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# Towards an Analysis Framework of Technology Habituation by Older Users

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## ABSTRACT

Smart everyday objects could support the wellbeing, independent living and social connectedness of ageing people, but their successful adoption depends upon them fitting with their skills, values and goals. Many technologies fail in this respect. Our work is aimed at designs that engage older people by building on their individual affective attachment to *habituated objects* and leveraging, from a participatory design perspective, the creative process through which people continuously adapt their homes and tools to their own lifestyle. We contribute a novel analytic framework based on an analysis of related research on appropriation and habituated objects. It identifies steps in appropriation from inspection to performance and habituation. We test this framework with the preliminary testing of an augmented habituated object, a messaging kettle. While only used in one home so far, its daily use has provoked many thoughts, scenarios and projections about use by friends, both practical, utopian and dystopian.

## Author Keywords

Technology Habituation, Analysis Framework, Appropriation, Adoption, Acceptance, Messaging Kettle.

## ACM Classification Keywords

H.5.2 User Interfaces: Theory and methods.

## INTRODUCTION

The increasing availability of miniaturized computing and networking equipment has fueled a multitude of research initiatives to delve into the issues and opportunities, of creating *smart* everyday objects, i.e. *things* that, on top of their usual function of office, kitchen, or decorative tools, are endowed with the capacity for autonomous rational action. A promising application for smart objects in domestic settings is supporting the wellbeing, independent living and social connectedness of ageing people. However,

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despite the claimed direct and indirect benefits that would result from a fast and widespread adoption, older people have not adopted these “smart object” technologies and in some cases actively resist, suggesting problems in their conception and or design [18,20,27]. As Taylor et al point out, perhaps resistance is because the technologies are designed to be smart, but do not make us feel smart [51].

Our work is aimed at designing technologies that engage older people by building on their individual affective attachment to *habituated objects* [6] and leveraging, from a participatory design perspective, the creative process through which people adapt their homes and tools to suit their individual needs and goals.

This paper contributes a novel analytic framework based on an analysis of related research on appropriation and habituated objects, and with respect to technical advances on smart appliances and tangible/embodyed interaction. We benchmark the framework against recent results from the design and evaluation of a smart communicating device conceived to enable connectedness over the traditional family routine of making tea: the Messaging Kettle. We show that characteristic phenomena of technology habituation cannot be easily understood only in terms of place-making, but require a more comprehensive model to cope with affection and the symbolic value of objects.

## RELATED RESEARCH

Studies focused on design for domestic settings have investigated interesting properties of Internet enabled objects. Examples include almost any tool that could be found in the home, enriched of functionalities that may or may not be related to the original use of the tool: a knife and chopping board that know what food they are being used with [28]; a kettle that recognizes activity patterns of its users, such as when it has been picked up, if it is being refilled, etc. [3]; a coffee mug [4] augmented with a number of sensors for temperature, movements, position (e.g. placed on a surface or held in one's hand); a tablecloth that holds and makes visible a memory of objects that were placed on it [19], and much more.

As it has been observed, a large majority of such projects address isolated tools and their functionalities, rather than exploring how such objects could become part of everyday routines within the complex home ecology [53].

In fact, the goal of such smart objects is often focused on sensing and inferring either their own specific state (idle, in use, etc.) or the surrounding context (e.g. in a party, in a meeting, etc.) and act upon it. Additionally, such works are mostly innovation driven and empirically grounded; they explored interesting and challenging aspects of technology development and human-computer interaction, but made little attempt to explain why a certain design can succeed, whereas others may fail.

The idea of *smart home*, on the other hand, has been largely sketched in terms of an *assistive* environment (e.g. [11,17,18]), capable of sensing and recording the activities of its inhabitants, and infer their needs or possible dangers, and often insisting on the need of a disappearing and unobtrusive design to encourage the acceptance of technology assisted living [27].

Such approach has drawn some criticism, not only based on privacy and ethical concerns, such as the risk of social stigma for the user, resulting from the lack of independence and disabilities [18], but more radically on the legitimacy of systematically anticipating and presuming how to care for the needs of users, rather than designing tools to empower them and their capacities [40].

Such a change of perspective is particularly urgent when designing for ageing people. In fact, while the specificity of needs and goals of older users is generally acknowledged, they are just as often stereotypically linked to loneliness and social isolation, illness, incapacity to use or learn to use technology [14]. Furthermore, the supposed homogeneity of people in old age, considered as a user group, has been challenged (e.g. [32,37]). Although evidence suggests a shared view of what 'ageing well' means among seniors, e.g. maintaining physical and financial independence, being socially active and actively engaged in their communities and families [36], it has been observed that the individual histories and experiences, including the *scars* that a long life invariably imposes, result for each person in a unique mix, and hence in a unique implementation of actual strategies for ageing well [36].

On the contrary, smart environments, as they are often conceived, offer little opportunity for active appropriation of, and engagement with, the technology: the older person is the monitored subject. Taking an opposite perspective, technology enhanced objects can be designed so as to reveal, amplify and inspire the capacities of people [39]. As Taylor and colleagues have observed, smartness does not belong to things, but rather to the way in which people appropriate and adapt those things: people shape and adapt their homes to their everyday use, for example using space and surfaces as a shared sketchpad to communicate with each other [51].

In fact, despite their potential, many innovations have failed to engage their potential users. To name a few examples, Pierce and colleagues [34] have pointed out the potential

harm of energy feedback systems, including the risk of achieving opposite results from those intended by the designers. Rothensee [43] shows that potential users reacted with lack of enthusiasm when asked to evaluate the usefulness, ease of use and intention to use a smart fridge. An attitude of distrust and suspicion that may result in a firm rejection when the evaluation focuses on potential privacy violation [42].

The reasons behind such disappointing results are certainly complex and difficult to generalize; however, often *smartness* has been considered independently from the cultural and emotional attachments that characterize the home. As Leonardi and colleagues observe [29] the home is often the center of the emotional universe for seniors, technologies are more welcome in certain rooms, such as the kitchen, whereas the bedroom is often regarded as *intimate*, and the place of symbolic objects. Such differences, however, are far from universal; as pointed out by Rode [38] differences in infrastructure, size, number and use of rooms, number of occupants etc. call for more cross-cultural ethnographies aimed at making sense of how different people conceive and shape their house.

As an overall philosophy our research and investigation into technologies for the home focuses on engagement rather than monitoring. People thrive when socially engaged and older people may need more opportunities to socially engage.

### **Technology acceptance and appropriation**

A large body of research exists that models user's attitude towards technological innovation and the (un-)successful adoption of new devices.

The widely adopted Technology Acceptance Model (TAM) [12] and its numerous improvements and extensions (see e.g. [55]) approach user acceptance in a workplace context, where perceived usefulness plays the pivotal role as a predictor of acceptance [21,43]. By contrast, the home setting, calls for a hedonic, rather than utilitarian dimension of interaction, in which *ease of use* (i.e. usability and classic HCI concerns) and *perceived enjoyment* (i.e. affective dimension and user experience) are key factors leading to acceptance and intended adoption [21,23]. Venkatesh [56] further deconstructs the perceived ease of use in a number of determinants, including control (i.e. having the skills and external support for using the technology), computer *playfulness* (i.e. individual inclination towards adopting the technology other than for reaching a goal, intrinsic motivation [45]), and *emotion* (in the form of anxiety).

