Knocking on Elders’ Door: Investigating the Functional and Emotional Geography of their Domestic Space

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ABSTRACT
The domestic environment is more than a place where to live. It is a “territory of meaning”, a place where pleasure, affect and aesthetics are deeply interwoven with the functional and utilitarian dimensions. With the aging process, the home is progressively invested with new meanings and functions, and becomes the emotional center of older people’s life.

This paper presents a user study based on cultural probes on how domestic spaces are managed and perceived by older adults, uncovering some of the complex interrelations among the daily activities, objects and meanings revolving around the home. The findings provide suggestions on how the dimensions of remembrance, perception of safety and environmental stability may affect the design of domestic technology for elderly people.

Author Keywords
Aging, Design of domestic technology, Cultural Probes.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
The domestic environment is more than a place where to live. It is a “territory of meaning”, a place where pleasure, affect and aesthetics are deeply interwoven with the functional and utilitarian dimensions. As age progresses, people spend increasingly more time at home and most of their daily activities take place there. Elderly people progressively experience motor, cognitive and psychological difficulties and give their domestic environment new meanings and functions [24; 31]. Technology might play an important role in supporting independent life at home [29], especially for what concerns the simplification of domestic duties – e.g., white appliances, task reminders – and the need of safety – e.g., gas, fire and intrusion alarms, fall detectors, visual and acoustic monitoring systems; it also plays an important role in maintaining and nurturing the elder’s social network – e.g., through video-communication systems [15]. Yet, the actual adoption of technology at home by elders is strictly dependent on a delicate acceptance process: no matter how functional a technology is, older people will not use it, if they perceive it as intrusive, complex, embarrassing, revealing their limitations, or disrupting their home environment [28]. In order for the benefits of technology to be clear, it should be designed so as to fit the practical routines of daily activities, the functional organization of the domestic environment and its evolutionary nature, and the emotional and affective qualities the home assumes in the old age.

In this paper, we focus on how domestic spaces are managed and perceived by older adults, the ultimate goal being that of producing information and knowledge that could be used in the design of advanced domestic technologies for older people. One of the fundamental challenges is to shed light on the complex net of interrelations exiting between daily activities, objects and meanings revolving around the home, for the purposes of design. Addressing these research questions requires the simultaneous consideration of the physical and functional aspects related to living at home, of the representations and emotions associated to the domestic environment, as well as information about the everyday routines older adults living independently form and follow.

We exploited cultural probes [18] to clarify these issues. The study involved 19 older people in a 3-week activity and follow-up interviews. The collected data suggest that in general, the home is a static environment which articulates along two main axes: the kitchen vs. the bedroom as the places of the activities and the intimacy respectively; and the living room vs. bedroom as the places of the sociality and the mourning. Remembrance emerged as an important dimension that articulates in two alternative and complementary aspects realized at different places in the home: a social part/place where mementos are publicly displayed and made accessible to all, and an intimate...
part/place where to mourn the beloved ones and recall the happy moments of past life. Finally, the subjective feeling of safety emerged as something that cannot be reduced to the mere prevention of physical damages; for it to be understood, consideration of the emotional and experiential dimension, and of the related notion of comfort are necessary: places that are felt as more comfortable because of their emotional importance (e.g., the bedroom) are also seen as safer, independently of actual risks.

RELATED WORK
The home has been a major topic of investigation for HCI researchers for nearly a decade and, since the seminal work of Hindus [20], an increasing number of studies has investigated its specificities for technological innovation. Empirically grounded researches have emphasised the complex nature of “places” as opposed to “spaces” [21], a place being an environment “inextricably linked with the wealth of human experience, activities and usages occurring with it, and invested by values, attitudes and cultural influences” [8]. Other design-oriented researches [20; 4] have shed light on the differences between work-oriented environments – based on productivity and efficiency attainment – and domestic one, where emotions, affects, pleasure, and aesthetics play a major role. Ethnographically-based studies have provided useful suggestions to reconsider the nature of the home in relation to daily routines and practices [9; 22]. Relevant issues for the HCI community have been identified, such as the need to consider the gendered division of labour and the privatization of the domestic space [5], the cooperative practices surrounding the usage of communication appliances [30], and the relevance of informational displays for family members’ coordination [34]. Rodden and Benfort [32] stressed the evolutionary nature of home, since “technology will need to find a place within our homes and our homes will need to change to accommodate this technology”. The analysis of the psychological aspects of living in the house has been the base for the design of new home technologies [3].

