

# DOMESTIC TECHNOLOGIES OF THE FUTURE

## *Approaching through visual scenarios*

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**Abstract:** An overall goal of the *Morphome* project is to create design principles for domestic applications of proactive computing in a way that could support existing values of domestic life. During the first year of the project we studied meanings and understandings associated with domestic technologies and their roles in everyday life by applying the probes approach. The focus was on the material environment of the home as well as the social: important things and practices affecting cosiness, domestication of media technologies, and use routines of different kind of domestic devices. One purpose of the project is also to explore how emphatic design methods can be applied to produce understanding of people's emotional relation to their domestic environment and dynamic use contexts of domestic media and technologies. The starting point was that proactive solutions applied in the homes have to meet high standards in aesthetic and social usability in order to become widely adopted and accepted by the people.

**Key words:** Domestic technology, future home, scenarios.

## 1. BACKGROUND

The overall goal of the *Morphome* project is to create design principles for domestic applications of proactive computing in a way that takes sensitivity of the home as a use environment into account. The idea is to increase the understanding of people's emotional relation to their domestic environment and the dynamic use contexts of domestic media and technologies. During the first year of the project in 2003 a probes approach was applied in order to explore meanings, practices and values associated with domestic technologies and their roles in everyday life (see Soronen & Sotamaa 2004).

The goal was to produce a diversified notion of current domestic life in the media-rich Finnish homes before ideating product concepts that would suit the principles of proactive computing.

During the second year of the project in 2004 we have come closer to the field of proactive domestic technology. The work done in our project can be called design-oriented research in which production of new knowledge is the main contribution instead of artefacts. However, the knowledge acquired would not have been attainable if design (in the form of experience prototypes and scenarios) had not been a central part of the research process. (cf. Fallman 2003.) When it comes to research methods, our starting point can be summarised with the notion by Botero Cabrera & al. (2003) when they argue that in order for people to be co-designers discussing directions of future technology, they must be given tools and materials inspiring them to reflect on personal possibilities and alternative practices of new technology. Furthermore, we were not interested in approaching proactive computing as a tool for specific domestic tasks to be conducted as efficiently as possible but rather to consider what kind of meanings and feelings the participants would relate to the chosen application concepts from the viewpoint of their personal or familial life. An underlying idea of our work supports Hallnäs and Redström's (2001) suggestion that with the increasing ubiquity of computational things becoming a natural part of people's everyday lives we should shift focus from design for efficient use to design for meaningful presence.

This paper describes work in progress. The focus is on the goals and the implementation of the interview study in which visual scenarios were used to illustrate concepts of proactive computing. The first year's probes material functioned as a starting point and inspiration for devising scenarios. Conducting the interviews in the homes of the participants was a significant choice because the idea was that people could assess the scenarios from their own domestic context. Moreover, we wanted at least some concepts to be simple applications that could be used in existing home environments without much work of installing large-scale systems. Hence, the idea was to be sensitive to the particular homes and their practices and to give tools for the participants to think of their homes as environments in which novel proactive solutions could be potentially used together with existing ones.

Because the term 'proactive computing' is intangible and unfamiliar to most people, concretising it is a challenging task. And because we as researchers had no personal experience of testing, or living with embedded systems called 'proactive', our concept ideation was based more on what we know about contemporary domesticity in Finnish homes than what we know about proactive technology available to consumers. During the interviews we aimed at gaining a fuller understanding of people's everyday lives by

focusing on their practices and activities in particular living situations instead of merely discussing our design concepts. In fact, we did not want to restrict the scenarios to represent concepts that can be categorised purely as proactive computing, since the focus was more on acceptability of novel computing technology in such an emotionally and socially sensitive use environment as the home. Hence, some of our concepts could be more accurately labelled context-aware than proactive technology. We understand context-aware technology to be a broader concept than proactive computing which is generally used to refer to technology that takes initiatives or even anticipates the needs of the user. The starting point was that proactive technologies applied in the homes have to meet high standards of aesthetic and social usability in addition to reliability in order to become widely adopted and accepted by people (see Mäyrä & Vaden 2004).

