

# **Provoking Social Connectivity in the Prosaic**

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**Subtly Stimulating Everyday Elderly Life**

## **Design Document**

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# 1. Introduction

## 1.1 Project Overview

This project examines the everyday domestic lives of senior citizens to investigate how new technology can support and promote social activity within the home. Senior citizens represent one of the fastest growing segments of the population in the United States—over thirty-six million Americans are currently over 65 years of age and this number is estimated to double by 2030 [1]. As seniors age, their social network starts to decrease [26] and they face a risk of social isolation, which has been shown to result in an increased risk of depression [35]. Social isolation paired with a lack of stimulating activities pose major risks, such as physical and mental deterioration, to the elderly population [2, 26, 32]. A recurrent theme in the lives of aging senior citizens is characterized by a reduced interest in actively pursuing social relationships among friends and family as well as a decline in personal hobbies or activities [2, 13]. While additional time for reflection and contemplation in everyday life is not undesirable, the underlying theme of this study questions whether it only has to be this way. Specifically, in this project we explore how pervasive technology can build upon familiar domestic practices in the everyday lives of elderly citizens to subtly improve social activity and connectivity among friends or family members.

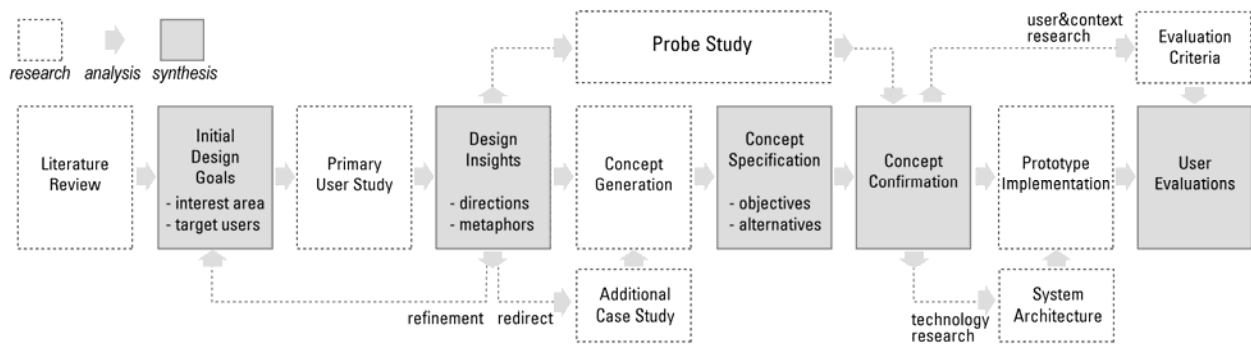
This project is characterized by an experience-centered, design research approach [12, 13, 26] to (i) develop a working pervasive prototype capable of producing a beneficial outcome based on our target population's needs and requirements as well as (ii) better understand the nature of the design process through which such a product is developed. We acknowledge the important role of routines within the domestic setting and previous efforts to coordinate these activities using pervasive technology [9, 10, 15, 39], however this project explicitly addresses the deeper social and emotional side of domestic life—an rising area within HCI research. Our approach is strongly influenced by emerging theoretical and methodological perspectives emphasizing the pleasurable and critical aspects of human experience [6, 12, 19-22, 36, 40], in addition to previous studies focusing specifically on social, emotional, and environmental factors in the design of technologies for the elderly [7, 16, 27, 37].

The target user population for this study is senior citizens between the ages of 65 to 75 that are living in their own home without assistance. As the baby-boomer generation continues to age, this particular group will rise steadily, presenting a key population to focus on currently and into the future. We employed a series of novel methods to gain rich, deeply textured accounts of senior citizens' everyday lives within their homes. Our methodological approach is principally informed by multi-sited design ethnography [5, 31, 35], and, in particular previous case studies of daily life within the home [5, 11, 40]. Based on initial exploratory ethnographic interviews and cultural sense mapping exercises [25], we developed and deployed a set of cultural probes [6, 19, 21] within local participants' households to gain a deeper understanding of our target population's everyday domestic experience. The rich information obtained from these cultural probes, paired with multiple ideation sessions and conceptual sketching, ultimately fueled the final design concept direction. In what follows, we offer an in depth description of our design process detailing our (i) initial exploratory study, (ii) refinements made based upon this study, (iii) process and motivation for constructing cultural probes, (iv) further literature and design ideation

sessions, (v) physical prototype development, (vi) conceptual sketches, (vii) additional design ideation, (viii) probe data analysis, (ix) our tentative final concept direction.

## 1.2 Design Process

Our design process basically consists of iterative research, analysis and synthesis as marked as different unit of blocks in figure1. Based on literature review, we set our initial design goals with interest areas and target users. Within this domain, we conducted two sessions of exploratory user study with ethnographic and semi-structured interview. Although we could not generalize the primary user study results, they provided us meaningful design insights, based on which general design directions and specific design metaphors were developed as well as refinement of our initial design goals. According to refined design directions, we prepared probe study materials and deploy them to users to get more focused and rich understanding about users’ contexts and desires. While waiting for users to complete probe study, we conducted two sessions of design ideation- basically about brainstorming ideas, sorting similar ones, and finding emerging patterns among them. After the first concept generation, we specified our design keywords, which directed additional research about similar case studies. During the second design session, we specified each possible concept according to design objectives and alternatives that enabled rational comparison among various conceptual ideas with requirement criteria. We could compare each idea in more details based on users’ real contexts with probe study results. One design idea among various was selected and refined with appropriate design rationales based on comparison of requirement satisfaction and analysis of probe results. Design specification with technology and user research would be followed and result in prototype implementation and its user evaluation.



[Fig. 1] Design Process.

## 1.3 Personas

Based on our own predispositions about our target population and research from our initial literature review regarding the social, physical, and emotional aspects of aging [1, 7, 13, 27, 37] as well as the general everyday domestic lives of senior citizens [2, 26], we developed two personas to help empathize with our target population and guide concept development throughout the design process [24]. To avoid many of the common pitfalls associated with persona use in design research, we initially developed one primary and one secondary persona [32].

**Primary Persona:** Diana Longstead



Diana, 66 years old, is the mother of 3 children and the grandmother of 5 grandchildren. She lives with husband Charles and their dog Sibelius in Atlanta, Georgia. Melinda's children are all married by now, living in the northeast and California separately. Among the three families, two of them have kids.

Diana taught elementary school before retiring 15 years ago and, after the retirement of her husband, they began to travel around the world. This time has since past and Diana often finds herself considering what she should do with her life now. Her back has become troublesome, giving her bouts of muscle spasms from time to time, and she has experienced cataracts in the past. She uses a personal computer from time to time to check her email and the weather forecasts for the regions her children now live in. While she used to pride herself on being independent, she now relies on the support of her husband to help motivate her to get out of the house. Increasingly, Diana turns to television and daily crossword puzzles to occupy her time, in addition to often pondering what her loved ones are doing.

**Secondary Persona:** Harris Pierce



Harris, 69 years old, is the step-father of two children that his wife Marion, age 66, has from a previous marriage. Harris lives with his wife in Portland, Oregon and their two step children, Andrew (30) and Tammy (34), live in the neighboring city of Hillsboro.

Throughout his life, Harris has been his own boss and rarely enjoyed having to work under others when he was growing up. Harris has become a fairly successful landscape architect in the greater Portland area and is preparing to sell his business and move into retirement. Harris prefers to be outdoors—oftentimes by himself to quietly reflect on his personal and professional life. After recently being diagnosed with a mild liver condition, Harris has begrudgingly reduced his outdoor activities, spending more time inside than he can remember doing any other time in his adult life.

Harris' wife Marion keeps in frequent contact with her two children through email and text messaging. Harris never really understood why Marion uses these technologies with such frequency when her children already live so close. Generally speaking, even within his long running business, Harris has shied away from technology, preferring to record everything by hand rather than risk losing it on a confusing (and often intimidating) machine. As Harris begins to settle into his soon-to-be retired life, he is already contemplating how he will deal with the encroaching confines of his home.

## 2. Preliminary Exploratory Study

### 2.1 Overall Process

Initially, we conducted semi-structured interviews with two elders aged 69 and 87 living in Bloomington. We visited participants' homes to obtain rich insights about the nature and experience of their daily

lives. The purpose of this preliminary study was to establish a sensibility for understanding elderly participants' lives and draw meaningful insights to guide our design process and project. This study investigated how participants value the direction of their current life in relation to their past experiences, as opposed to focusing on practical problems or needs in daily routines. This study consisted of four distinct parts: (1) interviewing participants about their activities, relationships, and life stories (2) touring participants' homes and documenting personal objects that were highly significant or meaningful, (3) visualizing activities and objects over the house layout—namely through co-developing a *meaning map* and (4) asking general questions about technological use and habits (see Appendix I).