A considerable body of research in the field of social psychology and gerontology has been produced on the specific meaning of the home among older adults. As pointed out by Osvald [31], the domestic environment is their primary living place, both in terms of time spent and of the relevance of the activities occurring there. It is experienced by the elders in terms of physical interaction with artefacts and architectural boundaries, of social relationships, and of emotions; it supports self-identity, self-expression, and sense of belonging [23; 33]. The domestic environment has its own dynamics, with environmental changes and behavioural adaptations being introduced by the elder to, e.g., help compensate for the reduced functional capacities.

Many technological prototypes conceived for older people’s homes are currently under development and being tested; they monitor the occurrence of emergences, support cognition in daily activities, and promote social communication or remote presence [1]. The initial findings that are emerging highlight both potentialities and risks. For example, it has been shown that while older people have a positive attitude toward monitoring technologies, their acceptance depends on a clear recognition of their usefulness to support independent living [2; 11]; resistance and rejection may be caused by the feeling of intrusion into own private life [19]. In this connection, Kwasny and colleagues [26] noticed age differences related to privacy perception: while younger people tend to conceive of privacy in terms of information, older adults are more concerned about the privacy of spaces.

More in general, even if a huge effort has been invested in exploring families and younger adults’ routines and daily life organization for the sake of design (see, among others, [9]), less attention has been paid to understand the logic underlying the relationship between older adults and their domestic life. This relationship involves people, products, the environment, and the community as noted by Forlizzi and colleagues [16], who described it in terms of ecology of aging. This work intends to contribute to clarify at least some of the dimensions along which the relationship between older adults and their domestic life articulates, with particular emphasis on how older people conceive their home environment.

This study borrows the intuitions and the approach – namely the cultural probes – from the seminal work conducted within the PRESENCE project [17]; yet, while the researchers in that project focused on the role of older people in the community they live in, we are concerned with the relationship between the elderly and their home environment.

USER STUDY
Involving older people greatly challenges the applicability of traditional User-Centred Design tools such as in-situ interviews, shadowing, ethnography, and so on, because of the peculiar physiologic, psychological, and ethical issues that enter into play [14]. In particular, the difficulty of obtaining the consent for in-home observations has been noted by several researchers (see among others [13]). Although ethnographic methods have been successfully employed with older people (see for example [16]), we encountered strong resistance within our user group to access their homes, especially at the beginning of the study.

In the context of the European-funded project NETCARIETY, we have adopted a comprehensive approach to motivate the participation of older people in the design team and to establish a long-term relationship with the other elders of the group. This approach [27] encompasses: (i) the endorsement by, and the direct involvement in the project of, local authorities and older people associations with the role of mediators and guarantors; (ii) the establishment and nurturing of the sense of belonging to a pioneering group,
with emphasis on the value of both individual and group contributions.

Within this approach, we used the cultural probes [18] as an appropriate methodology to gain a deeper understanding of older adults’ experience of their home and to access the symbolic and affective dimensions related to living at home. Moreover, the participative nature of cultural probes, which extends to the collaborative analysis of the assembled material, responded well to our need of keeping the engagement of the participants high throughout the course of the project process.

The design of the probes kit was conducted in cooperation with the staff of the seniors’ day centres participating in the project, through a series of meetings during which probes, stimuli and tasks were illustrated, iteratively discussed and modified to suit attitudes and values of the group of older adults. Some modifications to the standard methodology were applied. In particular, as described in more detail below, we decided to administer the stimulus material in three separate blocks to reduce the burden of the task for our users, and to conduct periodic discussion meetings as well as most of the interviews in the day centres, rather than at home, in order to value the social workers role as mediators and to keep the user group engaged. The probes kit was designed with two sets of goals in mind: a) the collection of information about the situated character of daily activities, about the relationship between the physical experience of a place and the evoked emotions, and about the complex net of relationships among activities, contexts and artefacts; b) making the experience meaningful, appropriate and pleasant to the participants.

