
Ambient Plant Pot: Subtly Stimulating Everyday Elderly Life

Heek-Young Jung

School of Informatics
Indiana University
jung5@indiana.edu

Micah Linnemeier

Computer Science
Indiana University
mwlinnem@indiana.edu

Will Odom

School of Informatics
Indiana University
wodom@indiana.edu

Selvan Thandapani

School of Informatics
Indiana University
selthand@indiana.edu

Abstract

This study explores the everyday lives of senior citizens to investigate how ubiquitous technology can build on already familiar domestic practices to subtly stimulate social connectivity among separated friends and family members. We build on previous research in HCI and the findings from our initial study to present a set of implications to guide future research relating to ambient ubiquitous technology in the domestic domain.

Keywords

plants, ambient displays, ubiquitous computing

ACM Classification Keywords

H5.2. [Information interfaces and presentation]

Introduction

Senior citizens represent one of the fastest growing global demographics and are predicted to compose fifteen percent of the world's population by 2050 [1]. As seniors age, their social network typically begins to decrease and they face a risk of social isolation, which has been shown to result in an increased risk of depression as well as physical and mental deterioration [1, 5]. In this study we examine the everyday lives of senior citizens to investigate how ubiquitous technology can be used to subtly stimulate social connectivity among separated friends and family members. We conducted a series of preliminary studies drawing on

participants sketching relationships among common domestic activities and objects, and (iv) asking general questions about habits of interactive technology use. In particular, sketching exercises (**Figure 1** and **2**) were helpful in engaging participants in reflection on their everyday activities and emotional attachments to objects and spaces. Additionally, these exercises resulted in tangible maps visualizing the ecology of social and material relationships that characterize participants' everyday lives.

From these initial user studies, we found that participants strongly valued their social relationships with family members. Similarly, the objects that participants felt to be most meaningful often had direct ties to the memories associated with these familial relationships. These findings served as core impetus for our initial design objective: to support and stimulate social connectivity among senior citizens and their separated loved ones.

Cultural Probes

These initial contextual interviews provided a foundation for us to establish our design objective, however we required additional information to better understand the specific relationships and interactions among participants and their domestic environments as well as separated family members. This requirement motivated us to conduct a series of cultural probe studies that allowed participants to unobtrusively reveal their personal and emotional relationships with objects, places, or people. Specifically, we provided two elderly households with diaries and disposable cameras as well as an instruction sheet to provoke participants to reflect on these relationships. After two weeks, the probe packages were returned to researchers with

approaches including ethnography, cultural probes, and participatory sketching exercises [2] to obtain rich, domestic lives as well as explore the role that ubiquitous technology could potentially play in this domain. Based on the findings from these initial studies, we decided to focus on the deeper social and emotional side of domestic life. After generating a number of design ideas based on this direction, we selected a concept centering on embedding ambient information in an already familiar domestic object to promote social connectivity among our participants. Following this direction, we developed an interactive plant pot prototype and plan to conduct an initial pilot study in the near future. In what immediately follows we present our (i) user research process and findings, (ii) conceptual design idea, (iii) ambient plant pot prototype, and (iv) plan for further evaluation. We conclude with a set of implications for designing ambient ubiquitous technology, particularly in relation to augmenting already familiar objects within the domestic domain.

User Research

Contextual Interviews

During our user research we conducted contextual interviews and observed the activities of two elderly couples to develop a deeper understanding of everyday elderly life. Specifically, we focused on the meaningful relationships that participants formed with objects and environments in and around their homes. These interviews consisted of four distinct parts: (i) interviewing participants about their activities, relationships, and histories, (ii) touring participants' homes and documenting personal objects that they felt were highly significant or meaningful, (iii) observing



Figure 1. Cultural Sense map
from contextual interviews

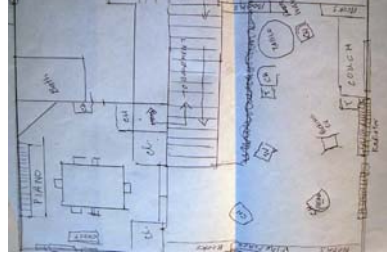


Figure 2. Cultural Sense map
from contextual interviews

people through communication. Additionally, all concepts were categorized according to physical interface form—whether the concept would be embedded in an existing familiar object or be created as a new device. We mapped each concept on the two dimensional axes of *themes* and *interface*, allowing us to compare and critique the potential benefits and drawbacks offered by each concept (**Figure 5**).

Specifically, we focused on refining and specifying the following five concepts, which offered potential to stimulate users in a variety of different ways and could be implemented as interactive prototypes.