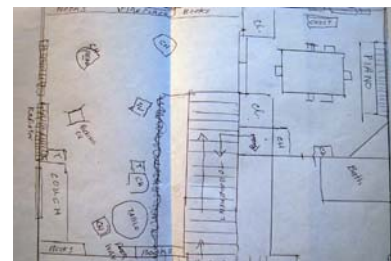
- (1) **Interview about activities, relationships and life stories:** We had a casual conversation with participants about their activities, relationships and life stories with a prepared set of questions. However, the interview was not limited to those questions but guided by them to stimulate responses related to a variety of relevant issues. While participants talked about their stories, researchers noted keyword activities, relationships, and life stories on post-it notes, which were later used in the meaning map exercise.
- (2) **Touring the house:** We asked participants to show us around their house and describe their most favorite, valuable, or meaningful objects and places. While participants explained their objects and places, one researcher took Polaroid pictures of the respective objects or contexts, which were additionally used in the meaning map exercise.
- (3) **Making a meaning map:** After touring the house, we asked participants to draw a layout of the house on the white board and to organize keyword post-it notes and Polaroid pictures of objects according to their placement over the house layout [Fig. 2, 3, 4]. This method of visualizing a meaning map helped establish a broader material and meaning ecology among activities, objects, and places, in addition to provoking participants to discuss a range of different personal stories and histories tied to familiar activates and objects.
- (4) **Interview about using technologies:** Finally, we specifically asked participants about their use of technologies with a prepared set of questions. These technology-centered questions helped us establish a better idea of the different tools and use-contexts that we could consider in our design process in terms of realizing and scaffolding the memories and desires expressed by participants earlier in this study.



[Fig. 2] Materials for meaning map.



[Fig. 3] Meaning map during the study



[Fig. 4] Meaning map during the study

## 2.2 Insights from Preliminary User Study

The purpose of this preliminary exploratory study was to gain a deeper understanding of the everyday lives and interactions of senior citizens within their homes, rather than generalize the results of the two

sessions to cover most elderly people's needs and problems. This study provided a variety of meaningful insights relating our initial design objective—particularly in terms helping generate conceptual ideas with metaphors based on rich contexts and informing the development of our cultural probes.

Specifically, after analyzing the detailed findings of the study, we categorized preliminary design insights into activities, relationships, objects, life stories, and use of technologies. For each category, we defined potential design opportunities based on our initial design objective:

- **Activities:** Elderly people usually have quite much free time. We aim at transforming their daily routines and environments into pleasurable and constructive activities.
- **Relationships:** Relationships with family is important part of elderly life. We aim at provoking supportive and intimate relationships with family- particularly with children and grandchildren.
- **Objects:** Elderly people are quite attached to their old objects due to their original values or memories accumulated over time. We aim at appropriating the emotional attachment as familiar interface for new types of interaction.
- **Life stories:** Elderly people love to reflect their past for explaining an object, activity or place. We aim at supporting reflection and sharing their memories of past experiences.
- **Technology:** Elderly people are not satisfied with new technologies comparing to old ones, which felt more sustainable and friendly to them, although they do not have serious problems in use. We aim at balancing old and new technologies considering their familiarity and acceptance.

Through interpreting relations among those insights, we focused on the role of familiar daily activities, emotional attachment to objects and tendency to reflect their life stories, all of which can be extended as potential interaction or interface of our ultimate design goals. In terms of fundamental users' desire, we extracted two general design directions to stimulate elderly people's daily life:

- **Desire to share past experiences:** Elderly people usually have a strong desire to share past experiences with others in order to reaffirm meanings of their life as well as to share useful learning from past experiences. We aim at supporting their desire to share past experiences and also activating communication with others through those sharing.
- **Respect for unrealized dreams:** Elderly people have some regrets about the past as well as wishes for the future. Those dreams might not be realized in their remaining life. However, they still can bring motivations or new meanings in their life. We aim at supporting and stimulating their dreaming through daily activities for the future regardless of its realization.

Including elderly citizens' daily activity patterns and contexts of life as well as fundamental desires, those directions guided further probe study plan and two sessions of concept generation, which will be described later.

### **2.3 Study Refinements based on Preliminary User Study**

Based on our initial exploratory research we made a variety of refinements to our study. Originally we had the perception that elderly citizens within our target group would be somewhat resistant to using new technology, however we found that our participants had largely and seamlessly integrated technologies, such as the cell phones, computers, and the internet, into their everyday domestic lives. More importantly, we had the perception that many senior citizens had a general lack of activities and that new incentives to promote activity could be beneficial. We found that, in the context of our target group, this was not the case. While the participants of our preliminary study varied quite a bit in terms of their age, they nonetheless both exhibited highly active lifestyles in, around, and outside of their homes. In fact, it was apparent that our participants unequivocally did not need a new device prompting them to engage in more activities. Based on this unpredicted trend, we reworked this study's primary persona to more accurately reflect our target population (see Appendix II), however our secondary persona remained unchanged as it accurately described a portion of the population that our participants reflected in their personal stories and anecdotes (and this description correctly filled the role of a secondary persona).

Prior to our exploratory study we had a concrete general design objective, however our target group was rather broadly defined as senior citizens living independently within their own home. Information collected from our interviews and observations (particularly with participant #1) indicated a strong correlation between senior citizens aged 65-75 years old living independently and, among other things, moderate to high levels of activity, interest in continued self-cultivation and education, desire to maintain connections among friends and family, and general familiarity with technology. Based on these correlations from and sufficient research grounding our observations [2, 13], we narrowed the scope of our target population to seniors between the ages of 65-75 year old and living independently in their own home. This target group represents a substantial and growing population with strong potential to be positively affected by our design objective and outcome, without the major health complications and constraints characteristic of old and very old elderly populations.

### **3. Cultural Probes**

In order to develop a design that would cater to our target population's (i) user requirements and (ii) social and emotional needs, as well as (iii) be capable of seamlessly fitting within the material ecologies of senior citizen domestic settings, we needed to develop a deep sensibility for understanding the experiences characterizing everyday elderly life. While our ethnographic inquires and semi-structured interviews played a key role in helping us develop this design space, we required further information to better take into account the idiosyncratic and acutely personal nature of the domestic setting. Considering these constraints, cultural probes emerged as a novel and worthwhile method to allow our target population to unobtrusively show us the personal and emotional relationship they share with their home, the objects populating it, as well as their friends and family members. Based on our literature review relating to cultural probes [6, 19-21] and researchers' prior experience with this methodology, we developed our probes to have two main components: (i) a disposable camera and diary study as well as (ii) an internet use study (see Appendix for all questions included in probe study).



Researchers together developed questions for the cultural probe study to provoke participants to reflect on emotional relationships they have with spaces and objects within their home. These questions were purposefully left open-ended to allow participants to have the freedom to choose which relationships in they wanted to reveal and subsequently reflect on or interpret these relationships for the researchers. Based on prior knowledge of our participants' frequent use of the internet, we expanded our probe study to include an additional component to (i) gauge participants practical uses of the internet and (ii) use the internet as a medium to provoke participants to further reflect on their ambitions, desires, and imaginings. The probes were deployed in two participants' homes for ten days and participants logged reflections on pictures and experiences on note cards included in the probe package. The probe packages were returned to researchers with extensive notes and a disposable camera full of pictures. In the meantime, while the probes were deployed, researchers continued to develop initial conceptual designs in ideation sessions.

## 4. Design Ideation I: Concept Generation

### 4.1 Conceptual Categories

Based on analysis of our exploratory study and our new personas, we performed an additional literature review to inspire ideas for our first design ideation session. During this session we each wrote our ideas on post-it notes and later grouped all of these ideas into the following five conceptual categories (Figure 5):

- **Agent**  
Elders often feel isolated and lonely as they grow older, it is essential to find and engage in sustained companionship to combat problems of social isolation and depression [2, 26, 30, 32]. Specifically to address this issue, a number of our ideas centered on creating an agent that learns certain things from the outside world, delivers the information to home, and provokes creative or reflective activity [3, 4, 14, 33, 40, 47, 48].
- **Aspirations**  
It is important for elderly citizens to engage in meaningful activities in relation to self-development and contribution to others [13]. A group of ideas focused on provoking aspirations by way of recording and sharing new desires or dreams among a close-knit community of elderly citizens.
- **Storytelling**



[Fig. 5] Design Ideation Concepts

We observed that stories were often by elderly participants to their close friends and family members to teach lessons and to preserve local history [8, 11]. Many of our ideas focused on technology that would aid in this sharing [41, 44]. One such idea was to record participants' memories (or histories) of objects and pictures in the house and for friends or family members to later listen to.