Yet, it has been observed that TAMs, focusing on a managerial, top-down introduction of new technologies, fail to capture the user's interpretation of the role, value and purpose of a new tool [47] and the way a tool is integrated into one's activities and competencies.

Such integration represents a continuation of design in use, as articulated e.g. by Suchman [49,50] and Ehn [15]: people

actively figure out new uses for tools, and adapt their environment and practices to accommodate and exploit such uses (that, is worth noticing, often the designers did not anticipate [13], such as using email as a backup tool or to send notes or a reminder to oneself) in a continuing process of *appropriation*.

In the home, this process has been characterized as “Everyday Design” by Wakkari and Maestri [57,58]: they observe how routines are often supported by finding new uses for existing tools, evolving and changing those tools, and discovering new affordances for them.

Carroll [9] proposes for appropriation a model that separates *technology-as-designed* from *technology-in-use*, describing it as the process through which a new technology is adopted and transformed by its users, as opposite to non-appropriation and dis-appropriation that are observed when a technology fails to engage the users’ interest, or, respectively, is abandoned even after an initial success, evidencing the dynamic and always evolving nature of the appropriation process.

Riemer and Johnston [35] have characterized such adaptation in terms of *place-making*, i.e. an active process through which new technologies are first inspected by potential users and evaluated against existing skills, practices, and social norms; then the affordances of the new tool are explored, new skills may be acquired, and existing practices could be adapted accordingly; finally the new tool is placed amongst existing ones, and becomes part of the toolkit and of the social identity of the user. During this process the new technology moves from conscious attention (foreground) to taken for granted (background), and from being perceived as a set of properties to being a means to achieve a specific goal.

The factors that influence non-appropriation and dis-appropriation, such as cost, safety, security, usability, social status, etc. have been further studied in the context of mobile technology and young users [7,8]. Technology appropriation by older users has however received far less attention. While some of the factors that facilitate or inhibit appropriation in younger people may well apply, other important factors are likely to be peculiar of a senior audience. It has been observed, for example, how young users appreciate the ubiquity of mobile phones, and the possibility to access their favorite services *anytime, anywhere* [7] while the same possibility may be seen as invasive by some seniors, as it is not necessarily relevant to their own goals and values [6].

### **Habituated objects**

Robertson and colleagues underline the diversity of experiences, personal history, attitudes and needs, in contrast to the perceived homogeneity of ageing people that can be found in common sense and scientific literature, and that such heterogeneity of needs and attitudes also shaped the process of appropriation of new technologies, including

the ones that are not specifically age-related [36]. Nansen and colleagues observed older people’s experience of a *natural user interface* in relation to *habits, habitus* (i.e. bodily abilities, skills and performance) and *habitats*. They propose the concept of *reciprocal habituation* to underline the mutual adaptation that technologies and people act on each other through design, adoption and appropriation

Hence, on the one hand, technology adapts (through design) to people’s values and needs, practices and skills, houses and workplaces; on the other hand people acquire new skills, reshape their practices, redesign their houses to accommodate technology. When one or both parts fail to meet such accommodation, the whole process may fail, as is sometimes the case of new technologies that are not perceived as relevant or useful by older users [32].

On the other hand, *habituated objects*, which are already part of peoples’ routines, may offer opportunities, through well considered technological enhancement, to enhance and extend pleasurable routines and socialization, leveraging the emotional value of the object or extending the associated rituals [6].

As observed by Forlizzi [16], products can evoke social behavior as they are embedded in a *Product Ecology* that includes social and cultural practices. The usual dimensions of interaction design, functionality and aesthetics, combined with the social, emotional and symbolic values of products, shape the activities and interactions that can take place in a given environment, including the social interactions [16].

Focusing on older users, Vaisutis and colleagues have investigated how some objects are invested with an emotional and social meaning by seniors [53]; they found that a special significance was often attributed to certain objects, for their capacity to afford independence, comfort, to communicate prestige or preserve tradition, to represent a social relation with a loved person, or to foster creativity and relax.

They further observe that many of such objects are routinely used for social interaction, and could potentially be enhanced with technology to support communication and independent living. However they also stress that the strong emotional attachment that ageing people have to those objects, besides what they represent, means that such objects need to be treated very carefully in design [53].

Similarly, Leonardi and colleagues have investigated the meaning of the domestic space to older people, and the relation between objects and activities; they identify *functional* objects (used in daily activities), *symbolic* objects (having a commemorative or reconstructive role) and *leisure* objects (functional to entertainment), and recognized how different objects are found in different areas of the home, according to their intimate or emotional valence [29].

## MESSAGING KETTLE

It has been noted how elderly people, often marginalized in the adoption of new technologies, found a powerful motivation in keeping in touch with relatives, especially with grandchildren, for acquiring and learning to use a computer or mobile phone [33,52].

Family separation is becoming more and more common, as the world becomes smaller and the job market breaks through geographical boundaries, and new household models emerge that struggle to keep alive their family rituals. Yet, as we have shown above, existing messaging technologies, including mobile phones, social media, video conferencing, are not always easily integrated in the older users' practices, due to a lack of attention to such practices in their design.

The use of messaging technologies by extended families has been the focus of extensive research.

Rowan and Mynatt [44] describe a *Digital Family Portrait* capable of sensing and sharing the activities and whereabouts of an old person living alone to her distant adult children. The focus being on making routines visible, showing that life is going on as usual at Granma's, not much support is given to explicit messaging.

Lindley [30] studied technology supported lightweight communication between households using a tablet-like device capable of supporting drawing, handwriting, taking photos and of sending such simple notes to preregistered contacts. Thanks to the convenience, asynchronicity and glanceability of the device, the study reports a great engagement and on the seniors' part, that notably were the most active in sending messages to their children and grandchildren.

Tee and colleagues explored how extended families use technologies to share and communicate [52]. They highlight several themes that describe common challenges in family communication, including fitting communication in people's busy lifestyle; inadequacy of hardware/software (specially for older users) to cope with certain media formats or lack of specific skills; concerns arising from the sense of obligation and the burden of keeping in touch.

They also underline how a larger majority of participants reported a desire for more communication with their extended families, but are either too busy (and feeling guilty for that) or believe the others are too busy [52].

Other projects have explored the affordances of various house tools and devices, how they were used to support communication and how they could be extended to support remote communication or share a ritual/routine over a distance: among the many examples, the fridge door [51], a cup [10], and a candle burner [1].

Finally, intimate communication at a distance has been proposed by Mueller and colleagues [31] in the form of a hug at a distance; we considered the most limited form of

sending hugs, bits [25,26] or pokes (as in Social media), to be too limiting in terms of engagement and semantic expression.



**Figure 1. Messaging Kettle: a traditional kettle is augmented by means of an external device (middle) that senses when the water is boiling and allows to record/play voice messages. A companion tea-box device provides networking and a scribbling interface. Somewhere else, possibly several timezones away an identical device is connected to this one like in a presidential hotline.**

These limited forms seem to survive in social media, because these services support additional expression through other means. However none of the very limited forms of phatic expression appear to have gone to long term trials or to have survived beyond the concept stage.

With such scenarios of separation between older people and their adult children in mind, our research on the *Messaging Kettle* aims at supporting communication over a distance by augmenting the functionalities of a traditional kettle with messaging and networking capabilities. The communication is asynchronous in order to be tolerant to time zone differences of families living in different parts of the world, but should instead unroll over a longer period of time, while yet preserving some of the features of the original tradition, i.e. gathering around tea and sharing family matters.