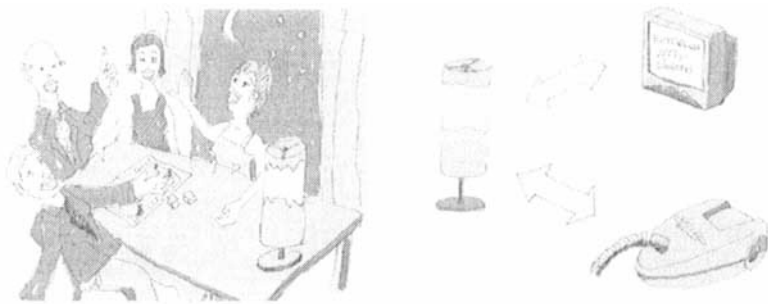
## **2. HOW THE STUDY WAS IMPLEMENTED**

After discussing the research methods for exploring acceptability of concepts of proactive computing, we decided to organise interview studies in which scenarios would form the basis for discussion. The idea was that the first study focuses on solutions that would be fairly easy to implement now or in the near future and the second one will represent proactive technology that is more futuristic or even utopian.

The designer of our team used a lot of time to come up with new concepts and questions to be studied. After several common brainstorming sessions we were able to choose seven concepts to be used in the study. The selected concepts were related to domestic routines, comfort, security and “being together” in the home. The purpose was that the scenarios would work as flexible conversation points illustrating possibilities of context-aware technology to be used in a domestic environment. The concepts ranged from a small trash-can-like object informing one when the real trash can in the kitchen is full to an application playing a fanfare when members of the household or relatives assemble in the home for a special occasion or just as a part of everyday life. We also had a more familiar “smart home scenario” in which networked components adjust the quantity of light, temperature, and ventilation and are connected to some domestic appliances, such as a coffee maker or an alarm clock. From the viewpoint of technology the concepts ranged from simple applications to larger systems more difficult to implement.

Each scenario was composed of 2-5 pictures in which different situations of use or merely a product (involving embedded computing technology) were visually depicted. During the interview the researcher explained some

alternative functionalities of the concepts while the participants glanced at the pages of the booklet in which the scenarios were put together. The booklets were used because they were easy to carry along when doing field work and because the participants could thus personally handle the visual information they were offered (cf. Keinonen 2000). The concepts were represented as drawings illustrating situations of use or functionalities of the concepts because we assumed that it would be easier for the participants to imagine use of the novel applications in their own domestic life if they were not related to any particular users. Sketchy drawings, the scenarios were more like open-ended descriptions of use situations of different applications (see Figure 1) than detailed descriptions of determined features of ready applications.



*Figure 1.* Two example pictures from the same scenario illustrating a possible situation of use and functionality of the concept.

Before the interview the participants were sent priming questions related to their domestic everyday lives and also to the use contexts of the concepts. The questions were sent to the participants beforehand in order to 'tune them in' to the themes of the scenarios since the topics of the questions were more or less related to the intended use of the application ideas. The scenarios also functioned as a basis for a dialogue between the researcher and the participants. On the one hand, the objective was to make concepts so accessible to the participants that they could piece together whether the proposed application would suit them or not. If the priming questions motivated people to think about the interview themes, the scenarios motivated them to produce personal descriptions about the potential or undesirable situations of use for the concepts in question. The priming questions concerning the scenario in Figure 1 were: "What kinds of sounds disturb you at home?" and "Have you ever needed ear plugs at home?"

Our scenarios differed from those scenarios in which designated users of the product, their objectives and activities with the product and the context

of use are written down in a narrative form (see e.g. Carroll 1999). Although the scenarios represented users of different ages and gender they remained anonymous 'flat' characters whose role was minor in the discussions between the researcher and the participants. The appearance, clothing, ethnic identity, gender and age of characters affect the participants' thinking to some extent but during the interview attention was directed away from 'particular characters' towards the participants themselves as potential users. Hence, the scenarios were not intended to be character or plot-driven stories but application-driven storyboards in which pictures combined with the verbal explanation of the interviewer formed a starting point for conversation. Some hints of the technical possibilities were presented, but no proper use cases. They were hidden on purpose. The interviewer also had predefined themes and some detailed questions that were discussed before moving on to next scenario. The aim was that the drawings, together with the interviewer's arguments, would invite the participants to create stories about appropriate and inappropriate uses for the concepts in their own domestic contexts. The purpose was also to attain information to be used for selecting our forthcoming experience prototypes in the Morphome project. The study confirmed some of our own insights but also gave us new ideas and information for prototyping.