- **Emotional Context**

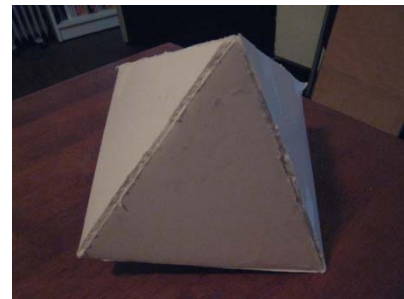
Relationships and closeness with family are an essential part of elderly life [13, 16, 23, 39]. Some of our ideas focused on assisting the emotional aspects of elders by making them feel calm and safe in their house, while connecting to other family members living apart. One such idea was to use LEDs embedded in a blanket to ambiently show a person's status and mood.

- **Photo editing**

Photos are important in everyone's life for remembering the past [33, 44]. The elderly participants that we observed showed strong connection to the photographs adorning their homes. One of our ideas was to decorate certain parts of the wall by projecting images shared and selected by family members across separated homes.

## 4.2 Initial Physical Prototype Development

We created a physical prototype of a pervasive agent device, which took the form of the pyramid (Figure 6). Our rationale for creating the pyramid shape is that, given our target population user requirements, it would be easy to touch as well as be able to connect up to four other people in separate locations. Each face of the pervasive agent device would represent a person you are connected with (who in turn has their own identical device). The user can inform other separated users of their presence by touching the face of the agent that corresponds to that particular remote location. The touch marks left on the faces of the remote agent will fade over time. This agent allows a user to stay 'in touch' with remote users in an ambient way, maintaining a social connection over long distances.



[Fig. 6] Initial Physical Prototype

# 5. Design Ideation II: Concept Specification

## 5.1 Conceptual Sketches

Before our second ideation session, each group member individually developed a number of more concrete ideas based on initial ideation session and further independent research. At the beginning of the session each group member presented and discussed their ideas with the group. Below is a table with all these concepts and brief descriptions, which were based on the conceptual categories developed during this design ideation session.

Concept Title	Description
Mutual sharing of memories with friends and families	This concept is to create a device that could be used to share memories and reflections about an object or thing. A network of people can be connected to an elderly person. The elderly person can share memories and reflections with all the other four people connected to this system.
Understanding the contemporary world through the past	This concept is about using pervasive technology to make the elders aware about the current world.
Memory calendar	This concept is about creating or augmenting the existing calendar to keep record of the daily events and also as a memory mapping device.
Ambient Plant Interaction	This concept is about ambiently displaying domestic activity in central rooms to connect family members living apart from each other and display the emotional climate of the household.
Secret Messages	This concept is about reinforcing and extending the unique connection between grandparents and grandchildren
The Hummingbird Metaphor	This concept is about using the metaphor of a surprise humming bird encounter to provoke/stimulate creative activity
Tangible Sharing & Editing of Photos	This concept is about using easy, intuitive, and enjoyable tangible manipulation of photos to create new co-experiences and to share newly edited photos among separated family members
Story of Things	This concept suggests a system to record and play personal stories or memories in relation with specific objects. Recording module will be attached to existing objects and stories recorded in objects will be shared and played through a main device
Family Jukebox	This concept suggests a system to exchange cultural contents- particularly music files, between grandparents and grandchildren.
Avatar Playground	This concept suggests a system that represents agents of family members. Each family member can reflect their status or define their characteristics through their agents that will be displayed on screens embedded in wall or floor of house.
Multi-household virtual pet	The multi-household virtual pet takes the feelings of mutual ownership and enjoyment of caring for and interacting with a single-household pet, and expands it to multiple remote households
New activity TV recommender	The new activity TV recommender encourages increased activity in television viewers by recommending local activities based on the content viewed through the television.

## 5.2 Design Objectives & Alternatives

We then explored potential ultimate design objectives based on commonalities among our ideas. The following design objectives are the result of that discussion:

- artistic interaction to provoke creative experience
- practical production interaction for later sharing experience
- to create a feeling of being connected or supported

- unrealized desires, dreams
- develop nurturing interaction to evoke feeling of caring for something
- provoke or create new aspirations in everyday life

In order to fulfill one or more of these design objectives, we decided to analyze our ideas based on several different ways of achieving these goals in a pervasive computing context, which we refer to as “design alternatives.” We specified these alternatives in relation to technical implementation, contexts of use and user interfaces (see detailed concept explanations in Appendix V):

- **Focus of interaction:** Within this context we first categorized our concepts into **(i) practical or (ii) rich interactions**. For practical interaction, the focus lies on direct information sharing or communication with others. Thus, the interaction style or interface design should be seamless and transparent to meet users’ practical goals of using the system. On the other hand, rich interaction focuses on the rich sensory affordance and feedback. This direction aims at providing users with emotional stimulation, rather than direct practical information.
- **Types of user connection:** Considering one of our design objectives being to evoke a feeling of social connection and support, most of our design concepts aim at communication among family members. We categorized these design alternatives for this objective into **(i) direct and (ii) indirect types of communication**. For example, direct connection among users provides real time communication that immediately involves all users. In contrast, indirect connection evokes the feeling of being connected through asynchronous or ambient information sharing.
- **Mobility of system:** In relation to contexts of use, we consider distinctions among mobility of system as **(i) stationary, (ii) autonomous in house, and (iii) totally pervasive**. The first two directions assume the context of use as the home while the last direction considers total portability for our ubiquitous device.
- **Forms of prototype:** Potential prototype forms that we considered are categorized by **(i) augmented existing objects, (ii) screen-based interaction or (iii) embodied agents**. The first direction adds interactive features to existing objects—building on its already established meaning, contexts, and familiarity of use. The second direction is to develop a screen-based interface focusing on conveying meaningful information. The final direction is to develop a personified or autonomous agent to provide direct, embodied interaction.
- **Types of sensory I/O:** This design alternative considers types of sensory input and output, such as **(i) visual, (ii) auditory, or (iii) tactile** input and output. These I/O parameters will be used to support the ultimate design outcome.
- **Types of information:** We conceptualized two main ways information may be delivered or displayed: **(i) symbolic/ ambiguous or (ii) specific/exact**. The first direction is related to ambient information display using colors, sounds or kinetic movements that are widely open to the users own interpretation of their meaning, while the second direction employs specific textual phrases or discrete numbers to convey exact information.

The categories described above also form a foundational set of requirement criteria that helped us develop and finalize our ultimate design concept during and after analysis of cultural probe data. We decided to focus on emotionally or sensory rich interaction opposed to providing practical information to support task-based activities. By providing new types of rich interaction, we aim to stimulate the pleasurable, creative, or social sides of users’ everyday lives. Similarly, we focused more on indirect communication rather than direct to subtly enhance users’ lives by providing a new way of receiving

information opposed to popular communication channels such as phone calls or video chatting. Also, our research and observations indicated that elderly people generally have more free time by themselves and tend to live apart from their children or grandchildren, making it difficult to always be connected to each other in real time. Furthermore, indirect communication offered strong potential to naturally fit within the daily contexts of our users.

In regards to context of use, the domestic environments we observed presented fertile ecologies of familiar objects and interactions onto which we could enhance or introduce a new object into. Therefore, a stationary or autonomous system in the home, in forms of either augmented existing objects or embodied agents were mainly considered as design outcomes. In other words, we aimed to reduce the use of text on information displays and input with typical buttons as much as possible considering elderly citizens' cognitive and physical hardships with using such devices. Based on this direction, we were open to employ visual, auditory or tactile input and output to address these constraints. Lastly, in one major design direction, we aimed to incorporate symbolic meanings into familiar objects to unobtrusively convey information across households.

## 6. Cultural Probe Analysis

The cultural probe data provided us with a personal glimpse into interesting objects, memories, desires, interests, dislikes and also few mundane activities of our target population. Our analysis of the cultural probe data involved (i) a discussion session about emergent themes across the pictures and written information provided by participants, (ii) a brainstorming session focused on how probe data could inform our already existing conceptual ideas, and (iii) a design session to finalize our project's concept.