The Messaging Kettle is different from previous research in several aspects.

First the object, a kettle, is one that is used in particular domestic routines. Second the communication method indicates in real-time when the routine activity is occurring and leaves a trace that it occurred. Third, compared to many of the examples given above, communication is of a slightly higher yet limited bandwidth, allowing brief asynchronous messaging that allows engagement and semantic expression.

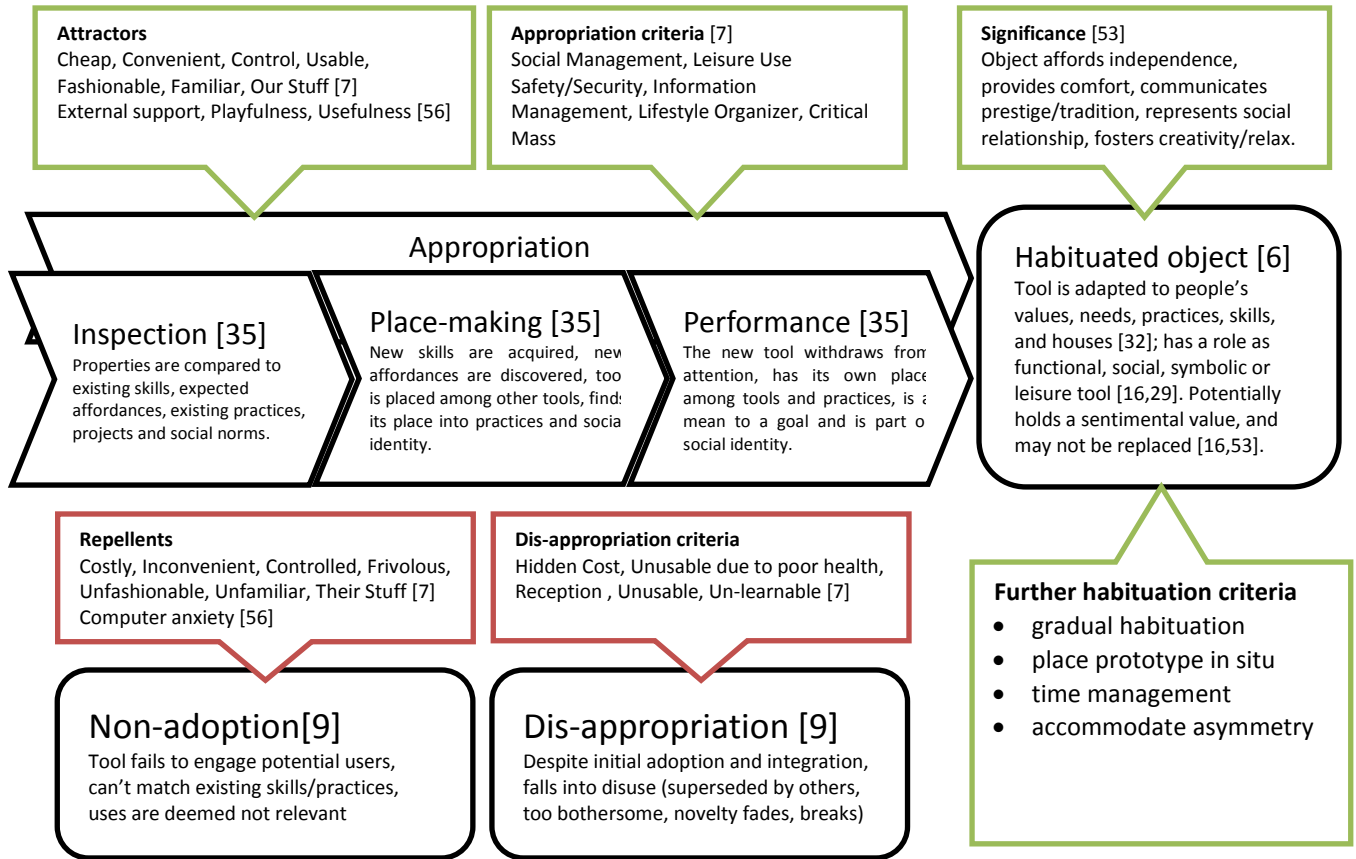


Figure 2. A framework for technology habituation; derived from [5–7,9,16,29,32,35,53,56]

The overall setup and a prototype implementation are briefly illustrated below. A traditional kettle (see Figure 1) is augmented by means of external devices that provide sensing and messaging capabilities. A *Kettle Mate* embeds a temperature sensor and is capable of inferring when the kettle has been turned on and of providing voice input/output. A *smart Tea Box* includes a dedicated tablet with touch and pen input for creating text based messages and provides the computing capabilities and Internet connectivity. Two *Messaging Kettles* are coupled, as in a presidential hotline, to display each other's state, and to forward voice and text messages. When one *Messaging Kettle* is turned on, the companion device, possibly located several time-zones away, starts to glow in order to make visible the remote activity. The user has the possibility to attach a voice or text message to the activity, hence sending a greeting to the distant person.

By combining pragmatic elements, hedonistic motives and emotional value, the Messaging Kettle represents a useful case study to shed light on technology habituation and on how to support and encourage intimate communication by

means of *smart* familiar objects. In particular, our research is aimed at showing (i) that focusing on engagement (rather than on monitoring) older users can be encouraged to embrace smart objects, and stay connected with their extended family, that (ii) supporting the specific ritual of making tea can shape the conversation in a peculiar way (different e.g. from fridge notes, short text messages, or other technologies), and that (iii) externally augmenting an existing habituated object can introduce new functionalities to enhance an existing practice without compromising the affective value of existing objects.

A long term evaluation is currently being carried on, and results gathered so far are presented further below. The evaluation is articulated in several phases. After building the initial prototype, with the goal of testing and refining the concept, we demonstrated it to several potential users.

We hosted two “morning teas” during which the functionalities, intended use, and design alternatives were discussed.

The first morning tea was held with 5 people in their 50s-60s all of whom had an older parent in their 80s. The second one was held with 6 people in their late 70s accompanied by two adult children in their 40s and 50s.

The discussion during morning teas focused, for the first one, on the challenges and experiences of staying connected with their older parents or adult children. The second morning tea focused on experiences of difficulties with technology and how this limits the opportunities for communication with their adult children.

The morning teas are methodologically grounded in Future Technology Workshops [54], and aim at uncovering the gap and possible interactions between current and envisioned technologies, leveraging the domain expertise of participants, and understand how future activities will be reshaped by technology.

Following the morning teas, two in-home demonstrations were performed with an older relative (mid 80s) of one of the research team and a friend of hers (in her late 80s). Morning teas and in-home demonstrations have been documented in [5].

After a further phase of development and several improvements, a more stable prototype is now being deployed. One installation is currently running between the homes of one of the research team (in Australia) and one older relative (in Europe). Four more prototypes will be gradually deployed in the next several months, with modalities that will be decided and adjusted based on the current progress. The prototypes are being rolled out slowly in order to: (i) gradually learn about the details of habituation; (ii) refine them based upon feedback; and (iii) to minimize participant inconvenience and management issues associated with deploying a research prototype in real homes.

The need of longitudinal studies, particularly when observing technologies that fit into the daily activities and domestic routines, has been repeatedly advocated (e.g. [2]).

