period without our maintenance. There is an inherent complexity and risk in negotiating these practical, social and technological constraints that we could only provisionally anticipate. While the machines’ functions were clear, the ways in which the family should make meaning and exercised intention from them was ambiguous and the subject of our study.

The resulting machines were highly produced for specific people and circumstances, by the tools and services we had at hand. Our physical case designs were deliberately familiar, product-like and readable. We primarily wanted to communicate a care and professionalism in their construction; we wanted to build trust that this complex unknown device brought into the family would behave well. In doing so we wanted participants to feel that they were each important and valued by us.

However, the success of our designs hangs on the ways in which they were made relatable to the participants, they needed to be embraced into their homes. The machines achieved a ‘sweet spot’ in managing ambiguity whereby: they were easily relatable and useable – there was no ambiguity about *how to use them*; yet their purpose was left often to interpretation. This meant that the families could interact meaningfully *through* them. Arguably the bespoke nature of the design process helped achieve this usability

conjoined with openness to meaningful appropriation – to being made ‘at home’ (a matter we return to further below).

A bespoke design process inevitably meant we could only work with two families, consequently the families we selected heavily circumscribed our findings. We see this however, as an explicit strength of the approach. Like many traditions of qualitative research there is value in idiographic case studies (detail over generalisability). Our design research strives less for ontological understanding and more for delivering tactical understanding [39] – providing inspiration for further activity (e.g. product development) and unpacking strategies for approaching a design space. We have also willfully invoked the notion of criticality. Ours were not critical designs, but tools for fostering critical reflection amongst the participants, which they did in part (whilst perhaps not engaging as we wished). Concurrently, however, our technical practice of design, our interrogative efforts to understand a design space, to respond to it, to make appropriate material selections to address it, all constitute an additional form of critical reflection, embodied within the objects we have designed, built and deployed, regardless of the users’ appropriation. And this is the value of a bespoke design approach.

Making technology at home

We also need to consider what it means to ‘make a technology at home’ – that is to situate it within the domestic and familial context, either static or mobile. We found that making the technologies at home for each of the families depended on a number of different qualities of family life. Comparing machines I and II we see how the aesthetics of the design was paramount. For Hywel and Jesper we were nervous about their stringent minimalism and the overtones that this would have for acceptance of any device we made them. To some extent the level of finish went way beyond our intentions for the project, and it was evident from the way they responded to and treated the device that it was a success. For Craig, Holly and Sam however, we had missed the mark. We did consider, quite carefully the aesthetics of their home, it did not help in part that they moved during the trial but we had missed the aesthetic that mattered. This revolved around flexibility. With a rapidly growing child things got moved. Where we saw mess, they saw carefully and contingently placed ‘things’. We needed to attune to this aesthetic and arguably we failed. The aesthetic in Craig and Holly’s home was probably actually *more* important than for Hywel and Jesper, but our reading of the setting overlooked this.

To make a technology at home also requires consideration of the social dynamics of an environment. Our probes revealed a possible gendered tension for Holly about the presentation of a technology and the assumptions that it might be making. As argued by others [24] the social assumptions that might be made by a technology should be foregrounded in the design stage when a technology is being situated in someone’s personal space such as a home.

It was also clear from our deployments that to adequately situate a technology in the home is to be cognisant of the temporal patterns and rhythms of the environment. And importantly to note how these might change, requiring designs to be flexible, appropriatable and adaptable. For Holly and Craig we needed to understand better the temporal alignments that they had when they were separated. The notion of taking a moment to share a drink together might not work because Craig’s rhythms altered when the family structure was not there. For both families however, even though we deployed our machines with them for relatively short periods of time the engagements were over some nine months. In this time for both families we saw large changes, a move of house, a change of jobs and altering of patterns of activity. For a technology to be made at home in this environment it must be responsive to the changing circumstances of use. Families are more mobile and are changing (arguably they always have been it is just the nature of some of those changes that is altering through mobility). As such this likely means we should think much more about designing broadly for mobility, and as indicated by previous work on ‘homing’ [20], the extent to which notions of home are enacted through mobile workers’ practices.

Finally, we wish to reflect on how our participants made efforts to ground our designs in dialogue with others. Perhaps the most interesting feature of the deployments, were the un-captured moments in which our participants introduced and demonstrated our designs to unknown others. The most valuable data that we didn’t get was about the way in which our participants made the technologies at home through using them as a ‘ticket to talk’ about the subject matter of our enquiry. We might consider how such embedded articulation work around and about the devices could be collected when doing such bespoke design work, as it is the families efforts to make the technology at home which is perhaps the most valuable in understanding their orientations to the critical issues of mobile working/living.

CONCLUSION

Through our design research we have elaborated a process of bespoke design. In doing this we have sought to unpack the contingencies and complexities of mobile workers lives. We have presented two new phatic devices, our Ritual Machines and have used their deployment to understand the potential roles and values in and of technology in domestic and mobile spaces, drawing conclusions about the importance and value of making technologies at home in both domestic and mobile settings.

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