Before beginning the probe analysis, we organized all the pictures and their corresponding notes (Figure 7). During this time, one of us read the information corresponding to each photograph, while another person entered all the notes into a document (see Appendix VI). Upon completing this process, we discussed how the pictures and note collectively reflected each participant's everyday life. While participants had a similar set of tasks to complete for the probes, their responses provided a variety of different outcomes. Pictures and responses from participant#1 tended to be more nostalgic and describe the histories of objects common to his everyday life, whereas participant#2 was focused much more on practical aspects of activities in her everyday life.



[Fig. 7] Cultural probe pictures, note cards, and diary letters.

The pictures taken by Participant#1 illustrated his interests in (i) sharing the memories of all the awards and accolades received during his service for the country, (ii) care for the nature and environment, (iii) close-knit family relationships, and (iv) common hobbies and activities within the house. The pictures taken by our Participant#2 highlighted her interest in (i) family (and particularly her grandchildren) (ii) wonders of nature, (iii) heirloom objects adorning her house, and (iv) activities for self-betterment (e.g. yoga).

We discussed in detail about all these categories to identify some common patterns among the participants. Both the participants took a variety of pictures of their family and noted that they prefer to spend considerable amounts of time with their children and grandchildren whenever possible. For instance, participant#1 meets his grandchildren every week for lunch and participant #2's grandchildren often visit for extended stays. Apart from family relationships, participant#1 grows a variety of vegetables and fruits in his house. Participant#2 maintains multiple bird feeders in her backyard that are visible from her breakfast table. These examples characterize the two main themes that emerged from our cultural probe data: *caring* and *sharing*. For both the participants, *caring* related to their close relationships with the family members and the environment, while *sharing* related to conveying their memories and stories to other people. After establishing these two themes, we compared them to our design objectives:

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Caring</li> <li>• Sharing</li> </ul> | <ul style="list-style-type: none"> <li>• artistic interaction to provoke creative experience</li> <li>• practical production interaction for later sharing experience</li> <li>• to create a feeling of being connected or supported</li> <li>• unrealized desires, dreams</li> <li>• develop nurturing interaction to evoke feeling of caring for something</li> <li>• provoke or create new aspirations in everyday life</li> </ul> |
|---|---|

Considering our participants already exhibited a high level of activity in their everyday life, we decided to eliminate the objective of *provoking new aspirations in their life*. Additionally, due to the increased focus on *caring* and *sharing* in our project at this stage, the objective of *promoting artistic interaction to provoke creative experience* and *stimulating unrealized desires and dreams* became out of scope. After these eliminations, the remaining objectives were:

- to create a feeling of being connected or supported
- develop nurturing interaction to evoke feeling of caring for something
- practical production interaction for later sharing experience

We mapped our conceptual design ideas based on these three concepts against the two themes.



- Tangible Sharing & Editing of Photos
  - Story of Things
  - Multi-household virtual pet

We then discussed each idea and how it fit within these two general objectives. *Mutual sharing of memories* and *tangible sharing & editing of photos* are both deeply related to sharing memories of objects and pictures, thus we grouped them under *sharing*. *Story of things* focused more on *sharing*, while having some qualities associated with *caring*. *Multi-household virtual pet* is characterized by evoking a feeling of presence and companionship, qualities strongly lending it to be classified under *caring*. Finally, *ambient plant* strongly represented the characteristics of both *sharing* and *caring*.

Mapping all of our final conceptual ideas on the *sharing-caring* continuum allowed us to compare and critique the benefits and drawbacks offered by each. 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 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 (initial concept pictured in Figure 8).



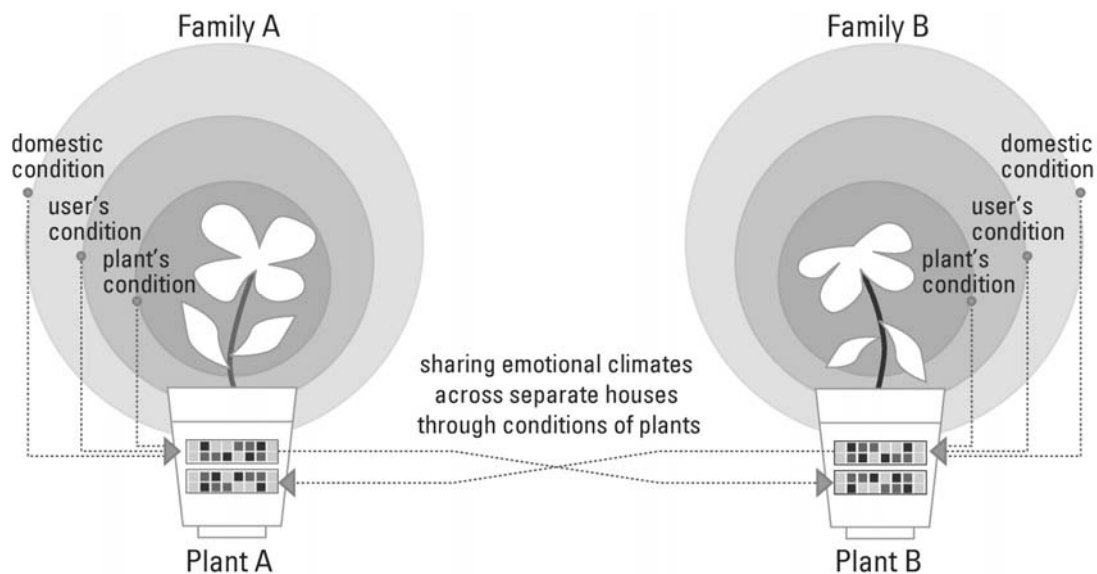
[Fig. 8] Concept Specification.

## 7. Final Concept Direction: Ambient Plant

### 7.1 Concept Description

The ambient plant design concept seeks to (i) provide separated family members with a sense of social connection through the presentation of ambient information and (ii) provide family members with a sense of each other's presence. Based on our literature review, ethnographic inquiries, and cultural probe analysis, we determined that our target population exhibits a strong inclination to maintain social connections with their close family members and friends. The ambient plant supports and stimulates these social connections through a series of ambient displays of LED lights integrated into the pot of a normal houseplant. Informal discussions with our participants revealed that when they are experiencing stressful times or are very busy, they generally tend to neglect their house plants—revealing a key indicator of a household's shifting emotional climate. Furthermore, our participants noted that they commonly took care of a wide array of different types of plants within their homes.

The ambient plant is intended to connect family members living in separate homes by sensing the moisture levels of the living plant and displaying this information through a series of colorful LEDs on one display located on the plant pot (Figure 9). Along with these readings, the moisture level information from participants' separated family members' household plant is also displayed. The ambient plant pot allows members from both households to keep track of the wellbeing of each others' respective plants. In this context, the familiar everyday practice of watering and caring for the plant is transformed into a symbolic act to check in on the condition of close family members as well as the broader emotional climate of their domestic household. Additionally, when a family member is standing in front of their plant, the connected pot within the separated 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 [40, 46]. 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 an already existing domestic object and practice.



**[Fig. 9] Conceptual Model of Ambient Plant**

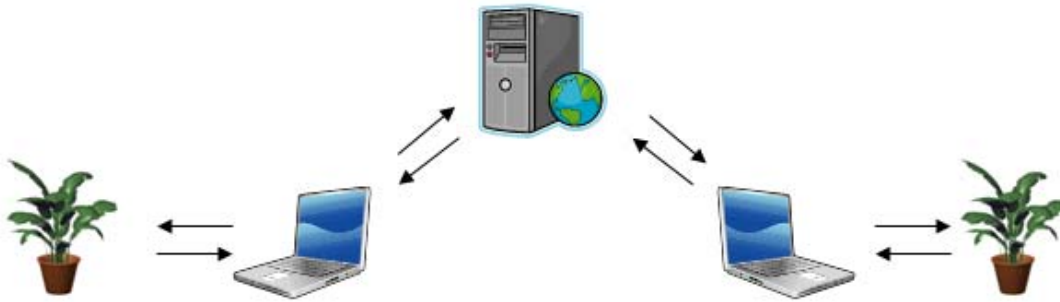
## 7.2 Future Directions of the Ambient Plant

Currently, we are still considering how the ambient information will be conveyed on the plant part—particularly in regards to the LED colors and pattern that will be engrained in the ambient plant pot. We have developed a variety of different representational patterns and selected an initial grouping of colors, however we plan to finalize these notions after discussion with elderly participants. During this same discussion, we plan to present conceptual sketches and a semi-functional physical prototype of the ambient plant to elicit further feedback and criticisms from our target population. Additionally, we are in discussion with a botanist about the most appropriate plant to use in regards to our moisture sensing demands and master potter has agreed to create a custom ambient plant pot to house LEDs, sensor technology and the plant after our initial physical prototype has been developed and final



specifications are established. We expect that these specifications will be completed soon after a review of our technical specifications is completed.