The approach described above aims at uncovering issues of longer term habituation involving the concrete prototype and its use experience in one particular place and social relationship at a time.

Our goal is to elicit reflection and facilitate the projection of possible uses and misuses by personally adopting the new technology and presenting it in its situated use, in a serendipitous, rather than artificial, context. As argued by Sacks [46], novel technologies are introduced into existing practices (“made at home in the world”), and it is from such process that real uses emerge and design insights can be figured out.

For this to happen, long term use and continuous access to the technology is crucial to move past superficial insights about novelty and usability [22], in order to uncover the affective and symbolic dimension of the augmented

habituated object. The researchers keep track of such insights by means of a diary, snippets from which are reported below where appropriate. For clarity, quotes from the morning teas will be annotated as [MT1] and [MT2] respectively, quotes gathered during the in home demos will be indicated by [H] while snippets from the research diary will be indicated by [D].

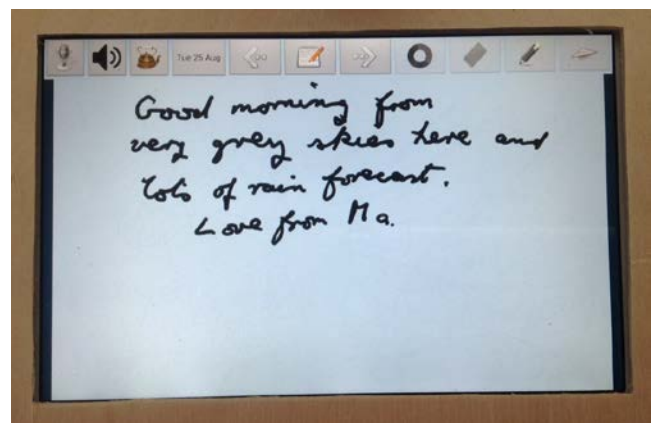
## A FRAMEWORK FOR TECHNOLOGY HABITUATION

To better understand and structure the analysis of technology habituation phenomena, we propose the framework detailed in Figure 2. It combines the related literature presented above to our own findings (also presented in [5,48]. The framework details the steps of habituation (horizontal axis) and relative determinant factors (vertical axis) and serves as a guide to structure the exploration and understanding of the process that leads to technology habituation.

Related research has been integrated in the framework when the proposed models addressed specifically the appropriation or habituation phenomena ([5-7,9,32,35,53]) or when they discussed variables or determinants that are consistent with related work on appropriation ([16,29,56]).

Other models, most notably the TAMs ([12,55]) focusing on a utilitarian perspective and workplace domain, seem less capable of capturing the social, emotional and symbolic value of habituated objects and the process that leads to habituation.

In this section we structure our findings from the ongoing evaluation of the Messaging Kettle. Our aim is to show that many observations (namely those ones that relate to the affective and symbolic dimensions, cannot be easily understood solely in terms of technology acceptance or appropriation, and rather require a more comprehensive model.



**Figure 3** One of the first sketches received by the researcher was a note on the weather, initially only black colour was used.

## Steps of Habituation

### Inspection

Inspection involves getting an overall impression of the device and deciding whether or not one will try it out. This

might be in a shop or in a friends house. In our case inspection happened at morning teas and also when the kettle was taken and demonstrated in the home of two octogenarians. During inspection the properties of the new tool/object are explored and compared to existing skills, expected affordances, existing practices and social norms [35]. The alternative modalities (voice and scribbles) and the visual feedback offered by the messaging kettle were seen as complementing each other. Participants in morning teas described problems with poor sight or hearing and felt the complementary modalities of the glowing lights, scribble pad and voice message would be helpful. Other everyday technologies, such as phone calls were deemed somehow less reliable: [MT1] *“my mother hates her mobile because she has an hearing aid ... and typing on the keypad... it's all too small for her”*, which results in frustrating attempts to communicate or have news [MT1] *“when she takes off her hearing aid, she forgets to put it on again, she can't hear the phone and you can't get any answer”*, or also, [MT1] *“there are times when mum forgets to hang-up the normal phone and the mobile is not charged and I cannot get through”*.

With the kettle deployed in the homes of researcher and mother, several friends have seen the kettle in use and this leads them to make projections on how it would work in their relationships. Seeing a prototype situated in a home and seeing how it is used, is very evocative for others and enables them to project all sorts of scenarios if it were deployed in their own relationships. Projections ranged from positive to negative. One single mother really wanted one to keep in touch with her own mother who lives in another city in the same country and they have asked to participate in the trial. Others had relationships in which they would find it irritating and onerous to deal with the messages with certain family members. One felt that some people in relationships with power imbalances would insist on it as a surveillance device for their partners. Quickly the question is raised of how many family members should be able to connect and what if one person wants the connection but the other doesn't.

#### *The emergence of adoption and Place Making*

At some point a decision is framed in which a person decides whether or not to try out a new technology. It may be an independent decision, one made at the behest of or inspired by friends and relatives etc. The framing and eventual decision are subject to many contextual factors, including whether one wants to engage or not with another person or persons through a particular technology platform

Offering the messaging kettle was a delicate affair, not wanting to foist it on a relative and offering as much to take it away so it wouldn't clutter the space as to leave it there. It was important to us that participation was voluntary. It was accepted tentatively. [H] *“Well I suppose we better try it out hadn't we.”* It is the sort of comment that is very hard to interpret even if you know the family. Would or wouldn't

she like it? Was or wasn't she willing? It wasn't clear. She seemed willing but there were probably some reservations. We could only wait to see if it got used. Inspection doesn't necessarily result in clear decisions about adoption. It is an emergent affair in many cases and not something that can necessarily be resolved in design workshops or demonstrations.

#### *Place-Making*

Place-making involves acquiring new skills, discovering new affordances and making a place in an ecology of devices and practices [35].

The In-home demonstrations revealed issues regarding the availability of space and power sockets in the kitchen, and how the new device could be made space for [5]. One participant proposed a different form factor for the Tea Box, that could be hang on the wall, to take less space.

The first skill to develop during the long term trial was to make sure it connected between Europe and Australia. [D] *“First we needed to work out if it is working. At first I got no messages from Mum which provoked all sorts of scenarios in my mind. Did she feel obliged? Is it somewhat of a tyranny? Has she just switched it off as she can't be bothered with it; I didn't want to hassle her so waited a few days before phoning. Then we worked out on the phone that the connection at my [the researcher's] end wasn't working.”*

She had been sending messages and getting no response. Although configuration has been made minimal, the initial setup needed working out and this is almost always the case. Both parties learned what signs of life in the messaging kettles meant that they were connected. Both parties also learned how to reboot their messaging kettles when they didn't seem to work.

Once connected, learning the features was quite gradual evolving over two weeks with each once or twice daily message (see Figure 3) [D] *“My Mum is only using black pen at the moment. Not sure if it is because she likes the contrast for her vision, or if she hasn't figured out the colours.... Today she is writing in colour. ... Yesterday she went to her Macular Disease society meeting and today she has drawn her first drawing, a seeing-eye dog... Surprise, today my sister showed up in a message on the teabox – she is visiting my Mum. She has tried out the audio button and managed to leave a message. I still haven't had one from my Mum though. ...Now we have figured out how to both write on the same page”*.

#### *Performance*

Once performance is enabled the new tool withdraws from attention and has its own place among tools and practices. Once habituated the tool is adapted to people values and needs and has a role as a functional, symbolic or leisure tool [35].