The final kit consisted of a number of tools to be used by the participants to report about their experience at home (see Figure 1):

- Pen and paper, to draw maps of the homes, and adhesive labels to describe the emotional and functional nature of the various places of the home. Drawing on ideas emerged during the discussion with the social workers about the meaning of the home for the older adult, we included labels referring to daily activities – e.g., “the place where I meet friends” – feelings – e.g., “the place where I feel safe” – and metaphors – e.g., “the heart of home” –. Participants were also asked to draw on the map relevant objects and technologies, and to relate them to the performed activities. We expected this information to contribute to our understanding of how older adults organize and give meaning to the domestic space, and of the relationship between objects and activities.
- A camera, to take pictures of the home and its spaces, to be used as an additional description of the house and the objects it contains, allowing for comparisons with the information provided by the maps.

- A photo album to collect and organize the pictures. Participants were asked to comment about the emotional aspects evoked by the portrayed places. Suggestions on what to write were given by using prompts such as “my favourite place”, “the most dangerous place”, “where I feel comfortable”, and so on. The album was used as a repository of suggestive material to be interpreted together with participants during individual follow-up interviews.
- A diary, to narrate, day-by-day and for a whole week, the activities performed at home and the temporal organization of daily life.
- A notebook, to describe in more detail how daily routines – i.e., the activities that are performed each day on a regular basis – take place (e.g., waking up, preparing food, preparing for going out, rituals at the end of the day,…).

![Figure 1. The Cultural Probes Kit](image)

**Participants**

The participants were 19 older people (12 women and 7 men; age range 65–89; mean 78) living in the urban area of a small town in Northern Italy. All of them are fairly healthy and autonomous people; 15 live alone (at the national level: 77.9% of older adults live alone). The participants represented well the target of the project and of this study: active, fairly healthy and autonomous older adults who live alone, experiencing a gradual weakening of their social network and a progressive reduction of their social and individual activities. 8 participants were students of the local University of Third Age; the remaining 11 people were regular attendants of a day centre for senior citizens. The subjects attending the university were on average more actively engaged in intellectual activities and had a stronger social network.

**Data Collection**

Following other studies exploiting cultural probes [35], we initially planned to present and assign the whole kit during a first workshop with participants for them to take it at home, and then to organize weekly encounters to collectively discuss and interpret the collected material.
During the discussion of the methodology with the social workers, however, it clearly emerged that our participants would have experienced severe difficulties in managing too many tasks at the same time. We therefore divided the kit in three parts, to be handed over to participants at three different times: map, camera and album first, diary at a later stage, and notebook later on.

The overall probes experience lasted one month. Four weekly workshops with the day centre’s staff and the participants were held to discuss and reflect on the experience and to assign the various probes (Figure 2). These meetings proved to be very useful: they stimulated the discussion and the confrontation among participants, positively shaping their understanding of the probes and the activity they would be involved in. The received feedback also allowed the research team to better organize and finely tune the following steps.

At the end of the study, follow-up interviews were conducted to complete missing information, deepen relevant topics, and discuss the researchers’ interpretation of the material with the participants.

It is worth noting that the socio-cultural differences between the two different sub-groups involved in the study turned out to have an important impact on the general attitude towards the probes experience. The group of Third Age University students meticulously performed the various activities, as if they were assigned homework, and lively discussed with researchers their research choices and hypotheses. The group composed by the day centre attendants experienced the activity as a playful and recreational activity, where their creativity, emotions and attitudes could be freely expressed. This unexpected difference in the approach to probes highlights the importance of carefully planning the way they are presented to participants, in order to increase motivation and the quality of the collected material.

Data Analysis

Recent works have discussed the challenges of adopting cultural probes into the design process, highlighting the proliferation and the different usages of this method, and pointing at possible epistemological consequences [6; 9]. The methodological difficulties in analysing the data have been discussed, too: cultural probes are not analytic devices and their fragmentary nature requires quite some effort to obtain a clear view of the problem. In our case, these difficulties were coupled with the challenge of interpreting visual material, such as pictures and maps [12].