### **3. TENTATIVE RESULTS**

Twelve households living in apartment buildings in Tampere and Helsinki were recruited for the study through an advertisement in a local newspaper and on the website of the Hypermedia Laboratory ([www.uta.fi/hyper/](http://www.uta.fi/hyper/)). In the advertisement we highlighted that we were looking for households that are interested in discussing everyday meanings of domestic technology and assessing product concepts of the future from the viewpoint of their own homes. Hence, the participants supposedly had a more positive attitude towards technology than people on average or at least they were more interested in reflecting on aspects of new technology.

The households were selected to represent different modes of living (including a single person, families with and without children, a couple with adult children living in their own homes, households with and without pets) and diversity in ownership of media technologies. The average age of the participants was 30 years, the youngest participant was 13 and the oldest 52 years old. We had 15 people in the working life, seven students, and one pupil in an upper level of comprehensive school. They all had variety of media technologies, for instance, every household had at least one computer and radio while none of them had a landline telephone. This can be related

to the prevalence of mobile phones in Finland. Among the participants we had also a family who had no television.

Next we highlight some points that will hopefully illustrate the diverse attitudes the participants had towards the concepts of proactive applications. We will not concentrate on the particular scenarios as much as on common opinions related to aspects of awareness of functionality of novel context-aware domestic technology.

### **3.1 Proactive domestic technology – the master of the house or a domestic help?**

Awareness of the functionality of automated domestic systems is closely related to the feeling of control. Most of the suspicions the participants had towards proactive technology were linked to decrease in control over automated home systems. For western people who live in an urban area, the domestic space is very often the only territory in which they can arrange the environment as they wish. In that sense it was not surprising that the participants were afraid of losing the feeling of control when living surrounded by proactive technology that senses the environment. Most of them were afraid of that proactive systems make decisions on their behalf and a possibility of misjudgements was felt very high. The fears were especially associated with situations in which the system would “assume” the dweller’s state of mind or the next activity. Most of the participants suggested that it should be possible to ‘turn off’ such an automated system or at least some of its functions. However, they supposed that in many cases they could accept the proactive system taking initiatives if it was just offering alternative functions to be chosen rather than making decisions on the grounds of predefined ‘parameters’. Thus, the participants highlighted that they could approve such a system on the condition that they have a possibility to ‘cancel’ a suggested function.

Depending on the concept, the participants’ reactions to the users’ sufficient awareness of technology’s functionality and presence varied a lot. For instance, when the focus was on the smart home scenario some of the participants considered that manually opening the curtains in the morning makes sense. The underlying idea was that this kind of a morning routine belongs to the waking up process and it is not a good thing to turn it over to a proactive system. However, most of the participants thought that they could accept a dim light switching on automatically simultaneously with the sound of an alarm clock.

The discussions about a pedestal lamp measuring the domestic decibel level and indicating the current level with changing colours also illustrates the diversity of attitudes. Some participants perceived this kind of a decibel

lamp to be a furnishing element that should work silently in the periphery of their awareness. A few pointed out that the alteration of colour is too strong of an indicator of change in sound level. They preferred the lamp to inform them about changes in the decibel level just by changing the intensity of the same colour. However, a majority of the participants saw the lamp primarily as a functional object that they would locate in a visible place within their home. They thought it was a pleasant idea that the lamp could offer information about the sound level which can be difficult to assess oneself. Some participants mentioned that the dwellers' ears are prone to adjust to their own domestic soundscape and at times it is very hard to know if the sounds carry to the neighbouring dwellings.

Compared to the other participants, comments diverging to an extent were voiced by a man who considered that in their home the decibel lamp would work best if it was an unobtrusive and decentred technology situated in a bedroom, the living room, the kitchen and possibly also in other rooms. In the living room the man would have placed it either on the bookshelf or next to the television where it can be easily observed when one is watching the television. On the other hand, he suggested that information offered by the decibel lamp might as well be presented on a computer screen. He remarked that the computer in their home is always on when he or his girlfriend is awake and therefore the 'lamp icon' could show the current decibel level, e.g. flashing when the level changes. In the latter case he related easiness and non-obtrusiveness to getting the information from the computer screen. Hence, the computer as an object was already felt to be a self-evident part of the visual order of the living room. Because the computer was frequently the target of attention the participant felt that it would also be appropriate to get sound information from the computer screen. He felt a new visible and distinct object to be potentially disturbing and preferred the idea that the lamp should be fairly imperceptible but easily available. Hence, he assumed that if the decibel lamp was a visible object, the place next to the television would probably ascertain that one would not have to shift attention from the television to other directions too much. In his arguments centrality and accessibility of "screen media" in the domestic environment was unquestioned.