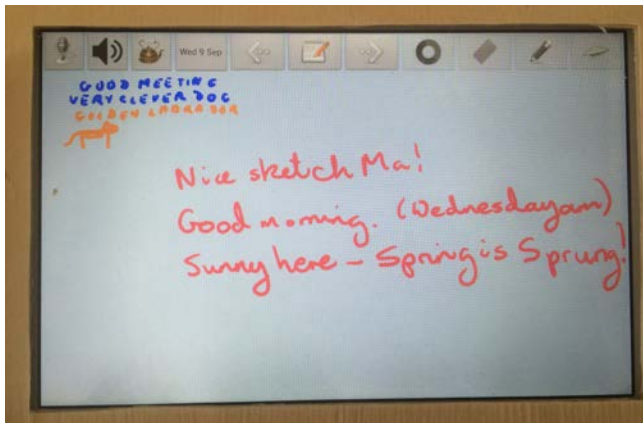
Place-making, performance and habituation are somewhat overlapping phases. Although place making has begun and some performance has been enabled with the tool being used on a daily basis, there are still aspects of performance being worked out such as sound. The researcher is reluctant to push the sound feature too quickly, as it seems to be the least reliable aspect of the prototype. It seems better to simply enjoy the tea-box messaging and lava lamp glow of the kettle-mate when the remote kettle is boiling. The sound can be worked out later... it might need fixing. It seems important not to rush and focus on the technology when the tea-box messaging and kettle glow is an enjoyable way to communicate.

While performance is being worked out, some aspects of habituation are being experienced.

#### *Habituation*

When a tool is habituated it fits people's values, needs, practices, skills, and environments [6,32]; the tool has a particular role as a functional, symbolic or leisure object [29]; potentially it will be given a sentimental value, and can be considered hardly replaceable [53]. Although performance is still being enabled some aspects of habituation are occurring.

The kettle-mate has begun to represent the extended presence of the older person.



**Figure 4** A sketch sent to the researcher, shows a drawing of seeing eye dog and use of many colours.

[D] *"I think the aesthetic is lovely - much more lava lamp than smoke alarm. I find it both exciting and calming. I love it when my son says "Mum, grandmas kettle is boiling and I look across and see the lavalamp like glow."*

Presence is felt though shared experience over time.

[D] *"I used to calculate if my Mum was up or not. Now I often see the kettle glow between 7:30pm and 9pm at night, when she is having her morning tea. It's the only time I see it, in part because of my own routines. Now I think of this evening time as the time that she is around and we are both available to each other. But I am not sure if she sees the glowing often in a habitual way yet"*

We acknowledge that the reporting of experience is researcher focused due to the greater availability of the researcher's diary.

[D] *"As for what my Mum thinks, I ask her each time I call (about once a week). I haven't asked her to diarise her feelings, as it seems using the new technology is enough to ask. Each time it breaks I ask if she has had enough. But she is persistent, saying I think we should keep going to make sure it works. Then she tells me of the messages she wanted to write except that she's has a problem with the tablet after going away for a week when it lost all its charge. She actually seems to really enjoy it. I am equally aware that at some point she could find it burdensome though, only because you never know. Those are the range of experienced that I can imagine, knowing her well"*

#### **Determinant Factors**

##### *Attractors*

The design builds upon familiar and relatively ubiquitous practices, such as leaving a note in the kitchen and recording a voice message. It was expected that the leisure use act positively towards place-making. Attractors are principles that can facilitate or encourage the adoption of a technology, as described in [7,9,56].

Participants from the 50 and 60 y.o. workshop were generally enthusiastic about the messaging kettle, as they intended it as specifically designed to keep in touch with their older parents [5].

All participants immediately pointed out the capability of the messaging kettle to enable a calm form of virtual presence that allows each user to be aware of some activities that are going on at the other end.[MT1] *"[...] it would be great if you want to keep an eye on a parent [...]".* *"so... it actually has two purposes: communication and seeing that they actually are still active, that there's nothing wrong"*. While the risk of a domestic accident is always present, not only in the elderly people's life, knowing that daily routines are going on as usual is reassuring. One participant mentioned being in contact with a neighbor: [MT1] *"we have a neighbor, if the blind doesn't go up in the morning they go and check on her"*.

##### *Repellents*

Several critical aspects were considered in the design. The cost of the service represents a potential repellent, as is the availability of necessary infrastructure (e.g. mobile network) as well as the perceived control over the system, including privacy issues. Ease of use and learnability have been considered in terms of heuristics, such as visibility of controls and system status, error prevention, minimalistic design. Repellents play against adoption, and can result in the technology being refused [7,9,56].

Some older participants expressed a preference for more traditional forms of voice and face to face communication, saying [MT2] *"The new way is to text etc. but I like to talk"*

on the phone”. “Messages can be received the wrong way if you can’t see or hear the person”.

Some participant reported that their relatives were very active in various respects, but not particularly into technology: [MT1] “I first tried to get her to have an iPad, originally she got a laptop, she doesn’t have internet access, she tried with email and photos, and things like that, but it was too much for her [...] after a couple of months she gave her laptop away”.

On the other hand, the simplicity of the interaction with the messaging kettle was regarded as a clear advantage: [MT1] “just a button to press to record something, and then you get it on the other end”. One participant commented that such simplicity was likely to be an attraction for an older user: [MT1] “it may be psychologically good for elderly people [as they] think they’re not very clever... they may be very impressed with their expertise if they can do that”.

Issues with potential costs [7] were observed during the deployment as well: [D] “she likes to turn off her computer and her home wifi all starts up when she turns on her computer”.

Also in this phase it becomes clear if the functionalities are well suited to the user’s skills and capabilities [7]: [D] “[she] is only using black pen at the moment. Not sure if it is because she likes the contrast for her vision, or if she hasn’t figured out the colours”.

#### Appropriation Criteria

Participants elaborated on the motivation that could influence their own or their relatives’ appropriation of the messaging kettle. With appropriation criteria we focus on aspects that could impact a regular daily use, and the technology entering the people’s routines [7,9]. The possibility of ‘keeping an eye’ on old parents has been discussed above, but pure and simple pleasure of keeping in touch on daily basis was frequently mentioned, especially for [MT1] “just those little things when you don’t need to have a big conversation”. Participants felt that just recording a short message when using the kettle would be enjoyable but not onerous.

Also, the possibility to receive a message from grandchildren was highlighted as most desirable: [MT1] “and kids... they can draw something for grandparents... and its fantastic... to get something from them”.

Being parents themselves, and having sometimes adult children living and working abroad: [MT1] “[useful to] other than old people, my youngest daughter lives in -- ... so she could get up and leave a message Hi mum... Hello”, some of the participants highlighted the possibility to receive such tiny messages: [MT1] “they could send a quick message or something and vice versa [...] rather than rely on phone calls”.

This is seen as a way of preserving a peace of mind, [MT1] “because when you are a long way away from your family

you know they’re safe, you know they’re all right, they’re well, but sometimes you just wonder if you haven’t heard from them”.

#### Dis-appropriation criteria

On the contrary, dis-appropriation may occur when the usefulness or convenience of a technology is no longer valued or relevant [7,9]. Participants almost invariably stressed that the messaging kettle was: [MT1] “useful - as long as it was simple - as long as there was no setup”.