### 7.3 Technical Specifications



[Fig. 10] System Architecture for Ambient Plant Pot.

The ambient plant architecture consists of three main components: the plant pot (with associated sensors and wireless transceiver), the plant owner's personal computers, and the web server (Figure 10).

- **Plant Pots**  
The plant pots collect data about the health of their plant, transmit that data, and receive and display data about the health of the remote plant. The pot will most likely determine the health of the plant by sampling the moisture of the soil. It will report that data continuously via a wireless connection to the owner's personal computer. Similarly, the plant will also be continuously updated on the health of the remote plant, by receiving data wirelessly from the personal computer. The pot will then display that information in a soothing ambient manner, possibly a glowing ring or LED, which becomes greener when the remote plant is healthy and redder when the remote plant is unhealthy. Ideally the wireless transceiver would be something cheap and small which fits into the pot itself, but for the purpose of constructing a prototype it could potentially be simpler to connect the sensors to a laptop which uses a conventional wireless LAN connection to transmit data.
- **Personal Computer**  
The owner's personal computer will have software installed which collects and interprets the data transmitted by the plant pot. The personal computer will update a web server with the collected information, through an internet connection. Also, the personal computer will download health information about the remote plant that has been added to the web server, and transmit that information to the local plant pot.
- **Web Server**  
The web server plays the role of mediator, acting as a central repository of health information for both plants. Each personal computer will send the health information for their plant to the server, and also look to the server to find the health information of the remote plant. Each pair of plants will have a shared identification number, so one plant will know which other plant is its counterpart. Although we have no plans to provide anything more than the basic functionality described above for the purposes of our prototype, The use of a web server also has some interesting side benefits, such as the option of

creating a web site that displays the plant health data in a more in-depth way than is available through the simple ambient display attached to the plant pot itself.

- **Sensors**

We will most likely require a 2 phidget interface kits, 2 moisture sensors, a series of LEDs, 2 LED controllers, and an infrared motion sensor.

## **7.4 Design Concept Evaluation**

The ultimate goal of the ambient plant is to support and evoke feelings of social connection among separated family members by subtly providing ambient information in the context of everyday domestic life. After developing our initial prototype (expected around November 20<sup>th</sup>), we plan to deploy ambient plants within the homes of two related participants that resemble our target population. After these prototypes have been deployed for ten days (around December 1<sup>st</sup>), we plan to visit our participants homes and conduct a follow-up study to evaluate the initial ambient plant prototype. Given the highly subjective area of emotional and social attachment, we will use a series of questions to elicit qualitative responses to probe different aspects of user experience. The general question themes explored during this evaluation session will be:

- How does the ambient plant really support social connectedness?
- How effective is this prototype in (i) fitting within domestic context and (ii) delivering ambient information?
- Has this prototype altered in any way how participants relate to the plant?
- Does this prototype support any unexpected fun or pleasure in users' daily routine?
- How do participants interpret the symbolic ambient information provided?
- Did any major technical problems occur during the pilot study?

The topic of Human-Plant interaction is becoming an increasingly popular within HCI. While there have been a few initial studies examining the possibilities of using sensors to provoke increased interactions and relationships with plants [28, 29, 31], none so far have attempted to project connections through plant interactions to promote the social and emotional wellbeing of elderly citizens. As an additional component to this project, we plan to report the initial results of our pilot study in a work-in-progress submission to CHI 2008.

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# Appendix I

## Questionnaire for Preliminary User Study

### 1) Interview about activities, relationships and life stories:

- Could you describe your daily activities? (from morning to night) ?
- Could you describe your social or family relationships?  
(Who do you mainly communicate or get along with?)
- Could you describe your life story?  
(happiest moment, hard times, successful achievements, regretful moments, etc)
- As you look back on your life, do you feel it is different than, say twenty or thirty years ago? If so how does it differ?
- Have your ambitions or desires shifted from 20 or 30 years ago?  
How so, could you describe them currently?

### 2) Interview about using technologies:

- How do you generally use technology in your daily life?
- What kinds of technologies do you use most often? like? Prefer?
- What technologies make you the most frustrated?
- Are there any older devices from 20, 30, 40 years ago that you are nostalgic about?
- Imagine that you are 10 or 20 years back into your life without current technologies...  
was your life easier in any way then?

### 3) Some additional questions we asked during the course of the interview

- We also of course asked her about her home, as she was doing the mental map.
- We asked about her hobbies and interests.
- We specifically asked about what non-family friends she had.
- We talked with her about her couch, TV, phone, computer, living room chair, kitchen chair, kitchen cabinets, calendar and notebook.

# Appendix II

## Refined Persona

**Primary Persona:** Diana Longstead



Diana, 66 years old, is the mother of 3 children and the grandmother of 5 grandchildren. She lives with husband Charles and their dog Sibelius in Atlanta, Georgia. Melinda's children are all married by now, living in the northeast and California separately. Among the three families, two of them have kids.

Diana taught elementary school before retiring 15 years ago and, after the retirement of her husband, they began to travel around the world. This time has since past, however Diana often remains busy baking, sewing, and volunteering in a variety of local organizations. Her lower-back has become troublesome, giving her bouts of muscle spasms from time to time, however she regularly practices yoga to relieve uncomfortable aches. A more pesky and troubling problem for her is a recurrent bout with cataracts. Diana often uses a personal computer to shop online and check her email, the latest news, and the weather forecasts for the regions her children now live in. Diana has largely maintained her independence, however she often thinks back to when she was younger and felt freer to venture out into the world. While quite active in her own life, Diana still often ponders what her loved ones are doing.

# Appendix III

## Plan for Probe Study

### 1) Disposable Camera Study

- Take about 5 pictures of objects that you like, hate or, are useful to you.
- Take about 5 pictures of pictures in your house that make you feel (miss) past experience, (or motivate) future action.
- Take about 5 photos of activities you find enjoyable.
- Take a photo of an object or place that evokes some emotion.
- Take a photo of a place, object, or activity that tells story about you.
- With the final photos take picture of anything you would like.

### 2) Internet Surfing Study

- **Travel**
  - Do you have any ideal places you want to go?
  - Have you ever searched for those places through the Internet?
  - Could you find the place through the Internet?  
Which information did you find about it?
  - How do you feel about the place after surfing the Internet?  
(Do you find the place is where you really want to visit? why or why not?)
- **Shopping**
  - Do you have any items you want for your birthday present?
  - Have you ever searched for those items through the Internet?
  - Could you find the item through the Internet?  
Which information did you find about it?
  - How do you feel about the item after surfing the Internet?  
(Do you find the item is what you really want to have? why or why not?)
- **Education**
  - Do you have any areas of interest that you want to study (or that you regret for not studying much in the past)?
  - Have you ever searched any information how to study them?  
(for example, related books, educational programs, institutions or communities)
  - Could you find any useful information? Which information did you find about it?
  - How do you feel about the potential opportunities of further education?  
(Are you still interested in those areas of study? Why or why not?)

# Appendix IV

## Concept generation and organization during initial ideation session

### Agent:

- **Agent based communication or memory-sharing device (something like a Rabbit-Robot)**  
The idea behind this agent is to help the elders share their memories among their families' members and friends. Apart from sharing memories, this agent will keep the elders engaged with some kind of activity which will make the elders happy.
- **Digital companion**  
This agent will have a Small screen embedded to some kind of creature that does amusing things throughout the day, senses ambient conditions (wakes up to noise, knows day vs. night). This is more or less like a pet to the elders that will create a presence of another person in the home.
- **Object genealogy**  
The idea behind object genealogy is to create an agent that will create a network of stories of all the objects in the home of the elderly. This will help the elderly to keep track of their memories and also useful in sharing with others.
- **Humming Bird**  
The hummingbird idea originated from one of our participants who have a bird feeder in her home and she loves to watch the birds feeding from it. We thought of creating an agent that resembles the humming bird and this could deliver some information or voice of the grandchildren's to the elders.  
We tried to augment this idea by employing Context enriched bird's presence, series of light may show frequency of birds, or supplement the time they are gone in the winter.

### Aspirations:

- **Hobby recommendation generator**  
Hobby recommendation generator is a device that will generate hobbies for the elders based on informations from their current hobbies, physical constraints, and other factors. This will keep the elders engaged to do something they like to do. This device will generate hobbies from elder's favorite television shows, favorite movies and also from various other sources.
- **Participation**  
This concept is about creating some kind of activity or community participation among the elders to provoke their dreams and create aspirations in their life.
- **Information calendar**  
Information calendar will be an augmented calendar, which can keep track of all the past and the future events. This device can also remind the elders about memorable things happened in the past.