We engaged in an inductive and evolving process of data analysis in which individual and collective sessions of data analysis were performed by a multidisciplinary team composed by an interaction designer, a psychologist, two sociologists and a computer scientist. Conceptual maps were used as a means for analyzing interconnections between the different dimensions of the study; they proved to be useful also in reducing and organizing data and in presenting and discussing findings within the multidisciplinary team [10].

The first step of the data analysis consisted in organizing the gathered heterogeneous material: textual material (diaries and notebooks) was transcribed, while visual material (maps and photographs) was archived in a digital form. Individual interviews with the participants were conducted to complete possibly missing material. For instance, in many cases we asked participants to link the pictures taken in their homes with the information they wrote on their Photo Album.

Maps and pictures were then individually analyzed, and the relationships between the physical configuration of the home, objects and meanings were identified (Figure 3). The textual material was used to understand the spatial, temporal and emotional context in which daily activities and routines are performed. The different views worked out by the researchers were compared and cross-verified during workshops.

We structured the data along two main dimensions:

- the functional and physical dimension related to living at home, consisting of the physical arrangement of the home, the distribution of the objects populating the spaces, and the kinds of activities in which households and artefacts participate;

- the affective and emotional dimension, whereby the domestic space is an extension/projection of the self, which we let emerge by analysing the metaphors participants used to talk about their home and the affective values they associated to spaces and activities.

Around those dimensions a number of important issues emerged.
The homes of our subjects are in general small. Some of them have a kitchen, while others have just a kitchenette. Very few have a second bedroom which, when present, was the former room of the children, now used for hobbies. All our subjects have been living in the same house for many decades, including the period they raised their families. This aspect, very common in Italy, contributes to the intricacy and strength of the emotional attachment to the home.

The first thing that emerged from analyzing the maps and that was subsequently confirmed by the follow-up interviews is that the distribution of the different types of objects in the homes adapts to a pattern that is common to most of the subjects: a sharp distinction between the kitchen and the living room on one side and the bedroom on the other.

Functional objects are usually found in the kitchen (e.g., appliances) and in the living room (e.g., communication technologies like the telephone) but almost never in the bedroom. In accordance to that, the kitchen is identified by older people as the most important place of the house for performing activities of daily living. At the same time, it is perceived as the most dangerous place because of the inherent risks associated with electricity, gas, blades, etc. This risk perception notwithstanding, the kitchen is also the place where new technologies are more easily accepted and integrated, even more so if they are related to safety. This warm welcome to new functional objects and technology is a peculiarity of the kitchen which hardly extends to other places of the home. Interestingly, children and relatives know this all very well, and they are the most active in introducing new artifacts in the kitchen of the elder person, in the form of gifts. The kitchen also welcomes objects supporting cognitive processes – such as memos, calendars – and entertaining objects. Radios in particular live in the kitchens: they “keep company” during the accomplishment of daily activities and mitigate loneliness and melancholy during lunch time.

On the other hand, functional objects are completely absent and not welcome in the bedroom, which is the place of symbolic objects and in particular mementos of the most intimate type, like the photos of the beloved ones. As it turned out, the resistance towards new functional objects is a consequence of the strong emotional attachment to the bedroom: its status, as a place of remembrance, must not be endangered. This pattern admits a few exceptions: so our subjects conceded during the interviews that they use the telephone, the radio, the alarm clock and, sometime, the TV in the bedroom. Yet, the choice is limited to a close class of objects, and no new ones are allowed to enter it. As to the degree of importance assigned to the bedroom, it varies among subjects, though everybody agrees that it is the most intimate one.

Finally, the living room is where leisure objects, such as TV, stereo and radio find their place as well as the functional objects related to hobbies. Like the bedroom, it is also the place where to display mementos but while the
bedroom is the shrine of personal and intimate remembrance, the living room is the place for public exhibition. The mementos are only partially different in the two rooms and the assigned degree of intimacy is rather subjective: some subjects keep medals and trophies in the bedroom while others display them in the living room. But the difference remains, though it takes subjective forms: the mementos of the bedroom are for private use; those in the living room are there also for others to see. The living room, in fact, is the physical interface with the external world; as a consequence, it is often the most comfortable room, in fact, is the physical interface with the external world; as a consequence, it is often the most comfortable room, with activities like reading books, listening to music, − e.g., dish-washing − while many of the other household chores and emotional attachments are transferred to the living room.