Yet, participants observed that the cost, and availability of infrastructure, could be an issue, as it was in the case of landline and mobile telephone: [MT1] “because where she is that still costs her money, because she doesn’t have one of those unlimited plans”, also: “with the old parents... they don’t have internet access... mum, she’s got internet access... but they had to change their device to be able to have that connectivity...”.

The aspects of time management were often mentioned as critical and potentially a deal breaker. Having to connect people across time zones the Messaging Kettle could become an annoyance if it would call for attention at night [5]. Older participants often expressed a desire to communicate more, but also a difficulty to find the proper time to connect: [MT2] “They’re always busy, I’d love to speak that one now but it’s the wrong time.”.

#### Significance

The Messaging Kettle builds upon the significance of the family tradition of tea making to frame and contextualize the interaction. The corresponding messaging capabilities are designed to provide a one-to-one link with a loved person, hence amplifying the intimate and personal dimension.

After some weeks of constant use The Messaging Kettle became part a daily routine [7]: [D] “the kettle (and kitchen) is now linked to my Mum. When I am in the kitchen I think of her. I think of her much more because of the kettle”; the choice of implementing it as one-to-one messaging system resulted in a certain unobtrusiveness, and the device is starting to symbolize the relationship [53] that exists between its two users: [D] “not feel like I have to open a computer and deal with emails from everywhere else”.

It is also representative of the other person’s routines: [D] “I can envisage where she is. If it is a text it could be from anywhere. But it is her handwriting in her kitchen”. The aspect of using handwritten notes was particularly relevant: [D] “Usually most of what I see these days is typed”, perhaps because of its association with tradition and intimate communication: [D] “I usually only see [...] handwriting on birthday cards these days”.

Eventually, the scribbling functionality started to be used more creatively [53] to send humorous messages: [D] “My mum sent a pinch and a punch for the first day of the month” and sketches “Today my Mum has drawn a dog! A

*seeing eye golden labrador that was at her Macular Disease meeting”* (see Figure 4)

## **DISCUSSION AND CONCLUSION**

The analytical model presented in Figure 2 deconstructs appropriation into phases, from inspection to performance. When users encounter a new appliance or device, they first consider whether they would want to use it and whether it would fit for them. In terms of details of appropriation theory this would be described as first inspecting its properties to match them against existing practices and skills, and frame them into existing activities, practices and social norms. We can reasonably expect the Messaging Kettle to undergo a similar inspection. It can be described based on its properties as a messaging device, a note-taking pad, a kitchen related sensor, etc. Attractors and repellents are considered in this phase, and can lead to intended adoption, and eventually place-making, or to non-adoption. As discussed above, in the example of the Messaging Kettle, cost, usability and familiarity can be expected to play a critical part. (For the trial of the prototype, kettles with 3G will be provided for free and so cost will not be evaluated).

During a subsequent phase of place-making, people acquire new skills and discover new affordances, i.e. invent new uses, for the tool. In the case of the Messaging Kettle, people may learn how to operate its controls, recover from errors, etc. As the Kettle Mate is designed to sit on the kitchen bench close to the kettle, a place for it must be organized, with access to a power plug, in a position accessible and convenient to clean. Addressing such practical concerns is critical for the new tool appliance to disappear from attention, and become a taken for granted accessory of the kitchen activities. In this phase, and continuing throughout the lifecycle of the tool, appropriation and dis-appropriation criteria play a relevant role. Leisure use, safety and privacy, hidden costs and usability issues may determine the success or failure of the place-making activity.

The subsequent performance, in our intention as designers, can see the Messaging Kettle become part of the daily routine of tea making, and checking messages or leaving a message for the loved one become a part of the ritual of tea making, i.e. just like the kettle is the tool for making tea, the messaging kettle becomes the tool for making tea and sharing it with a distant person. A crucial role to facilitate the appropriation process relies on the practical and affective value of the already existing kettle, and the surrounding practices and rituals.

From its status as a habituated object, we expect the kettle to facilitate the appropriation of the new functionalities of the messaging kettle, and the corresponding place making for the Kettle Mate and tea box

The early experience of using the kettle confirms that all of these stages occur from inspection to place-making through

to performance and habituation. It highlights the extent to which adoption and habituation can be gradual and evolving, its success dependent upon many contextual factors, in particular the relationships within which the technology is embedded, but also the habits, habitus and habitats as articulated [32] by Nansen et al.

The model also indicates the role of gradually habituating prototype technologies as a design method that places a prototype in situ (in real houses and real relationships) and thereby allows people who encounter the prototype to project how it would play out in their own and others relationships.

This method relates of course to many related methods of designing “in the wild” [41], RAID “reflective agile iterative design” [22] and technology probe methods [24]. But usually these methods elicit the experience only of the participants. Habituation, which acknowledges relationships and place-making, also acknowledges all of the people who encounter the prototype and then consider how it might relate to their own lives. This has been a strong element of the experience of prototyping in the Messaging Kettle project. Gradual habituation may well be an important approach to designing technologies for older people, who do not want to spend their lives configuring technologies, and may like to see how they are used by others before adopting them. So far this projecting phenomena has largely been witnessed on the side of the adult child (researcher), although there have been two known demonstrations by the older adult, which have led to projections about use by those seeing the prototype. In this paper we have discussed a conceptual model of the process of appropriation that we apply to discuss the design and evaluation of the Messaging Kettle. Our work is grounded on related research on place-making and habituated objects, and highlights the main phases of appropriation: inspection, place-making and performance, in relation to the main variables that facilitate or obstruct the process of appropriation.

We further link the models of appropriation available in the literature to the concepts of habituated objects and reciprocal habituation, and the main variable underpinning the significance of habituated objects for elderly people.

The Messaging Kettle represents an example of design for appropriation that builds on affective value and existing function of an already habituated object. By choosing to augment the functionalities of the existing kettle by means of a Kettle Mate, we aimed at exploiting the existing tool (and the related skills, practices, affordances) as a host for new functionalities, leveraging the affective attachment and the existing place-making, and framing (while not constraining) the use to the existing rituals.