### Story telling:

- **Family Facebook**  
Each family member will have a customized page that will reflect them. This will help the elders to keep track of all the family members and also facilitates family communication.
- **Picture in wallet**  
This is an enhanced version of "pictures in wallet" phenomenon.



- **Story telling campfire**

Elders are always interested in sharing their stories with the grandchildren's. This concept will help the elders to share their stories with grandchildren's living in the different part of the nation.

- **Sharing experience as a means of charity**

Sharing past experience as a means of charity is about contributing to oral history archive of town. This will help the present and the future generations to have a better understanding of the place they live and its history through someone who has experienced it.

## **Photo editing**

- **Tangible editing of photos**

Sharing and editing pictures across network of grandparents and grandchildren would enable them reflect on the pictures and also a way of sharing memories.

- **Sharing photos**

With the help of modern technologies it is very easy to share a photo from a mobile phone or camera to a digital display. Family and friends can share interesting pictures from their phones and cameras to the elder's home.

# Appendix V

## Conceptual Ideas with requirement criteria

#1 Mutual sharing of memories with friends and families.	
Sketches	
Background	This concept is to create a device that could be used to share memories and reflections about an object or thing. In the sketch, four people are connected to an elderly person. The elderly person can share memories and reflections with all the other four people connected to this system.
Main purpose	<ul style="list-style-type: none"> <li>• Reflecting on the objects and pictures that evoke memory.</li> <li>• This helps in sharing memories with the loved ones.</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>• Rich interaction</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>• Directly connecting family members and friends.</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• The outcome device could be an augmented existing object or screen-based interaction</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>• Stationary</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Information will be reported across/between context of homes.</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Input: Information can be shared as audio or visual (camera and microphone).</li> <li>• Output: there will be a visual display along with audio.</li> </ul>
Types of information	<ul style="list-style-type: none"> <li>• Information shared will be relevant to the objects or pictures shared.</li> </ul>
#2 Understanding the contemporary world through the past.	
Sketches	

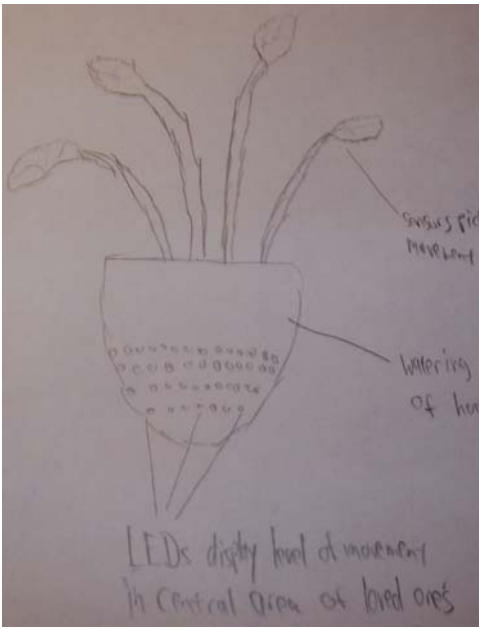
Background	<p>This concept is about using pervasive technology to make the elders aware about the current world. In the sketch, an elderly person is learning about the improvements in the phone by specifying the phone he is familiar with.</p>
Main purpose	<ul style="list-style-type: none"> <li>To keep updated or learn about the current world.</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>Rich interaction</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>Indirectly connecting family members.</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>The outcome device will be a screen-based interaction</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>Stationary</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>Information will be reported across/between context of homes.</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>Input: Information can be shared as audio or visual (scanners, camera and microphone).</li> <li>Output: it could be either a Television or a visual display.</li> </ul>
Types of information	<ul style="list-style-type: none"> <li>Information shared will be about a particular object, device or something that has changed over a period of years.</li> </ul>

**#3 Memory calendar**

<p>Sketches</p>	
Background	<p>This concept is about creating or augmenting the existing calendar to keep</p>

	record of the daily events and also as a memory mapping device.
Main purpose	<ul style="list-style-type: none"> <li>• Memory mapping and event organizer.</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>• Rich interaction</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>• Indirectly connecting family members.</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• The outcome device will be an augmented existing calendar.</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>• Stationary</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Input: Information could be fed using the touch panels and also through wireless communication.</li> <li>• Output: Interactive visual display.</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Information will be about memories and events.</li> </ul>

#### #4 Ambient Plant Interaction

Sketches	
Background	This concept is about ambiently displaying domestic activity in central rooms to connect family members living apart from each other and display the emotional climate of the household.
Main purpose	<ul style="list-style-type: none"> <li>• Convey information across separated family members.</li> <li>• Convey emotional state of household to loved ones.</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>• Minimally rich interaction, peripheral display</li> <li>• Human-Plant Interaction</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>• Indirectly connecting family members.</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• The device would be sensors built into a plant pot (with a living plant in it). The outside of the plant would have LEDs to indicate changes in activity and</li> </ul>

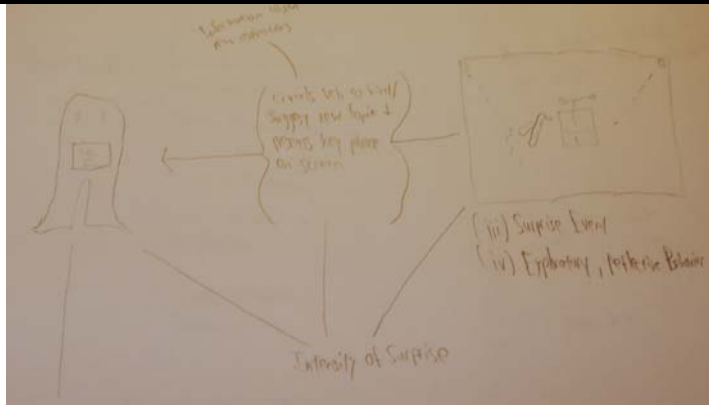
	emotional climate.
Mobility of system	<ul style="list-style-type: none"> <li>• Stationary</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Input: Information is collected through motion and moisture sensors</li> <li>• Output: revolving LED display.</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Raw information is about daily movement and moisture levels in the plant. Considering the context the design would be implemented, this information would convey attachment among family members and provide insight into the local social/emotional order of the context.</li> </ul>

**#5 Secret Messages**

Sketches	
Background	This concept is about reinforcing and extending the unique connection between grandparents and grandchildren.
Main purpose	<ul style="list-style-type: none"> <li>• The main purpose is to increase the sense of secrecy and immediacy between grandparents and grandchildren</li> <li>• Trade secrets between each other in a safe environment</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>• Speech , social exchange in a safe environment</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>• Directly connecting grandparents and grandchildren</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• The device would assume the shape of a comfortable, inanimate object that is unassuming and conforms to the user requirements of both children and senior citizens</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>• Stationary (can be picked up and held by users)</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Input: Voice/Sound recordings , RFID to unlock secrets</li> <li>• Output: Sound recordings, blinking signal to alert users that a new secret is awaiting</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Raw information is sound input and RFID frequencies. This design is to be implemented in an environment both users feel very safe in (the bedroom according to our research). Users then speak and trade secrets, which await other users and can only be unlocked by a special RFID keychain (to preserve feelings of safety and security).</li> </ul>

**#6****The Hummingbird Metaphor**

Sketches



Background

This concept is about using the metaphor of a surprise humming bird encounter to provoke/stimulate creative activity.

Main purpose

- Use the spontaneity of a humming bird visit to trigger and provide new information about an interesting subject to pursue

Focus of interaction

- The focus of the interaction is on a personified agent that recommends a new area to study in the fleeting moment after a humming bird has visited a feeder.

Types of user connection

- Connecting participants to their desire to develop new knowledge and pursue lifelong education.

Forms of design outcome

- The device would be sensors built into a plant pot (with a living plant in it). The outside of the plant would have LEDs to indicate changes in activity and emotional climate.