### **3.2 Is calm technology a solution?**

The notions and reactions relating to the scenario of the decibel lamp can be considered together with the idea of calm technology, in which the presentation of information in a non-obtrusive way is pursued. According to Weiser and Brown (1996), calm technology moves easily from the periphery to the foreground of our attention, and back. They see this calming effect

happening because people are able to attune to many more things when most of the technology is placed in the periphery of attention. In their vision information technology comes to the centre of attention only when it is needed but the users remain in control because through peripheral awareness they are attuned to the technology while simultaneously free to do something else. On the grounds of the decibel lamp example, it is really hard to define when information is sufficiently in the foreground of attention and, on the contrary, when it is sufficiently in the background of attention. For instance, the red colour indicating the most stentorian sound levels was perceived to be potentially disturbing because it requires a lot of attention and sometimes you cannot avoid loud situations in the home. In this case, the lamp would irritatingly strengthen the awareness of stentorian sound levels although you could not necessarily change the situation, e.g. if you had an ill baby bawling or a painting had to be fixed on the wall by using a drill.

The discussions with the participants indicated that the home as a use environment changes when different dwellers and especially visitors are present. With visitors people are prone to think more carefully which devices are allowed to be in the centre of attention and which ones are not. For instance, a middle-aged couple said that they always switch off the television when visitors are coming because they do not want the television to take too much attention and steer the conversation. Furthermore, many domestic appliances (such as a vacuum cleaner, a washing machine or a tumble dryer) were felt to be so loud that it is not possible to move them to the periphery of one's attention when they are in use. When asked if the participants would keep the decibel lamp on when they had visitors the answers were twofold. Some felt that it would be impolite towards the visitors if the decibel lamp would show that talk was too loud by its colour. Meanwhile, other participants argued that it would be just fun to have parties with the lamp turned on because it would be a playful focus among the visitors.

In western countries homes are perceived more and more as centres of individualized leisure culture (Livingstone 2002). At home people can choose fairly freely how they organise time and space, what activities they undertake and how they make the environment more agreeable and comfortable to themselves (Meyer & Rakotonirainy 2003). Although the participants of our study were technologically oriented people, most of them highlighted that they want to have domestic moments when most or all media technologies are switched off and during these moments also peripheral awareness of technology is felt to be irritating. Thus the idea of continuous presence of embedded proactive system was mostly questioned whereas simpler proactive applications were more easily accepted. The home was often perceived to be the 'last' place where amount of information can be delimited and maintaining of this limitation was probably easier to



link to the single applications than to the large-scale systems. However, some participants had positive attitude also to the larger proactive systems in the case their functions were confined to specified tasks.

As expected, people were prone to think of new proactive technology on the grounds of their experiences with existing technology. The idea of embedded proactive technology could be felt dubious because people are used to perceive domestic technology as visible and concrete devices that they can place and control. When the technology and its functionalities transforms into something that is embedded in the domestic surroundings in pursuance of taking initiatives for “domestic action”, there emerges a threat of losing the control and knowing insufficiently what the domestic technology is doing. Calm technology can sound ideal but in the contemporary media-rich homes it is not so simple to determine which information or functionalities should be in the periphery and which ones in the foreground of attention because the use of technologies seems to be fairly dynamic and situation-specific in nature.