## REFERENCES

1. Hanif Baharin and Salman Khalidi. 2015. Fyro: A Symbolic-Based Phatic Technology. *Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction*, ACM, 304–308. <http://doi.org/10.1145/2838739.2838795>
2. Liam J Bannon. 2011. Reimagining HCI: toward a more human-centered perspective. *interactions* 18, 4: 50–57. <http://doi.org/http://doi.acm.org/10.1145/1978822.1978833>
3. Matthias Baumgarten, Daniel Guldenring, Michael Poland, Chris Nugent, and Josef Hallberg. 2010. Embedding Self-Awareness into Objects of Daily Life -- The Smart Kettle. *2010 Sixth International Conference on Intelligent Environments*, IEEE, 34–39. <http://doi.org/10.1109/IE.2010.14>
4. Michael Beigl, Hans-W. Gellersen, and Albrecht Schmidt. 2001. Mediacups: experience with design and use of computer-augmented everyday artefacts. *Computer Networks* 35, 4: 401–409. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1389128600001808>
5. Margot Brereton, Alessandro Soro, Kate Vaisutis, and Paul Roe. 2015. The Messaging Kettle: Prototyping Connection over a Distance Between Adult Children and Older Parents. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, ACM, 713–716. <http://doi.org/10.1145/2702123.2702462>
6. Margot Brereton. 2013. Habituated Objects: Everyday Tangibles That Foster the Independent Living of an Elderly Woman. *interactions* 20, 4: 20–24. <http://doi.org/10.1145/2486227.2486233>
7. J Carroll, S Howard, F Vetere, J Peck, and J Murphy. 2002. Just what do the youth of today want? Technology appropriation by young people. *System Sciences, 2002. HICSS. Proceedings of the 35th Annual Hawaii International Conference on*, 1777–1785. <http://doi.org/10.1109/HICSS.2002.994089>
8. Jennie Carroll, Steve Howard, Frank Vetere, Jane Peck, and John Murphy. 2001. Identity, Power And Fragmentation in Cyberspace: Technology Appropriation by Young People. *ACIS 2001 Proceedings*. Retrieved July 15, 2014 from <http://aisel.aisnet.org/acis2001/6>
9. Jennie Carroll. 2004. Completing Design in Use : Closing the Appropriation Cycle. *European Conference of Information Systems, January 2004*, 11. Retrieved from <http://aisel.aisnet.org/ecis2004> Recommended
10. Hyemin Chung, Chia-Hsun Jackie Lee, and Ted Selker. 2006. Lover's Cups: Drinking Interfaces As New Communication Channels. *CHI '06 Extended Abstracts on Human Factors in Computing Systems*, ACM, 375–380. <http://doi.org/10.1145/1125451.1125532>
11. Mohsen Darianian and Martin Peter Michael. 2008. Smart Home Mobile RFID-Based Internet-of-Things Systems and Services. *2008 International Conference on Advanced Computer Theory and Engineering*, IEEE, 116–120. <http://doi.org/10.1109/ICACTE.2008.180>
12. Fred D Davis. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly* 13, 3: 319–340. <http://doi.org/10.2307/249008>
13. Alan Dix. 2007. Designing for Appropriation. *Proceedings of the 21st British HCI Group Annual Conference on People and Computers: HCI...But Not As We Know It - Volume 2*, British Computer Society, 27–30. Retrieved from <http://dl.acm.org/citation.cfm?id=1531407.1531415>
14. Jeannette Durick, Toni Robertson, Margot Brereton, Frank Vetere, and Bjorn Nansen. 2013. Dispelling ageing myths in technology design. *Proceedings of the 25th Australian Computer-Human Interaction Conference on Augmentation, Application, Innovation, Collaboration - OzCHI '13*, 467–476. <http://doi.org/10.1145/2541016.2541040>
15. Pelle Ehn. 2008. Participation in design things. *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008*, Indiana University, 92–101. Retrieved March 10, 2014 from <http://dl.acm.org/citation.cfm?id=1795234.1795248>
16. Jodi Forlizzi. 2008. The Product Ecology: Understanding Social Product Use and Supporting Design Culture. *International Journal of Design; Vol 2, No 1 (2008)*. Retrieved from <http://ijdesign.org/ojs/index.php/IJDesign/article/view/220>
17. Y Fouquet and C Franco. 2010. Telemonitoring of the elderly at home: Real-time pervasive follow-up of daily routine, automatic detection of outliers and drifts. *Smart Home* .... Retrieved March 7, 2014 from [http://cdn.intechopen.com/pdfs/9631/InTech-Telemonitoring\\_of\\_the\\_elderly\\_at\\_home\\_real\\_time\\_pervasive\\_follow\\_up\\_of\\_daily\\_routine\\_automatic\\_detection\\_of\\_outliers\\_and\\_drifts.pdf](http://cdn.intechopen.com/pdfs/9631/InTech-Telemonitoring_of_the_elderly_at_home_real_time_pervasive_follow_up_of_daily_routine_automatic_detection_of_outliers_and_drifts.pdf)
18. Sylvia Gaul and Martina Ziefle. 2009. Smart Home Technologies: Insights into Generation-Specific Acceptance Motives. In *HCI and Usability for e-Inclusion SE - 22*, Andreas Holzinger and Klaus Miesenberger (eds.). Springer Berlin Heidelberg, 312–332. [http://doi.org/10.1007/978-3-642-10308-7\\_22](http://doi.org/10.1007/978-3-642-10308-7_22)
19. William Gaver, John Bowers, Andy Boucher, Andy Law, Sarah Pennington, and Nicholas Villar. 2006. The history tablecloth: illuminating domestic

- activity. *Proceedings of the 6th ACM conference on Designing Interactive systems - DIS '06*, ACM Press, 199. <http://doi.org/10.1145/1142405.1142437>
20. Daniel López Gómez. 2014. Little arrangements that matter. Rethinking autonomy-enabling innovations for later life. *Technological Forecasting and Social Change*, 0: -. <http://doi.org/http://dx.doi.org/10.1016/j.techfore.2014.02.015>
  21. Hans van der Heijden. 2004. User Acceptance of Hedonic Information Systems. *MIS Quarterly* 28, 4: 695–704. <http://doi.org/10.2307/25148660>
  22. Clint Heyer and Margot Brereton. 2010. Design from the Everyday: Continuously Evolving, Embedded Exploratory Prototypes. *Proceedings of the 8th ACM Conference on Designing Interactive Systems*, ACM, 282–291. <http://doi.org/10.1145/1858171.1858222>
  23. Se-Joon Hong and Kar Yan Tam. 2006. Understanding the Adoption of Multipurpose Information Appliances: The Case of Mobile Data Services. *Information Systems Research* 17, 2: 162–179. <http://doi.org/10.1287/isre.1060.0088>
  24. Hilary Hutchinson, Wendy Mackay, Bo Westerlund, et al. 2003. Technology Probes: Inspiring Design for and with Families. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 17–24. <http://doi.org/10.1145/642611.642616>
  25. Joseph “Jofish” Kaye, Mariah K Levitt, Jeffrey Nevins, Jessica Golden, and Vanessa Schmidt. 2005. Communicating Intimacy One Bit at a Time. *CHI '05 Extended Abstracts on Human Factors in Computing Systems*, ACM, 1529–1532. <http://doi.org/10.1145/1056808.1056958>
  26. Joseph “Jofish” Kaye. 2006. I just clicked to say I love you. *CHI '06 extended abstracts on Human factors in computing systems - CHI EA '06*, ACM Press, 363. <http://doi.org/10.1145/1125451.1125530>
  27. Thomas Kleinberger, Martin Becker, Eric Ras, Andreas Holzinger, and Paul Müller. 2007. Ambient Intelligence in Assisted Living: Enable Elderly People to Handle Future Interfaces. In *Universal Access in Human-Computer Interaction. Ambient Interaction SE - 11*, Constantine Stephanidis (ed.). Springer Berlin Heidelberg, 103–112. [http://doi.org/10.1007/978-3-540-73281-5\\_11](http://doi.org/10.1007/978-3-540-73281-5_11)
  28. Matthias Kranz, Albrecht Schmidt, Alexis Maldonado, et al. 2007. Context-aware kitchen utilities. *Proceedings of the 1st international conference on Tangible and embedded interaction - TEI '07*, ACM Press, 213. <http://doi.org/10.1145/1226969.1227013>
  29. Chiara Leonardi, Claudio Mennecozzi, Elena Not, et al. 2009. Knocking on Elders’ Door: Investigating the Functional and Emotional Geography of Their Domestic Space. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 1703–1712. <http://doi.org/10.1145/1518701.1518963>
  30. Siân E Lindley. 2012. Shades of lightweight: supporting cross-generational communication through home messaging. *Universal Access in the Information Society* 11, 1: 31–43.
  31. Florian Floyd Mueller, Frank Vetere, Martin R Gibbs, Jesper Kjeldskov, Sonja Pedell, and Steve Howard. 2005. Hug over a distance. *CHI 05 extended abstracts on Human factors in computing systems CHI 05*: 1673. <http://doi.org/10.1145/1056808.1056994>
  32. Bjorn Nansen, Frank Vetere, Toni Robertson, John Downs, Margot Brereton, and Jeannette Durick. 2014. Reciprocal Habituation: A Study of Older People and the Kinect. *ACM Trans. Comput.-Hum. Interact.* 21, 3: 18:1–18:20. <http://doi.org/10.1145/2617573>
  33. BB Neves. 2012. Too old for technology? How the elderly of Lisbon use and perceive ICT. *The Journal of Community Informatics*. Retrieved March 14, 2014 from <http://works.bepress.com/bbneves/1/>
  34. James Pierce, Chloe Fan, Derek Lomas, Gabriela Marcu, and Eric Paulos. 2010. Some consideration on the (in)effectiveness of residential energy feedback systems. *Proceedings of the 8th ACM Conference on Designing Interactive Systems - DIS '10*, ACM Press, 244. <http://doi.org/10.1145/1858171.1858215>
  35. Kay Riemer and Robert Bruce Johnstone. 2012. Place-making: A Phenomenological Theory of Technology Appropriation. *Proc. of 33rd International Conference on Information Systems*, Association for Information Systems. Retrieved from <http://aisel.aisnet.org/icis2012/proceedings/SocialImpacts/5/>
  36. Toni Robertson, Jeannette Durick, Margot Brereton, et al. 2013. Emerging Technologies and the Contextual and Contingent Experiences of Ageing Well. In *Human-Computer Interaction – INTERACT 2013 SE - 37*, Paula Kotzé, Gary Marsden, Gitte Lindgaard, Janet Wesson and Marco Winckler (eds.). Springer Berlin Heidelberg, 582–589. [http://doi.org/10.1007/978-3-642-40477-1\\_37](http://doi.org/10.1007/978-3-642-40477-1_37)
  37. Toni Robertson. 2012. Actual bodies are ageing bodies. *Proc. of the 2nd International Body in Design Workshop*.
  38. Jennifer A. Rode. 2005. Appliances for whom? Considering place. *Personal and Ubiquitous Computing* 10, 2-3: 90–94. <http://doi.org/10.1007/s00779-005-0006-y>
  39. Yvonne Rogers, Jeni Paay, Margot Brereton, Kate L Vaisutis, Gary Marsden, and Frank Vetere. 2014. Never Too Old: Engaging Retired People Inventing