Mobility of system

- Stationary

Types of data distribution

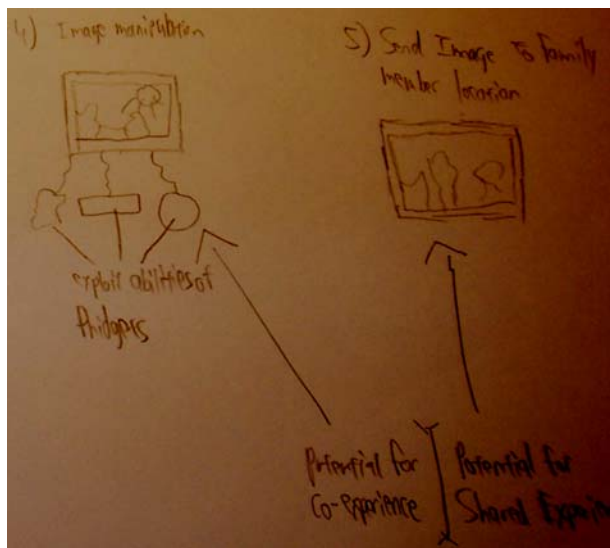
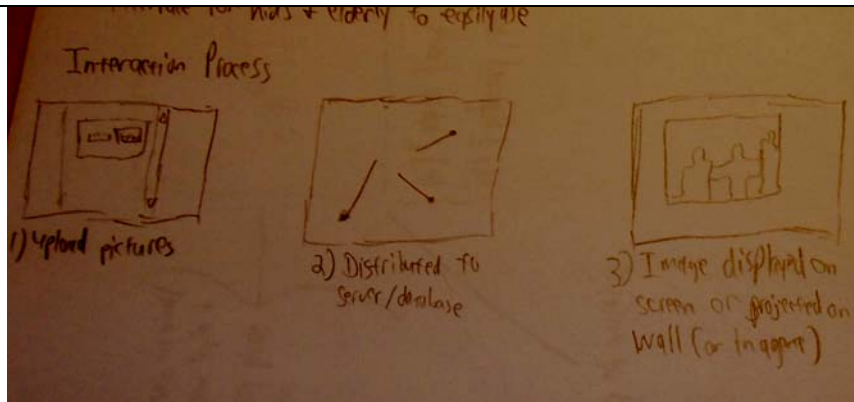
- Input: Information is collected using motion sensors and then triggers recommendation.
- Output: A new subject recommendation is displayed on a small LCD monitor (on a personified agent).

Types of sensory I/O

- The information provided is textual and hopes to catch a user in a moment of creative, exploratory behavior.

**#7****Tangible Sharing & Editing of Photos**

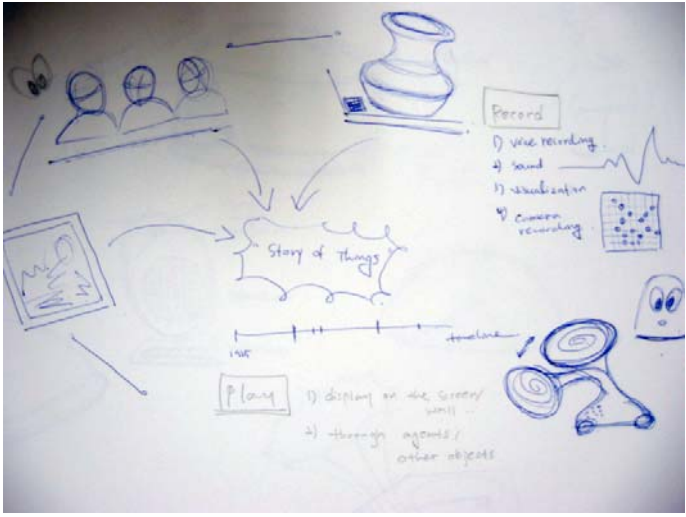
Sketches



Background	This concept is about using easy, intuitive, and enjoyable tangible manipulation of photos to create new co-experiences and to share newly edited photos among separated family members.
Main purpose	<ul style="list-style-type: none"> <li>To build on the increasing pervasiveness of digital photos and new potentials to craft co-experience through tangible manipulation.</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>The focus of interaction is on using tangible objects made of different material qualities to produce different effects on the photos.</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>This prototype connects users both immediately and over distances (directly &amp; indirectly).</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>The device would have a various tangible controllers and the interactions would be realized on-screen.</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>Stationary</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>Input: Pressure, motion, acceleration sensors would be embedded within tangible objects</li> <li>Output: These values would be fed through to a Flash application and then alter the photos in a variety of ways.</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>This information provided is new, remixed pictures as a means of crafting co-experience and connections across separated family members/households.</li> </ul>

**#8 Story of Things**

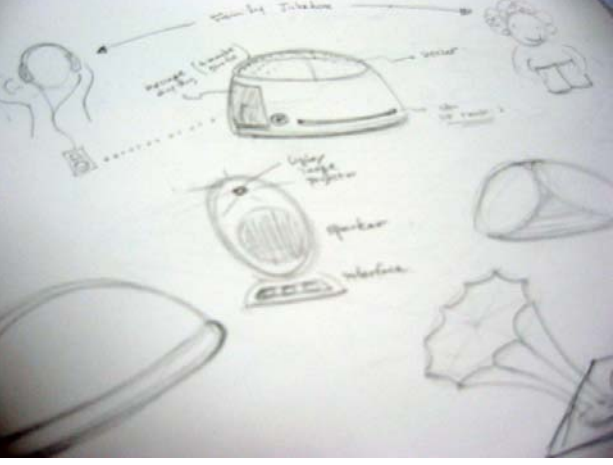
Sketches



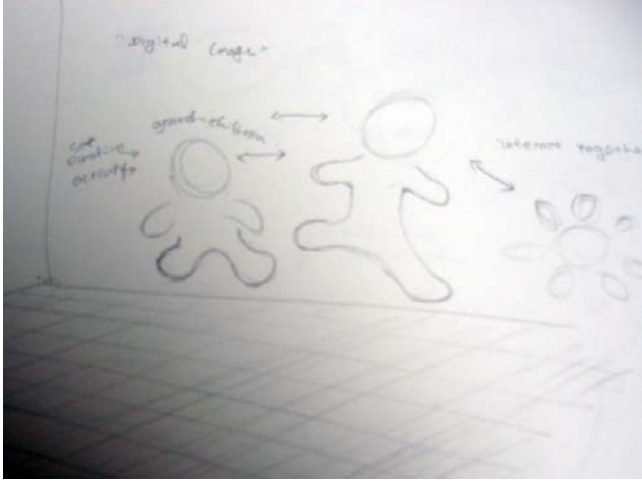
Background	This concept suggests a system to record and play personal stories or memories in relation with specific objects. Recording module will be attached to existing objects and stories recorded in objects will be shared and played through a main device.
Main purpose	<ul style="list-style-type: none"> <li>• Reflection of old memories through archiving stories</li> <li>• Communication among family members through sharing stories</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>• Practical interaction to share stories</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>• Indirectly connecting family members through asynchronous story-sharing</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• Recording device (module) attached to existing objects (ex: RFID tags)</li> <li>• Playing device to detect and play recorded stories/information of existing objects</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>• Recording device (module): stationary (attached to existing objects)</li> <li>• Playing device: portable in domestic context</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Reporting on status of home (data recorded in existing objects and reported to a main playing device within home)</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Input: recording narrative stories (voice) or manipulating tactile patterns according to users' memories toward a specific object</li> <li>• Output: playing auditory stories or displaying visual patterns</li> </ul>
Types of information	<ul style="list-style-type: none"> <li>• Specific (narrative) stories</li> <li>• Ambiguous visual patterns</li> </ul>

**#9 Family Jukebox**



Sketches	
Background	<p>This concept suggests a system to exchange cultural contents- particularly music files, between grandparents and grandchildren. It is expected that elderly people would have more opportunities to learn current technologies and cultural trends according to the recommendation from their grandchildren as well as to be emotionally connected with them.</p>
Main purpose	<ul style="list-style-type: none"> <li>• Communication among family members through sharing and playing multimedia contents</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>• Practical interaction to recommend and share multimedia contents</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>• Indirectly connecting family members through recommending and sharing multimedia contents</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• Main device to share and play multimedia contents (Grandparents)</li> <li>• Portable device to play or send multimedia contents (Grandchildren)</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>• Stationary main device</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Reporting across/between context of homes</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Photo, music or text message</li> </ul>
Types of information	<ul style="list-style-type: none"> <li>• Specific music files and messages</li> </ul>

<b>#10</b>	<b>Avatar Playground</b>
Sketches	

	
Background	<p>This concept suggests a system that represents agents of family members. Each family member can reflect their status or define their characteristics through their agents that will be displayed on screens embedded in wall or floor of house. Elderly people can get brief information about what other family members are doing or just watch their autonomous interactions for fun.</p>
Main purpose	<ul style="list-style-type: none"> <li>• Communication among family members through individual agent</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>• Rich interaction to represent their status or watch others'</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>• Indirectly connecting family members through autonomous agents</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• Screen-based interaction (embedded in wall or floor of house)</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>• Stationary main screen</li> <li>• Portable input device using computers or mobile phones</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Reporting across/between context of homes</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Input: visual (selecting or define graphic icons)</li> <li>• Output: visual patterns</li> </ul>
Types of information	<ul style="list-style-type: none"> <li>• Ambiguous visual patterns</li> </ul>