The Places of Activities
The kitchen, when present, is by far the most important space in the house for what concerns daily activities. Not only cooking and eating take place there but also normal household chores, like ironing or sewing, do. It is also the place where routines, like taking daily medications, are conducted. Of course, the activity of cooking is the most prominent one in this room and it has different and sometimes contradictory emotional connotations. For women living alone, it is usually a positive activity often related to enjoyment and self-realization: cooking was considered by many female subjects as a form of artistic endeavor. On the contrary, male subjects living alone expressed concerns and a sense of displacement when it comes to cooking. Both for males and females, cooking and dining also have a strong emotional component: these activities evoke the past, when the husband (or the wife) was still alive and the family still used to join at the table for the meal.

As discussed above, technology is welcome in the kitchen because it alleviates the workload, allows to prepare richer recipes or simply because it improves safety. When only a kitchenette is present, the main activities are cooking or cooking-related − e.g., dish-washing − while many of the other household chores and emotional attachments are transferred to the living room.

The living room plays functional, aesthetic and representational roles. It is the place where guests are welcome but at the same time, it is the place of self-expression and self-realization − e.g., listening to music, reading during the day, practicing hobbies, etc. Many subjects defined the living room as the place where they spend most of their time and as their favorite one. It is connoted by relaxing activities and by sociality. Often the space is organized in such a way as to facilitate and make activities pleasant, by centralizing and gathering together as many relevant objects as possible: comfortable chairs and couches, easy access to stereos and TV, etc. (Figure 5). As noted by [16] environmental reduction is a critical component of the experience of aging. Similar centralization processes have been noted also by Carbtree and Rodden [9] as a way of using the space to increase efficiency of routine tasks, even though for our subjects these practices seem more related to psychological comfort rather than efficiency.

An interesting dimension that emerged during the interviews is the particular interpretation our subjects give of the activities commonly referred to as free-time activities, such as gardening, do-it-yourself, etc. They are often referred to as ‘my job’, are organized in a job-like fashion, and are made part of daily routines. From the interviews it emerged that this way of considering free-time activities is motivated by need to secure that they will be executed, their execution, in turn, being an antidote to depression and cognitive decline (“if I do nothing I get depressed”). In other words, behind the usage of the word ‘job’ for free-time activities, there lays the externalization and reinforcement of an intrinsic motivation that would be too weak or inconstant to support sustained activities. In this connection, it is important to consider the situation with the computer: the few people possessing it do never use it for activities described as playful, but always associate it to tasks, mostly framed within social settings: e.g., preparing a brochure for the day center, sending an email to the children, etc. In other words, the most common kind of ‘job’ our older people associated with the computer is social, and its goal is to maintain the person’s social network.

Finally, the activities that take place in the bedroom are limited to dressing, undressing and sleeping, with very specific routines concerning waking-up in the morning and indulging in remembrance before sleeping. All of the subjects referred to the bedroom as the most comfortable and most important room in the house from the emotional point of view. It is also the room that undergoes fewer changes and remains more stable in time. The furniture are rarely upgraded or changed because of their very strong ties with the past. In the interviews our participants revealed a slightly higher degree of flexibility with respect to the bedroom, with activities like reading books, listening to radio and in some cases watching TV more or less
occasionally taking place in the bedroom, often in relation to insomnia. Still, the bedroom remains the less accessible room of the house, not only to external people, but to the older person herself: although she can read a book there at night, she would rarely take her time during the day to read a newspaper or a book in it.

**A GEOGRAPHY OF EMOTIONS**

The observations emerged from the cultural probes concerning the affective and emotional dimensions have been organized along two axes.