- the Future with MaKey MaKey. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 3913–3922. <http://doi.org/10.1145/2556288.2557184>
40. Yvonne Rogers. 2006. Moving on from Weiser's Vision of Calm Computing: Engaging UbiComp Experiences. *UbiComp 2006: Ubiquitous Computing*, Springer Berlin Heidelberg, 404–421. <http://doi.org/10.1007/11853565>
  41. Yvonne Rogers. 2011. Interaction Design Gone Wild: Striving for Wild Theory. *interactions* 18, 4: 58–62. <http://doi.org/10.1145/1978822.1978834>
  42. Matthias Rothensee and Sarah Spiekermann. 2008. Between Extreme Rejection and Cautious Acceptance: Consumers' Reactions to RFID-Based IS in Retail. *Social Science Computer Review* 26, 1: 75–86. <http://doi.org/10.1177/0894439307307687>
  43. Matthias Rothensee. 2008. User Acceptance of the Intelligent Fridge: Empirical Results from a Simulation. In *The Internet of Things SE - 8*, Christian Floerkemeier, Marc Langheinrich, Elgar Fleisch, Friedemann Mattern and SanjayE. Sarma (eds.). Springer Berlin Heidelberg, 123–139. [http://doi.org/10.1007/978-3-540-78731-0\\_8](http://doi.org/10.1007/978-3-540-78731-0_8)
  44. Jim Rowan and Elizabeth D Mynatt. 2005. Digital Family Portrait Field Trial: Support for Aging in Place. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 521–530. <http://doi.org/10.1145/1054972.1055044>
  45. Richard M. Ryan and Edward L. Deci. 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist* 55, 1: 68.
  46. Harvey Sacks. 1992. A single instance of a phone-call opening. In *Lectures on conversation Volume II*. 542–553.
  47. Antti Salovaara and Sakari Tamminen. 2009. Acceptance or Appropriation? A Design-Oriented Critique of Technology Acceptance Models. In *Future Interaction Design II SE - 8*, Hannakaisa Isomäki and Pertti Saariluoma (eds.). Springer London, 157–173. [http://doi.org/10.1007/978-1-84800-385-9\\_8](http://doi.org/10.1007/978-1-84800-385-9_8)
  48. Alessandro Soro, Margot Brereton, and Paul Roe. 2015. The Messaging Kettle: It's IoTea Time. *Proceedings of the 5th Decennial Aarhus Conference*, 57–59.
  49. L. Suchman and B Jordan. 1988. Computerization and women's knowledge. In *Women, work and computerization: Forming new alliances*, K. Tijdens, M. Jennings, I. Wagner and M. Weggelaar (eds.). 153–160.
  50. Lucy Suchman. 1987. *Plans and Situated Actions - The Problem of Human-Machine Communication*. Cambridge University Press.
  51. Alex S. Taylor, Richard Harper, Laurel Swan, Shahram Izadi, Abigail Sellen, and Mark Perry. 2006. Homes that make us smart. *Personal and Ubiquitous Computing* 11, 5: 383–393. <http://doi.org/10.1007/s00779-006-0076-5>
  52. Kimberly Tee, A J Bernheim Brush, and Kori M Inkpen. 2009. Exploring communication and sharing between extended families. *International Journal of Human-Computer Studies* 67, 2: 128–138. <http://doi.org/http://dx.doi.org/10.1016/j.ijhcs.2008.09.007>
  53. Kate Vaisutis, Margot Brereton, Toni Robertson, et al. 2014. Invisible Connections: Investigating Older People's Emotions and Social Relations Around Objects. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 1937–1940. <http://doi.org/10.1145/2556288.2557314>
  54. GiasemiN. Vavoula and Mike Sharples. 2007. Future technology workshop: A collaborative method for the design of new learning technologies and activities. *International Journal of Computer-Supported Collaborative Learning* 2, 4: 393–419. <http://doi.org/10.1007/s11412-007-9026-0>
  55. Viswanath Venkatesh, Michael G Morris, Gordon B Davis, and Fred D Davis. 2003. User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly* 27, 3: 425–478. <http://doi.org/10.2307/30036540>
  56. Viswanath Venkatesh. 2000. Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model. *Information Systems Research* 11, 4: 342–365. <http://doi.org/10.1287/isre.11.4.342.11872>
  57. Ron Wakkary and Leah Maestri. 2007. The Resourcefulness of Everyday Design. *Proceedings of the 6th ACM SIGCHI Conference on Creativity & Cognition*, ACM, 163–172. <http://doi.org/10.1145/1254960.1254984>
  58. Ron Wakkary and Leah Maestri. 2008. Aspects of Everyday Design: Resourcefulness, Adaptation, and Emergence. *International Journal of Human-Computer Interaction* 24, 5: 478–491. <http://doi.org/10.1080/10447310802142276>