### **3.3 Remote awareness of the condition of the home**

If the home is typically perceived as a shelter for its dwellers, it is also seen as a place that has to be sheltered. The commonly shared idea among the participants was that after the workday, school day or a holiday trip the home is basically expected to be in the same condition that it was left in. It was not surprising that the participants were eager to know if something untoward is happening in their home when they are not present. According to Meyer and Rakotonirainy (2003) security systems that increase awareness of the condition of the home belong to the recurring visions associated with context-aware homes. Hence, the participants were presumably familiar with the idea of remote emergency alarms informing the dwellers about ‘harms’ in their homes. The automated alarm systems increasing security or at least the feeling of security seemed to be desirable both among home-owners and tenants because the home with its personal and memorable objects has strong emotional value. Many participants experienced their home to be some sort of an extension of themselves and the threat to domestic property was felt to be a threat to one’s own subjectivity. The home’s “intactness” seemed to be on the minds of the participants fairly often when they were away from home.

Most of the participants felt it to be meaningful to use mobile technology that could inform them in real-time about material damages or emergencies going on in their home, even if they did not know whether the alarm was related, e.g., to an intruder or damage caused by water or fire. This discussion was related to the scenario in which people came up with ideas

about the kinds of situations in which they could receive a vibratory alarm from their home when they were somewhere else. A majority of the participants thought that an instant vibratory alarm would work well in emergency situations. Most of them wanted to receive alarms with their mobile phones but some favoured the key chain. However, a few participants thought that the mere vibratory alarm would not be a satisfactory information source and they also wanted to receive verbal information about what had actually happened if they were to use an alarm system. An exception was a female participant, a mother of a 6-year-old girl, who thought that the vibratory alarm would be most useful to her when her daughter starts going to school. For instance, the vibratory alarm could inform her when her daughter has left for school in the morning and when she is back from school. So, the mother thought that the vibratory function would be more useful to her when used to inform her about her daughter's school-day comings and goings instead of emergencies which usually occur rarely.

The desire to be made distantly aware that everything is alright at home was limited to the indoors of the dwelling. For instance, nobody mentioned that they would like to receive these "damage reports" relating to the whole block. The alarms from home received by a mobile phone were seen as a natural information channel probably because both are personal objects that people want to protect from outsiders. Just like many users understand the mobile phone as a 'body part' (Morley 2003) some of the participants talked about their homes as extensions of themselves. However, a few participants indicated that they would prefer to use the vibratory function received by a ring or a bracelet because they are always worn on their bodies and compared to the mobile phone the vibratory notification would be more easily noticed when it happened on the skin.

Awareness and control of proactive computing technology are very challenging issues especially when designing applications or systems for domestic environments. Generally speaking, people were of the opinion that they want to be highly aware both of the condition of the domestic space (especially when not present in it) and the availability of functionalities or information the technology offers. They also argued that, in most of the cases, they want to keep control and avoid systems in which technology can make decisions on their behalf. Although the participants in question were interested in new technology and its possibilities, they highlighted that they do not want to have new futile technologies in their homes. The underlying idea was that among new domestic technologies there are lot of useless devices that are not appropriate or meaningful for long-term use. In this regard, embedding new features into existing domestic products seems to be a direction that has to be taken into consideration more carefully in the near

future. However, designers and researchers should also consider to what extent existing domestic objects, such as furniture, can be transformed by adding embedded computing features without “disturbing” the homely aspects and comfort of domestic environment.

#### **4. DISCUSSION**

By using the scenarios we were able to illustrate some possibilities of domestic technology of the future and they also functioned as tools for conceptualizing different approaches to it. It was important that the interviews were conducted in the homes of the participants because the feasibility of the conceptual ideas was easier to contextualize for both the participants and the researcher in the participants' homes. The scenarios without a story line or designated characters induced the participants to further develop the concepts and come up with stories of their own for possible uses. The scenarios together with the priming questions diversified our understanding of the variety of the participants' domestic practices related to the specific situations and the time of day. Nevertheless, although the interview based on scenarios seemed to work well in a concept design phase, it is not a sufficient participatory design method when the aim is to produce new products. In order to bring out more detailed demands on the features of the form, appearance and user interface of new technology, people need to have personal use experience of the product or prototype.

The next round of scenarios will concentrate more on controlling and alternative means of being aware of the surrounding proactive technology. We are especially interested in the following questions: Is it possible to ‘teach’ a proactive system? How do users experience the potential error conditions in different situations? What is a meaningful degree of proactivity (so that it will not affect the nature of domesticity and cosiness too much)? In addition to the scenarios we will build prototypes that participants can test in their homes to get concrete ideas of possibilities of proactive technology to be used in the home.

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