- 1) Mutual sharing of memories:** a system to record and play stories of each objects or photos, which can be accessed later and shared among different users
- 2) Ambient plant:** ambiently displaying domestic activity and the emotional climate of the household to connect family members living apart from each other
- 3) Tangible photo-sharing:** using easy and enjoyable tangible manipulation of photos to create and share newly edited photos among separated family members
- 4) Story of things:** record stories directly to existing objects through attached recording module, which can be played later through a main device
- 5) Multi-household virtual pets:** enrich emotional connection among different households through shared interaction with a virtual pet (collaborative nurturing and transferring messages through the pet)

Our ultimate objective was not specifically to produce a concept capable of advancing both *sharing* and *caring*, but rather one that would most strongly stimulate the emotional and social aspects of daily life as well as easily fit within the domestic ecology. While each of

participants' reflections logged on diary entries and note cards as well as undeveloped disposable cameras.

The pictures taken by Participant#1 illustrated their interests in (i) sharing the memories related the awards and accolades received during diplomatic service for the country, (ii) care for the nature and the environment, (iii) close-knit family relationships, and (iv) common hobbies and activities within the house. The pictures taken by our Participant#2 highlighted their interests in (i) collective family interactions and activities (ii) wonders of natural and animal life in and around their home, (iii) heirlooms and antiques adorning their home, and (iv) activities for self-betterment (e.g. yoga).

Photographs and textual descriptions (**Figure 3** and **4**) were organized into a series of categories to inspire new ways of thinking about prototype form and function, contexts of use, and user interface and interaction. We specified our design objectives for supporting general relationships among family members to connect two households living apart and to integrate the feeling of social connection into daily activities or casual objects around home.

Concept Direction

Based on the findings and insights from our user research, we continued to explore the design space by generating specific design concepts through two brainstorming sessions. Themes that emerged consistently across our ideation sessions were *caring* and *sharing*. *Caring* is related to close relationships with participants' family members and domestic environment, particularly in terms of their desire to support or nurture. *Sharing* relates to participants' longing to convey their memories and stories to other



Figure 3. Photos from Cultural Probe



Figure 4. Notes from Cultural Probe

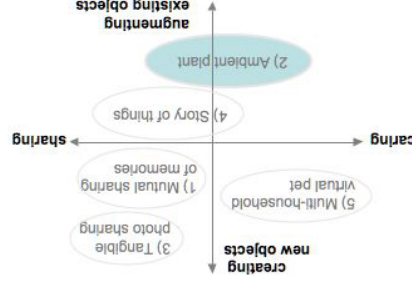


Figure 5. Conceptual Dimensions



Figure 6. Plants common to domestic ecology

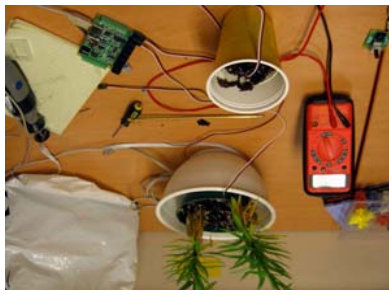


Figure 8. Testing moisture sensor



Figure 9. LED display & controller

these conceptual ideas touch upon our criteria, the *ambient plant* presented the most compelling case, offering strong potential to (i) easily integrate into the daily lives of our target population, (ii) stimulate social connectivity among separated family members, and (iii) build upon a common and already existing domestic practice.

Ambient Plant Pot Prototype

The ambient plant pot aims to provide separated family members with a sense of social connection through the presentation of ambient information relating to multiple plants' moisture levels, in addition to providing members with a subtle sense of each other's presence. As noted in our user research, participants exhibited a strong inclination to maintain social connections with their close family members and friends. Discussions with participants in follow up interviews revealed that when they were experiencing high levels of stress, caring for houseplants was generally one of the first domestic chores they tended to neglect—revealing a key indicator of a household's shifting emotional climate. Furthermore, our participants noted that a wide variety of plants were common to their domestic landscape (Figure 6).

As shown in the concept diagram (Figure 7), the ambient plant is intended to connect family members living in separate homes by sensing local plant moisture levels and displaying this information through a series of colors produced by LEDs on a plant pot-based display. An additional display conveys the condition of the separated household plant, allowing members to keep track of each others' respective plants. In this context, the everyday practice of nurturing houseplants becomes a symbolic act to contemplate the broader

emotional climate of a separated loved one's domestic household. Additionally, when a family member is in close proximity to their plant, the pot in the distant household begins to glow brightly to convey a loved one's temporary presence. These surprising, ephemeral moments are likely to result in a stimulating period of time characterized by a participant's interpretive reflection on what family members may be doing [6, 9]. The ultimate desired outcome of the ambient plant is not to replace direct forms of communication (such as telephone and face-to-face interactions), but rather support social connection among separated family members through subtle enrichment of a familiar domestic object and practice.