<b>#11 Multi-household virtual pet</b>	
Sketches	
Background	<p>The multi-household virtual pet takes the feelings of mutual ownership and enjoyment of caring for and interacting with a single-household pet, and expands it to multiple remote households. It facilitates emotional connection both through direct interaction with the pet (petting, feeding, etc...), as well as through the use of the pet as a means to transfer messages (sending the pet media through the home network, which is later delivered to the target family). The pet would "hold up" the media on the screen. Also, the pet would only exist in one household at a time, making the pet seem to exist in physical space, and leading to feeling of anticipation for when the pet would arrive.</p>
Main purpose	<ul style="list-style-type: none"> <li>• Connect family members or friends through shared interaction with pet</li> </ul>
Focus of	<ul style="list-style-type: none"> <li>• Practical interaction, to have fun with pet and share media</li> </ul>

interaction	
Types of user connection	<ul style="list-style-type: none"> <li>• directly connects family members through media and mutual care of pet</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• Small touch-screen</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>• Can be moved anywhere in house (wireless connection to computer)</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Transfers media from one household to another</li> <li>• Pet carries over mood from previous households to current household</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Visual output</li> <li>• Haptic (touch screen), and personal computer based input (for media exchange)</li> </ul>
Types of information	<ul style="list-style-type: none"> <li>• Text, photo, or video exchanges between family members.</li> <li>• Mood of pet</li> </ul>

**\*12 New activity TV recommender**

Sketches	
Background	The new activity TV recommender encourages increased activity in television viewers by recommending local activities based on the content viewed through the television.
Main purpose	<ul style="list-style-type: none"> <li>• Encourage more active engagement in the user's interests</li> </ul>
Focus of interaction	<ul style="list-style-type: none"> <li>• Passively collects information based on content watched on user's TV</li> </ul>
Types of user connection	<ul style="list-style-type: none"> <li>• Connects user with their immediate outside world (activities and people in their town/city)</li> </ul>
Forms of design outcome	<ul style="list-style-type: none"> <li>• Standard screen with connection to internet (for TV listing information), and a connection to the TV itself.</li> </ul>
Mobility of system	<ul style="list-style-type: none"> <li>• Connected to TV</li> </ul>
Types of data distribution	<ul style="list-style-type: none"> <li>• Reads information from internet and TV</li> </ul>
Types of sensory I/O	<ul style="list-style-type: none"> <li>• Visual output</li> </ul>
Types of information	<ul style="list-style-type: none"> <li>• TV Listings and TV viewing channels / times as input</li> <li>• Activity recommendations as output.</li> </ul>

# Appendix V

## Probe Study Data

Notes from Participant #2 probe

Picture Study:

Photo #1:

- Picture of husband outside of house, fond memories living there convenient to shopping and school for son

Photo #2:

- At brother Don' s house, take care of five dogs while they are away for the week

Photo #3:

- This house is where Ruth first met good, lifelong friends.

Photo #4:

- Bloomingfoods—showing organic, healthy foods

Photo #5:

- Bloomingfoods—Halloween, goes there for fresh chicken without hormones or steroids

Photo #6:

- Indiana Theater—brings back old memories of when she went there as a kid and aunt worked there

Photo #7:

- Bloomington Courthouse—lovely place to visit when they light the Christmas lights, very knowledgeable about local history

Photo #8:

- Friend Pat and her having food for lunch together at a restaurant.

Photo #9:

- Picture of the bridge group—playing game with local friends

Photo #10:

- Bridge game at friends house with 8 ladies in the group

Photo #11:

- Playing bridge, playing cards with money on the line

Photo #12:

- Bridge—“Senior Moment” for taking extra picture

Photo #13:

- Yoga studies in Nashville, IN , inside view,

Photo #14:

- Yoga studies in Nashville, IN, outside view of colorful Fall leaves—“enjoy the class but ambivalent about the drive home (because of deer)”

Photo #15:

- Eating Pizza after IU football game in her dining room (kids want more attention than she can handle)

Photo #16:

- Grandchildren in a tree

Photo #17:

- IU vs. Penn State, daughter-in-law used to be cheerleader

Photo #18:

- Marching band at halftime at IU stadium—enjoyed music & performance

Photo #19:

- Tailgate party at the IU football game with grandchildren

Photo #20:

- Pictures with great-grandkids

Photo #21:

- Two grandkids visiting from South Carolina eating at a restaurant, birthday party

Photo #22:

- Dining room table symbolic of many found memories of good food and friendship

Photo #23:

- Likes washing machine appliance because is quiet and uses less water

Photo #24:

- Humming bird feeder—all of have left and gone South and feels a sadness but knows they will return

Photo #25:

- Got new office chair, replaced old chair

Photo #26:

- Gateway computer, spend a lot of time on the computer (husband plays games, but her time is emails and searching)

Photo #27:

- Picture of clowns and likes them and feels like they have different personalities

### **Website Study**

#### **Travel**

- Southwest.com , excited, found good flights to Florida if they leave a few days early
- Mapquest.com, excited, I want to check distance and driving time to Louisville for Yoga workshop in November

#### **Shopping**

- Indiana Gas prices.com, disappointed, checked to see the lowest gas prices in bloomington (has to drive to Westside for lower fairs)
- Heralds.com, excited, RED TAG SALE—great prices, got a jacket, shorts, and blouse
- Amazon.com, excited, I found the YOGITOES skidless yoga mat

#### **Education**

- Epicurious.com, exciting, found some good recipes for bon appétit magazines, great for finding recipes
- Mayoclinic.com, motivated, used site to look at healthy living/questions, read about eat more fruits and vegetables & physical activity

- CatherineGuthrie.com, motivated, yoga teacher and in several magazines, about experience life, natural health
- Heraldtimesonline.com, excited & motivated, mammography about digital machine vs. analog machine

Notes from Participant #1 probe

**Objects that are valued or well liked:**

Photo #1:

- Chair tying to World War II veterans.
- Family get the chair.

Photo #2:

- Shed built at the end of property, Next to bamboo, self-built by them

Photo #3:

- Award received from State of Indiana for promoting Indiana manufacturing abroad

Photo #4:

- Picture/Award about a plane crash in Brazil

Photo #5:

- Award for foreign distinguished service (from Regan)
- Picture meeting Bush Sr. (embassy)
- More photos about presidential medals & meeting famous diplomats

Photo #6:

- 18<sup>th</sup> century original artwork print

Photo #7:

- More presidential awards (Eisenhower)

Photo #8:

- Presidential award for service

Photo #9:

- Examining stones/gems from South America

Photo #10:

- Wife examining artifacts from Peru

Photo #11:

- Book binding equipment

Photo #12:

- Lamp/Vase acquired in Mali

Photo #13:

- Table made in Brazil created from various stones

Photo #14:

- Using a tool to work on house

Photo #15:

- Long standing interest in genealogy—mothers and daughters of five generations (wall of pictures)

Photo #16:

- Bedside painting, given to him while abroad in service work (painted by an artist)

Photo #17:

- Photo of shed they built, one of the many projects they have done in the past 12 years, put a lot of work into their yard (have many things that are 100 years old)
- Experimented with a variety of fruits and plants in their yard

Other pictures with no written description:

- Him in front of the embassy in Argentina
- Working on the book binding
- Trees they planted in the backyard
- Plant given to them by their daughter that is 12 years old
- Original 18<sup>th</sup> century prints across the wall
- THING HE HATES: branch that was damaged by cicadas in his yard
- A painting he really likes
- A picture of numerous knick-knacks around house

**Travel**

- Wants to travel to see antique gallery in NY, NY
- Longstanding project to retrace genealogy regarding his grandfather Berlin and his actions in the civil war
- Not looking for new cultural experience (for travel)—they have already traveled a huge deal in their life

**Shopping**

- Gradually giving things to grandchildren and friends
- Nothing new that they want to buy for themselves or people, do have a number of items that want to give to children and others
  - o Fine, hand made alpaca wool
  - o Interested in purchasing 100 year old art prints to resell

**Education**

- A continuing interest in antique prints
- Developing knowledge of Astronomy → install a larger working telescope to view nearby objects in the solar system, interested in space exploration and how earth can be affected by astronomical events
- Continuing to take courses in IU continuing education program trying to antique prints & also get books from Monroe Library about art print