The first experiential axis concerns the notion of “remembrance”, which articulates around a public and a private pole. As we have seen, the mementos kept in the bedrooms are intimate in nature and are there only for private use: to mourn the beloved ones and to recall the happy moments of past life. The symbolic objects displayed in the living room, on the other hand, are used as a public expression of own identity, though being usually of the same type of the private ones, that is photos of dear people and artifacts of their active life. There is a difference, however: the private symbolic objects of the bedroom mostly concern past events and passed away people (own wedding, the parents, the husband/wife, see Figure 6), while those on display in the living room are about the present: the children and their weddings, the grandchildren, pictures taken during vacations, etc.

These differences confirm the distinction between the bedroom and the living room: the former is the shrine of family life, it is dedicated to mourning and to intimacy; the living room is the personal shelter, and is related to the sharing of memories with friends.

The second axis is related to the notion of “safety” in the home. The kitchen is usually described as a dangerous place mainly because of appliances, the use of electricity and fire, etc. Yet, it is also the place where technology is well accepted and easily integrated. The bedroom is usually associated with a sense of security; it is the place where you can relax your defenses.

Clearly, this sense of safety is not due to any real lack of danger (during the interviews participants recognized the risks of stumbling and falling at night), but rather to the spiritual calm induced by the intimacy and closeness to affects of such a place. For all these reasons new artifacts, and in particular technology, are unwelcome in the bedroom even when they address safety, like fall detectors.

**LESSON LEARNED FOR DESIGN OF TECHNOLOGIES**

The relation between probes and design is often indirect and inspirational in nature [18]. From the analysis discussed above, it is not a straightforward matter to draw principles to apply to the design of new technologies supporting the independent life of older people at home. Nevertheless it is possible to point at promising directions.

In the first place, the emotions and affects associated to the different rooms are likely to differently affect the acceptance of technologies. For example, it can be expected that functional technologies are more easily accepted if they are meant to be used in the kitchen while, technologies designed to fit the bedroom, even safety-targeting ones, may raise concerns despite their recognized utility.

The home as a whole is quite a static environment and for some rooms (e.g., the bedroom) any modification may be strongly opposed. The kitchen, in turn, being the most dynamic place, seems capable of accommodating changes, in the form of both new (functional) objects and new activities. Similar considerations, though to a lower degree, hold of other domestic spaces that tolerate a gradual transformation. For instance, our study confirmed the natural tendency of older people to create sort of “activity centers” – as already suggested by Osvald [31] – around which information, communication, recreational artifacts are organized in order to enhance comfort, promote a feeling of protection and reduce the physical effort required to perform activities (see Figure 8).

The living room seems particularly amenable to this environmental centralization: e.g., the central table or the unit composed by an armchair and a coffee table. Arguably,
these are places where several technologies supporting the control on the environment, entertainment and leisure functionalities, as well as personal interests and hobbies can be gathered taking advantage of the existing activity centers.

Figure 8. Example of environmental centralization

Finally, the notion of safety is a very complex one, as it appears from our study. It cannot be understood simply in terms of avoidance and/or prevention of physical damages, but requires consideration of the emotional and experiential dimension, and the related idea of comfort. There are places that are felt as more comfortable because of their emotional importance – e.g., the bedroom – and that are, at the same time, also seen as safer, independently of actual risks. That the interplay among the need for safety and emotional investments affects the readiness to accept new and possibly obtrusive technology is confirmed by the case of the bathroom. Our subjects never mentioned it in their narratives, despite being aware, as declared in the interviews, that this is the place where accidents related to aging (such as falls, for example) happen more often, and even more so than in the kitchen. At the same time, they seemed to be much keener to accept safety-related technologies in the bathroom than in the bedroom. The two facts seem related: while the strong emotional characterization and intimacy makes the bedroom into a safe place in spite of reality, the bathroom, a non-emotional area, does not even belong to the home proper from an emotional point of view. As a consequence, intrusive technologies, such as fall detectors, do not find the opposition they have to face in more affect-laden spaces.

CONCLUSIONS
The contribution of this study is a set of insights on how domestic spaces are managed and perceived by older adults. Although the user group is limited in size and geographical distribution, the study provides some evidence not yet discussed in literature that may prove useful for the design of advanced domestic technologies. In order to be really accepted, used and of some advantage, these technologies have to take into account not only the user needs but also the intricate web of emotions and practices in the elderly homes.

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