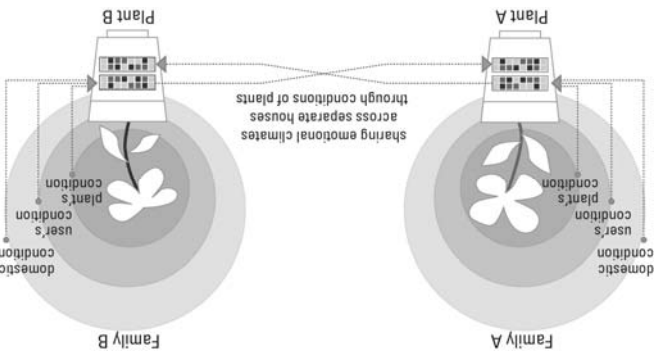


Figure 7. Conceptual diagram of prototype architecture

Technical specifications

The design and technical implementation of the ambient plant pot builds in part builds off of previous research in HCI that has examined the use of plants as interactive displays [3] and mediums of interaction [4]. The ambient plant architecture consists of two main components: (i) the plant pot with associated sensors, computer and wireless transceiver to capture local

interview session, in which questions will probe participants' general reflections on and suggestions for the prototype. This feedback will directly inform the final prototype design, which will be implemented in a longer, more rigorous study (see appendix).

Design Implications

In this project, we are centrally concerned with improving the social and affective aspects of elderly citizens' lives and suggested a concept that connects two separated households through ambient information embedded in common plant pots. Through this process we considered the following issues, which provide implications for designing ambient ubiquitous technology for the domestic domain.

- *Augmentation of a familiar object rather than creation of new one*: As new ubiquitous digital devices continue to populate domestic landscapes, Weiser's vision of computing fading into the background becomes increasingly distorted [8]. Integrating ambient information into common domestic objects and building on familiar practices offers potential to: (i) avoid disrupting already established social and material ecologies, (ii) reduce cognitive load to learn new interfaces, and (iii) enrich prosaic interactions with commonplace objects. By considering elderly participants' dense domestic ecology and cognitive or physical requirements we augmented one of their most familiar objects (plant pots) and practices (caring plants) with ambient communication information.
- *Intimacy through interactive objects vs. attachment to interactive objects*: Visual aesthetics and quality of material play important roles in fostering user attachment to everyday objects. However, digital

information and (ii) a web server to relay information between both pots. To measure the plants' moisture levels we began by experimenting with an analog moisture sensor (**Figure 8**), however due to technical constraints we decided to use a weight sensor in the initial prototype. We used the weight sensor to measure slight variations in the total weight of the plant and pot as moisture levels fluctuated over time (**Figure 10**). This value subsequently controls the range of colors exhibited by two LED displays that inform participants about both local and distant houseplants' moisture levels (**Figure 9** and **11**). Infrared distance sensors are used to measure participants' proximity to the plant pot. This value is used to control the brightness of LEDs on a third display that conveys presence. Each prototype is connected to a small thin-client computer that interprets and transmits data collected by sensors in the plant pot. The computer updates a web server with the collected information via a wireless internet connection. Also, the computer downloads health information about the remote plant and displays this information on the local plant pot.

Plan for Pilot Study (to be conducted soon)

We plan to deploy the current prototype in an elderly couple's home for a one week trial period. This initial study will employ a *Wizard of Oz* approach to obtain initial user perceptions of and attitudes towards the ambient plant pot prototype. Participants will perceive simulated changes in moisture levels of both their plant as well as a connected plant and be provided a diary to log their daily interactions and experiences with plant pot. At the end of one week, researchers will meet with participants in their home to conduct a debriefing



Figure 10. Prototype (with weight sensor and scale)



Figure 11. Prototype (displays on)

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devices are increasingly mediating human relationships and communication. In particular, this offers potential for everyday objects to evoke deeper symbolic meaning as emotions are projected through these devices and a sense of intimacy is created [7]. In the context of our study, the changing information display on the plant pot symbolizes the emotional climate of distant a household. The materials constructing the pot dynamically endow it with symbolic meaning, conveying an enriched sense of intimacy.

Conclusion and Future Work

In this study we explored the households of senior citizens to investigate how ubiquitous technology might build on already familiar domestic objects and practices to enrich everyday life. We have described the process through which we developed an interactive prototype to subtly stimulate social connectivity in this domain and the resulting broader implication this study suggests for future design. While these implications provide insight into conceptualizing and embedding ambient information within commonplace household object, they also raise a series of questions:

- What should methods and practices guide designers to determine appropriate familiar objects and practices to couple new interactions or streams of ambient information?
- What metrics ought to guide evaluate of these new designs in terms of seamless integration into and enrichment of everyday life?

In our future work we plan to further explore the implications and questions set forth by paper through a long term user study with a final version of the ambient plant pot prototype.